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Urbanization and Hybridization Threats to the Red Junglefowl *(Gallus gallus)* (Aves: Phasianidae)

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Abstract

Based on the evolutionary aspect, red junglefowl are a significant bird under the Phasianidae family. Red junglefowl is a native bird in many countries of the Asia. Lots of information revealed that due to religious or cultural aspects, domestic fowl easily enter into the forest and mix with such red junglefowl, and this is a common phenomenon at all. Rapid urbanization has fragmented their real habitats. Due to nearest human dwelling and their domestic fowl are prone to mix with junglefowl, so the genetic identity is hampering which could be fatal for the survival of this wild species. In this regard, all domestic fowl need to be kept in a farm or confined area in order to avoid such interbred. Additionally, creating protected area where purebred red junglefowl populations can thrive without the threat of interbreeding. Collaboration between geneticists, ecologists, and conservationist would be essential in this case.

Keywords: Red junglefowl, domestic fowl, characteristics, comparison, interbreeding, urbanization, Phasianidae

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Introduction

The red junglefowl (*Gallus gallus*), considered the wild progenitor of the domestic chicken, is a key species within the Phasianidae family. It is ecologically significant in forested and semi-forested areas, aiding seed dispersal, insect population control, and the stability of food webs. This species is found across much of South and Southeast Asia, including Bangladesh, India, Thailand, Myanmar, and exhibits high genetic variation along with notable ecological adaptability. However, the expansion of urban areas, agricultural lands, and human habitation has significantly modified their natural environments, resulting in habitat loss and fragmentation. Such habitat changes restrict access to vital feeding and sheltering areas and elevate the frequency of contact with domestic chickens. These contacts can lead to genetic mixing with domestic chickens, jeopardizing the natural adaptations, genetic purity, and survival prospects of wild populations. Understanding how anthropogenic alterations affect red junglefowl is critical for informing conservation planning and management. Maintaining habitat integrity, managing domestic poultry proximity, and tracking population genetics are key strategies for safeguarding this species. Each year, billions of domesticated chickens are hatched to meet global food demands, but the lack of genetic diversity in both industrial and locally adapted breeds, as well as in the wild red junglefowl the ancestor of domestic chickens is often overlooked (Fulton and Delany, 2003). Red junglefowl is the wild ancestor of domesticated chickens (Fulton *et al.*, 2004; Hata *et al.*, 2021; Rubin *et al.*, 2010). They serve as crucial genetic reservoirs for poultry breeding offering traits such as disease resistance adaptability and enhanced productivity (Tixier-Boichard, 2020). There are many village dwellers whom raise many domestic fowls. While crossing the road, observed many remarkable numbers of fowl. Due to significant number of variations, and continuous selective breeding to get more meat, farmers are always busy to cross between domestic and junglefowl. There is no doubt that fowl have evolutionary impact in avian kingdom (Kabir and Hawkeswood, 2023). Domestic fowl are very common and available all over the world. Its meat is cheap and popular dish item for everybody. Due to domestication, those fowls are focused with remarkable number of variations. In all small or medium-sized group, cock was the alpha or dominant to protect juveniles, chicks, and hens. All males are found ornamental feathers always. Hens were very casual but some had bright plumage especially on black plumages. For domestic purpose, bright plumage is not important for the farmers. They always try to raise them as their daily protein requirement. Cock is not suitable for meat production only important for breeding and ornamental purpose. Large-sized fowls especially hen are suitable for soft and tasty meat. Some domestic fowls are very close to red junglefowl with their long legs, slender body, plumage colour, comb and wattle, and tail feathers (Table 1). Jungle adjacent human habitats are prone to interbred between junglefowl and domestic fowl. Very close phenotypic appearance indicates that domestic fowl are originated from junglefowl. Especially in Chittagong and Sylhet Division of Bangladesh, many domesticated fowl go to the jungle and interbred with junglefowl. Junglefowl have feral population too. It has highly adaptation power. Till now, Sri Lanka junglefowl did not mix with local fowl due to geographic barrier. Gray junglefowl is used for its yellow skin in domestication. Females have cryptic colour than males. Sometimes, domestic fowl shows roosting behaviour on the trees. The objective of this write-up is to mention some guidelines in order to avoid interbred of red junglefowl and domestic fowl.

