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Parental care and nesting behaviour of flycatcher species: A review of ecological and evolutionary strategies in the Indian subcontinent and Southeast Asia

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Abstract
This study specifically examines nesting site selection, microhabitat preferences, and key reproductive behaviors of four flycatcher species: Asian Paradise Flycatcher (*Terpsiphone paradisi*), Amur Paradise Flycatcher (*Terpsiphone incei*), White-browed Fantail Flycatcher (*Rhipidura aureola*), and White-spotted Fantail Flycatcher (*Rhipidura albogularis*). Specifically, it addresses nesting site selection, parental care, climatic influences, and conservation requirements. Flycatchers contribute significantly to insect population control and the maintenance of ecosystem balance. These species inhabit diverse environments, such as dense forests and regions modified by human activity. Factors including habitat loss, predation, and climate change affect their nesting success. This review synthesizes findings from research papers, fieldwork, and bird counts across the Indian subcontinent and Southeast Asia. The findings indicate that Asian Paradise Flycatchers construct cup-shaped nests in dense forests near water sources, whereas Amur Paradise Flycatchers prefer nesting in high-canopy trees. White-browed and White-spotted Fantail Flycatchers demonstrate adaptability to habitats from forest edges to urban environments. Nest construction materials include plant fibres, spider webs, and human hair, with variations that may enhance survival. Both sexes participate in incubation and chick rearing, indicating significant parental investment. Climate variability, including heavy monsoon rains and extreme temperatures, reduces reproductive success by increasing nest abandonment and egg desiccation. The survival of these flycatchers depends on stable environmental conditions. However, deforestation and urbanization further compromise their breeding habitats.

Keywords: Climatic impact, conservation, flycatchers, habitat preferences, nesting ecology

Introduction

Birds play a vital role in maintaining terrestrial ecosystem stability by supporting seed dispersal, pest control, and pollination. Insect-eating birds help control insect numbers, spread seeds, and support pollination, which benefits biodiversity and ecosystem health. Flycatchers are a diverse and important group of passerine birds. Monarchidae, Rhipiduridae, and Muscicapidae are families of small to medium-sized birds with bright feathers and fast flight. They mostly eat insects and are found in a range of Asian habitats, from rainforests to open woodlands. Flycatchers play an important role in ecosystems by managing insect numbers, spreading seeds, and helping with pollination.

This paper emphasizes four main species: the Asian Paradise Flycatcher, Amur Paradise Flycatcher, White-browed Fantail, and White-spotted Fantail. Each of these species has distinct nesting behavior, including nest site preference and parental care strategy. These behaviors are closely linked to their habitat preferences and evolutionary backgrounds (Dissanayake *et al*., 2019) [9]. Variation in nesting habitat occurs within species. The Asian Paradise Flycatcher inhabits dense riparian forests, whereas the Amur Paradise Flycatcher selects high-canopy trees that offer significant cover (Pan *et al*., 2024) [27]. The selection of specific habitat types reduces predation risk and increases the availability of resources for offspring. Nevertheless, ongoing habitat degradation and climate variability have heightened the susceptibility of these species to environmental change. Land-use conversion and deforestation have further restricted wildlife's access to critical breeding habitats.

Extreme weather events, particularly intense monsoonal rainfall, have caused nest abandonment in the White-browed Fantail (Rhipidura aureola), resulting in reduced reproductive success (Dissanayake *et al*., 2019) [9]. The Grey Fantail (Rhipidura albiscapa) primarily displays monogamous mating behaviour; however, documented instances of extra-pair copulations indicate some variability in its reproductive strategy. During the breeding season, males frequently enter neighbouring territories (Munro, 2007) [25]. This species is subject to high rates of nest predation and exhibits notable male parental care (Munro, 2007) [25]. Grey Fantails abandon incomplete nests when predators are detected nearby (Berger-Tal *et al*., 2010) [1]. Understanding specific behavioural and ecological traits is critical for formulating effective conservation strategies. This study investigates the nesting ecology, reproductive behaviors, and conservation challenges faced by flycatchers. The results identify specific ecological adaptations, highlighting the necessity for tailored conservation strategies to promote the sustained survival of these species.

Method and material

This study focused on four focal flycatcher species: the Asian Paradise Flycatcher (*Terpsiphone paradisi*), Amur Paradise Flycatcher (*T. incei*), White-browed Fantail (*Rhipidura aureola*), and White-spotted Fantail (*Rhipidura albogularis*). Published studies from 1960 to 2024 [31] were

retrieved through systematic searches in Google Scholar, Web of Science, and Scopus using keywords such as flycatcher nesting behaviour, parental care, paradise flycatcher ecology, fantail nesting, avian reproduction, and climate change impacts. Only studies that provided information on nesting ecology, parental care, or habitat use within the Indian subcontinent and Southeast Asia were considered. Data were extracted under specific categories, including habitat preferences, nest type and materials, clutch size, parental care roles, ecological threats, adaptive traits, and conservation requirements. These data were then compared across species to highlight similarities and differences in nesting strategies, reproductive investment, and ecological adaptability. Nesting traits such as cup depth, construction materials, and placement were interpreted as indicators of adaptive strategies, while parental care patterns were used to assess reproductive success potential. A thematic synthesis was applied to integrate results from multiple sources, and descriptive statistics such as frequency counts and proportion analysis were used where possible to summarize reported patterns of nesting behaviour and reproductive traits. The findings were finally organized into narrative form, tables, and figures to provide a comprehensive comparative framework for evaluating flycatcher nesting ecology and conservation priorities.