Comparison between junglefowl and domestic fowl

Many reports suggested that domestic fowl have been evolved from junglefowl. In this case, selective breeding was induced by the breeders. People first domesticated such junglefowl for their meat consumption then eggs. Cockfight was a remarkable event in many countries of Asia. Cock was ornamental, so their hackled feathers were used in many purposes especially room-decoration. Due to domestication, there are many remarkable variants have been focused but as a proof sometimes domestic fowl exhibit same type of plumage in cock and hen.

Table 1. Features of junglefowl and domestic fowl

Features	Red junglefowl	Domestic fowl
Size and body mass	Smaller and leaner	Larger and meat yield
Plumage of rooster	Plumage changes due to season	Always the same
Comb and wattle	Red	Often red; female has more prominent comb and wattle than junglefowl
Feather colour	Limited colour variation	Vast array of plumage colours due to selection
Fear and tameness	Shy and wild	Less fearful and more comfortable around human
Flight ability	Short and rapid flights	Have a reduced ability to fly
Reproduction cycle	Seasonal breeding	All the year
Foraging	Active forager	Less exploratory
Skeletal structure	Thicker tibio-tarsus (wing bones)	Thinner tibio-tarsus which is reduced flight needs
Aggression	Male-to-male is high	Reduced conflict
Broodiness	Present in hen	Absent in many commercial egg laying breeds
Vocalization	Shorter call	Longer call
Genetic diversity	Huge amount of genetic diversity due to adapting to environmental	Less genetic diversity and some traits is a result of intense selective

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	changes and diseases. Modern red junglefowl had more DNA 100 years ago. This loss of wild-type adaptations can make them vulnerable and diminishes a crucial resource for the development of domestic birds.	breeding
Conservation needs	Should be re-evaluated due to its ongoing loss of genetic purity	The present status of domestic fowl is remarkable all over the world

Habitat uses in urbanizing landscapes

Red junglefowl prefer habitats with dense vegetation, forest edges, and bamboo thickets where they can find food and protection from predators. However, urbanization often modifies these habitats and introduces new environmental conditions.

Table 2. Habitat types used by red junglefowl in urbanizing landscapes

Habitat type	Vegetation characteristics	Food availability	Junglefowl presence
Forest edge	Dense shrubs, bamboo, trees	Insects, seeds, fruits	High
Agricultural land	Crop fields, hedgerows	Seeds, grains, insects	Moderate
Rural settlements	Gardens, small vegetation patches	Food waste, insects	Moderate
Urban areas	Limited vegetation	Low natural food sources	Low

Interbreeding of red junglefowl and domestic fowl in Asia

A critical issue is the interbreeding between domestic and red junglefowl which compromises the serious ecological and conservation challenges (Peters *et al.*, 2022; Tixier-Boichard, 2020). This hybridization not only threatens the survival of red junglefowl but also impacts the future genetic improvement of domesticated chicken breeds for human consumption (Peterson and Brisbin, 1998; Wu *et al.*, 2020). Interbreeding between domestic fowl and red junglefowl is common particularly in southeast Asia where red junglefowl is a native bird. in Thailand, the release of domestic chickens for cultural or religious practices has led to significant hybridization with red junglefowl (Rubin *et al.*, 2010). Similar instances have been observed in various parts of the Singapore over the past 26 years, particularly in Pulau Ubin and Bukit Timah National Reserve (Wu *et al.*, 2020). The resulting hybrids often display mixed traits such as varied plumage pattern, feather, and leg colours (Desta, 2019; Rubin *et al.*, 2010; Wu *et al.*, 2020), highlighting a growing red junglefowl plays an integral role in seed dispersion, insect control, and maintaining the balance of various trophic interactions (Peterson and Brisbin, 1998).