Nesting Strategies of Flycatchers

1. Asian Paradise Flycatcher (*Terpsiphone paradisi*)

The Asian paradise-flycatcher (*Terpsiphone paradisi*) has different breeding patterns and different forms of plumage (males have white long-tailed, rufous long-tailed, and rufous short-tailed, which are likely young birds, Mizuta, 1998) [24]. Breeding was seen starting in mid-March, with both sexes sharing incubation and chick rearing (Mizuta &Yamagishi, 1998; Das & Adhikari, 2019) [6, 24]. It primarily forages at the upper canopy level using a sallying strategy, assisting in niche partitioning from other insectivorous birds (Mansor & Sah, 2012) [20]. Recent studies carried out in West Bengal reported tiny cup-shaped nests, with the parents actively contributing to incubation and feeding duties (Ghosh & Sanphui, 2023) [12]. Its special behaviors and ecological significance make this one of the most studied species of flycatchers in this region.

2. White-spotted Fantail Flycatcher (*Rhipidura albogularis*)

The White-spotted Fantail Flycatcher (*Rhipidura albogularis*) exhibits unique nesting behaviour, constructing relatively shallow, cup-shaped nests using a variety of materials, including plant fibre, spider web, and even human hair. The use of different resources indicates flexibility within the available environmental material on the part of the species. Beyond material selection, this species exhibits considerable adaptability in its nest architecture. Variations in nest depth and vertical position serve as adaptive strategies in response to predation risk. Such architectural modifications enhance both nest stability and concealment, which in turn increase fledgling survival rates. This behavioural plasticity holds evolutionary significance as it allows the species to maintain reproductive success under changing ecological conditions (Sharma *et al*., 2024) [31].

3. White-Browed Fantail Flycatcher *(Rhipidura aureola)*

The White-browed Fantail (Rhipidura aureola) constructs compact, well-concealed nests using fine vegetation, soft plant fibres, and silk. These nests are typically positioned within dense shrubs, which reduces predation risk by providing enhanced camouflage and structural protection.

Nest building and incubation are performed by the female, whereas the male mainly defends the nesting area. Clutch sizes are usually 2 to 3 eggs, with an incubation period of around 14–16 days. Nesting success often declines due to predation and heavy monsoonal rainfall, which may cause nest instability or abandonment. Nevertheless, the species continues to persist across its entire range (Dissanayake *et al*., 2019) [16].

4. Amur Paradise Flycatcher (*Terpsiphone incei*)

Recent research on the Amur Paradise Flycatcher was focused on nest-site selection and the impact of male morphs on reproductive success. The study revealed that the species prefers to nest in relatively shaded sites that are more proximate to dwelling locations. Unexpectedly, the study revealed no difference in reproductive success between the two male morphs. Instead, nest-site conditions and existing environmental conditions were found to play a more important role in determining reproductive outcomes (Pan *et al*., 2024) [27]**.**

Habitat and Nesting Site Selection

Flycatchers are highly selective when it comes to the habitat and the nest site in terms of accessibility of food, predation avoidance, and climatic conditions. The Asian Paradise Flycatcher lives in dense water-related forests in which a high insect population ensures the availability of food for their chicks, minimizing predation risks (Nilemesh & Das, 2019) [16]. The Amur Paradise Flycatcher breeds in the tall canopy of forested areas, taking advantage of dense cover that offers security from predators and extreme climatic conditions (Pan *et al*., 2024) [27].

The White-browed Fantail Flycatcher selects shrubs and small trees and is adaptable concerning sites to achieve high levels of cover and resource availability (Dissanayake *et al*., 2019) [9]. While the White-spotted Fantail Flycatcher inhabits mixed habitats, including forest edges and agricultural landscapes, it tends to prefer low shrubs for nesting, which reflects its adaptability to habitat disturbances (Sharma *et al*., 2024) [31]. The nest materials come from the local deposit and region, with the flycatchers opportunistically using the leaves of the trees while probably being more selective of moss types (Briggs & Deeming, 2016) [2]. Differences in breeding success and timing exist between natural holes and nest-boxes, as the natural holes produce later egg-laying, smaller clutches, but predation rates are lower (Czeszczewik, 2004) [4]. Similar relative species, for instance, include the Asian Paradise Flycatcher. They begin displaying parental behaviors like incubation through fledging under different forms of weather adaptation to neighbouring species. Such adaptations among flycatchers show diversities in various environmental niches (Das & Adhikari, 2019) [6].

Fig 1: White-browed Fantail flycatcher feeding its chicks in a delicately woven cup-shaped nest. (Dissanayake *et al*., 2019)

Fig 2: An Asian Paradise Flycatcher bringing food to its nestlings in a compact, well-camouflaged nest. (Das & Adhikari, 2019) [6].

Table 5: Habitat Preferences and Nesting Characteristics of Flycatchers

Species	Habitat Preference	Nest Type & Materials	Clutch Size	Parental Care	Major Threats (Climatic & Ecological)	Adaptive Traits	Conservation Priorities
Asian Paradise Flycatcher (*Terpsiphone paradisi*)	Dense forests near water	Cup-shaped; plant fibres, spider silk	3–4 eggs	Biparental incubation and chick-rearing	Heavy rains, egg desiccation, and deforestation	Canopy foraging reduces competition	Protect intact forests near wetlands; monitor climate impacts
Amur Paradise Flycatcher (*T. incei*)	High canopy forests; shaded areas near settlements	Cup-shaped on *Cedrela* and other tall trees	3–4 eggs	Both sexes contribute; morphs show no reproductive difference	Predation, nest instability during rains	Careful nest-site selection (shade, concealment)	Maintain canopy cover; promote reforestation of tall native trees
White-browed Fantail (*Rhipidura aureola*)	Shrubs and low trees in varied habitats	Compact, camouflaged; fine fibres and spider silk	2–3 eggs	The female builds and incubates; the male defends	Predation, heavy monsoon rainfall (nest abandonment)	Camouflage and tolerance of semi-disturbed habitats	Preserve shrub cover; community-based monitoring
White-spotted Fantail (*Rhipidura albogularis*)	Forest edges, agricultural and semi-urban areas	Shallow cup with tail-like extension; fibres, spider webs, human hair	2–3 eggs	Biparental care reported	Drought, sudden rain events, and predation	Nest design flexibility (depth/height adjustments)	Promote agroforestry; provide artificial nesting structures

Climatic and Environmental Pressures

Climatic variability is a critical determinant of reproductive success in flycatchers, influencing both nest stability and food availability. Intense monsoon rains frequently destabilize nests and reduce the effectiveness of incubation (Kumar & Singh, 2022) [18], whereas prolonged heat and drought accelerate egg desiccation and diminish insect abundance, thereby constraining chick survival (Li *et al*., 2023) [19]. Fantail flycatchers (*R. aureola* and *R. albogularis*) display great adaptability in nesting, often placing nests in shrubs, low trees, cultivated agricultural fields, and even semi-urban locations. The adaptability of these species not only allows them to thrive in environments that are disturbed or modified, but it is also a reasonable assumption that they are at a reduced risk of extinction when compared to other, more specialized species.

Conservation Implications

The ecological needs of flycatchers must be treated as a part of conservation, with habitat conservation along with climate adaptations. Habitat restoration is one of the most important, which involves protecting significant habitats that include dense forest and wetland, along with promoting reforestation as well as afforestation for secondary nesting sites (Sharma *et al*., 2024) [31]. Artificial nesting in degraded habitats improves reproductive success. Climate variability long-term studies will be useful to ascertain the effect of climate change on flycatcher populations and help plan conservation (Sharma *et al*., 2024) [31]. The species also depends upon community-based conservation. Involving the locals to adopt habitat preservation activities and sustainable agricultural practices can help regain encroached habitat space and stabilize the habitat for the population of the flycatcher.

Conclusion

Flycatchers are also good ecological indicators, as their nesting success and reproductive rates respond to changes in habitat quality and climate. Comparative evidence indicates that fantails, due to their ecological adaptability, are generally more resistant to environmental disturbance, whereas paradise flycatchers, being habitat specialists, are even highly exposed to deforestation, habitat destruction, and extremes of climate. However, habitat destruction and deforestation, as well as the increasingly damaging effects from climate change-improbable weather patterns interfering with breeding patterns-suspect that increasing threats will impact their survival. Thus, protection and restoration of flycatcher habitats demand urgent conservation measures.

Restoration actions include reforestation, protection of wetland, and erection of artificial nests in degraded landscapes, which all reduce habitat loss. Long-term ecological monitoring must also be ensured for the possible understanding of the impact climate variability is causing on populations of flycatchers and adaptive adjustment of their conservation strategies. Only through developing habitat preservation initiatives with local communities and encouraging sustainable land use will habitat degradation be reversed for those birds to stay in the wild. It is only in combining the policy of conservation backed by scientific knowledge with community-led initiatives that survival will be assured for the flycatchers and the balance that they can introduce. This depends on a total approach, whether through habitat protection, climate adaptation approaches, and public awareness measures that may keep their kind existing despite mounting environmental challenges.

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