Plate 1. Red junglefowl at Gardens by the Bay

Plate 2. Domestic fowl at Botanic Gardens, Singapore

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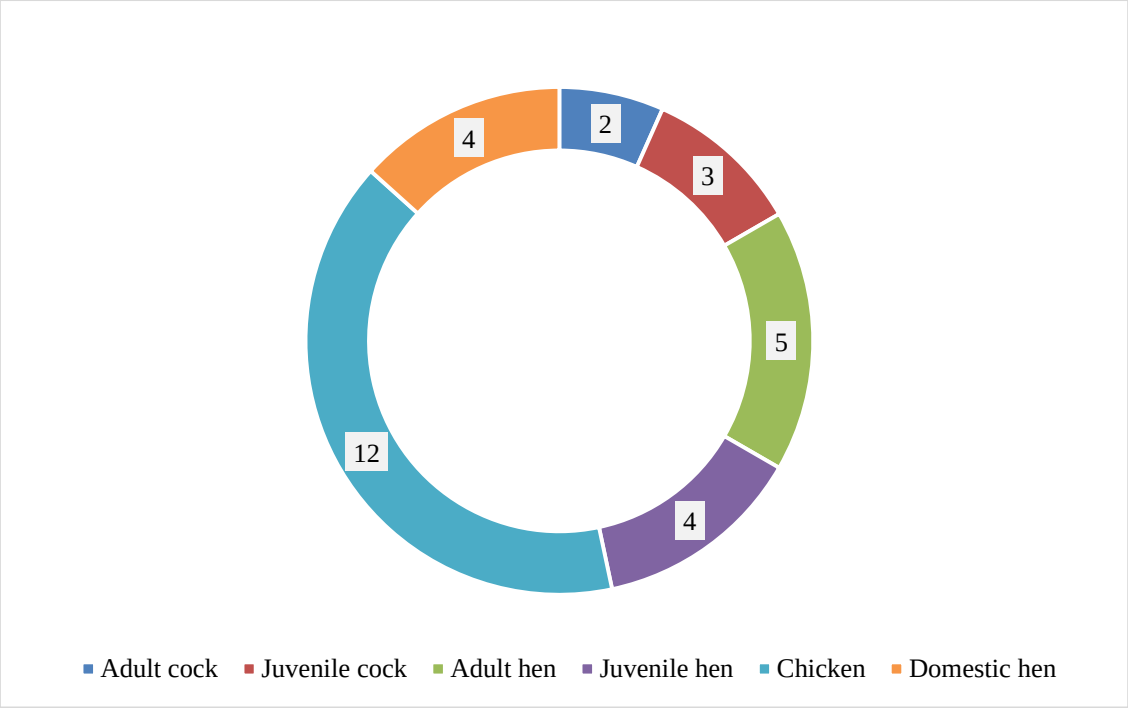

Fig 1. Observed fowl in urban areas of Singapore

Behavioural adaptations in human-modified environments

Red junglefowl (*Gallus gallus*) demonstrate high behavioural flexibility in urban and semi-urban environments. Habitat fragmentation caused by human development has altered their natural ecological niches. These birds adjust their feeding habits to exploit new food sources. In addition to seeds, fruits, and insects, they consume agricultural crops and food scraps (Table 2). Such dietary plasticity allows them to persist in human-dominated areas. They frequently forage along forest edges, gardens, and small green patches. Activity timing is shifted to dawn and dusk to avoid human disturbance. Junglefowl are highly vigilant while foraging near settlements. Flight is used to escape potential threats, especially in open areas. Dense vegetation serves as a refuge from predators and humans. Nesting sites are selected in areas offering sufficient cover. Hens often choose hedgerows, shrub patches, and isolated gardens for nests. Male junglefowl maintain territorial displays to attract mates. Vocal communication continues despite urban noise, though timing may adjust. Social hierarchies within flocks remain stable. Group size varies depending on food availability and habitat structure. Birds utilize vegetation corridors to move between fragmented habitats. Anti-predator responses intensify with increasing human presence. Urban junglefowl avoid heavily trafficked roads and open spaces. Juvenile birds exhibit cautious movement and exploratory behaviour. Males retain ornamented plumage for displays in urban landscapes. Roosting behaviour is modified to include gardens or low trees near human settlements. Dominant males enforce hierarchy through display and aggression. Reproductive behaviour is maintained with hens selecting safe and concealed sites. Vigilance allows birds to balance foraging with predator avoidance. Short-distance flights remain essential for survival in fragmented areas. Flexible behaviour enables coexistence with humans. Conservation measures should consider these adaptive behaviours to support wild populations.

Table 3. Behavioral adaptations of red junglefowl in human-modified environments

Behavioral aspect	**Observed adaptation**	**Ecological significance**
Feeding behaviour	Use of agricultural crops and food scraps	Expands food resource availability
Habitat use	Utilization of shrub patches and gardens	Allows survival in fragmented habitats
Activity pattern	Increased activity during early morning and evening	Avoids human disturbance
Anti-predator behaviour	Use of dense vegetation for hiding	Reduces predation risk

Conservation implications

Urban expansion is gradually reducing the natural habitats of the red junglefowl, making conservation efforts increasingly important. Protecting forest margins, shrublands, and natural vegetation patches can provide essential shelter and feeding areas for this species. Maintaining small woodland fragments and bamboo groves within rural and urban landscapes may help sustain local populations. Establishing ecological corridors between isolated habitat patches is another important conservation measure. These green corridors allow red junglefowl to move safely between different areas for feeding, breeding, and maintaining genetic diversity. Habitat connectivity can greatly reduce the negative impacts of fragmentation caused by roads and settlements. Controlling excessive hunting and reducing human disturbances are also necessary for protecting junglefowl population. In some regions, these birds are hunted for food or captured for domestication. Strengthening wildlife protection regulations and promoting responsible human activities can help reduce these pressures. Community awareness is equally important for effective conservation. Educational programs can encourage local people to value wildlife and protect natural habitats. When communities

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participate in conservation activities, the protection of red junglefowl habitats becomes more sustainable. Another important issue is the potential hybridization between red junglefowl and domestic chickens. Genetic mixing may threaten the natural characteristics of wild population. Therefore, monitoring wild populations and managing domestic poultry near forest areas can help preserve the genetic purity of the species. Overall, a combination of habitat protection, sustainable land management, and public awareness is necessary to ensure the long-term conservation of red junglefowl in landscapes affected by urban development.

Conclusions

Chittagong Hill Tracts and Sylhet area of Bangladesh have remarkable number of red junglefowl. Rapid urbanization has fragmented their habitat often kept as pets rather than for egg production. In Singapore, there are many places but remarkably Merina Bay sands, Botanic gardens, and Gardens by the bay are noteworthy of red junglefowl (Plate 1; Plate 2; Fig 1). Like the pigeon show, fancy chicken could be an additional exhibition in Bangladesh (Kabir and Hawkeswood, 2023). At the present context, should make an effective plan for storing genetic purity of junglefowl. All domestic fowl need to be kept in a farm/confined area/protected area in order to avoid interbred. Protected area can thrive without the threat of interbreeding (Delany and Cox, 2006). Red junglefowl (*Gallus gallus*) in Bangladesh face threats from habitat fragmentation and urban expansion too. Suitable habitats with forest edges, bamboo, and shrublands are essential for feeding, nesting, and shelter. Combined efforts from conservationists, geneticists, and local communities are necessary to ensure their long-term survival.

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