International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS
International Journal of Fauna And Biological Studies

ISSN 2347-2677
www.faunajournal.com
IJFBS 2020; 7(5): 01-04
Received: 26-05-2020
Accepted: 01-07-2020

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Nesting ecology of purple sunbird *(cinnyris asiaticus*) in a residential area

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Abstract
A sunbird was observed opportunistically collecting materials for the construction of nest. The material used by bird for the construction of nest included soft grass, fibers, small leaves, bark, cobwebs, pieces of thermocol, bits of paper, strings. The nest was made and incubation of eggs was done by female only and the male was involved in post incubation events like feeding and defending the hatchlings. After hatching, both male and female partners took active part in feeding the young ones. Authors observed all these things for a period of 90 days from February 25, 2020 to May 24, 2020.

Keywords: *Cinnyris asiaticus*, Congenial, Environment, Hatchlings, Nest building behavior

1. Introduction
Birds (Aves) are homoiothermic or warm-blooded egg-laying vertebrates characterized by the presence of feathers and modification of forelimbs as wings for flight (Verma and Prakash, 2020a) [21]. Indian subcontinent has rich avian biodiversity with around 1300 avian species but then also, long term studies on breeding ecology and behavior of majority of species in their natural environment are insufficient and scanty. A number of Indian bird species are now in IUCN Red List (Verma, 2018a, 2018b; Prakash and Verma, 2019; Balwan and Saba, 2020) [18, 19, 2]. Feeding and breeding is an important process in an avian species (Wani, 2020) [23]. A wide variety of breeding systems and phases (nest making, egg laying, incubation and hatching) are found in Aves. In the northern India, the primary breeding season of bird is before the Monsoons, April to June. *Cinnyris asiaticus*, purple sunbird, Family Nectariniidae (sunbirds), has three subspecies, *Cinnyris asiaticus asiaticus, Cinnyris asiaticus brevirostris* and *Cinnyris asiaticus intermedius* (Myers *et al.*, 2020) [13]. It is endemic to the Indian subcontinent. The population of this bird is now stable hence it is mentioned in IUCN Red list as LC *i.e.* Least Concern (Bird Life International).
These are sexually dimorphic; males are brightly colored but females are olive above and yellow to buff below and are small in size, feeding mainly on nectar but sometimes also feed on insects particularly while feeding the young. They can hover for short durations but usually perch to feed as mentioned by Klasing (2004) [12]. The birds join to mob predators after calling their family as these are very vociferous. Their singing notes are very melodious followed by ringing, metallic notes including a "chwit" or "chwing!" notes (Information about Birds).
They make their nests from thin strips of vegetation, cobwebs, lichens and bark having a shape of pouch. Like other birds' nest, this nest is not woven, but it is held together by cobwebs. The overhanging projection shades the entrance of the nest which is built almost entirely by the female. As mentioned in a recent ecological study it can be stated that after building of the nest for about five to ten days, the inner cavity is expanded by the bird by opening its wing and turning around on the inside (Janeček *et al.*, 2020; Cheke and Mann, 2020) [11, 6].

2. Materials and methods
In the present study, an attempt has been made to work on some aspects of breeding ecology of a resident bird, the purple sunbird (*Cinnyris asiaticus*) in Jabalpur District.

Climate of Jabalpur
Jabalpur (M.P.) has a humid subtropical climate. The last month of the winter (February), is also warm month with temperature range of 11.4°C (52.5°F) an average high of 28.8°C (83.8°F) and an average low of In Jabalpur, the average high-temperature slightly increases, from a moderately hot 24.5°C (76.1°F) in January, to a still warm 28.8°C (83.8°F).

Weather in March: The first month of the pre-monsoon summer, March, is a tropical month in Jabalpur, India, with average temperature ranging between min 16.2°C (61.2°F) and max 34.3°C (93.7°F).

Climate suitable for Sunbird

According to a recent study by Gulshan (2020) [8], in the Spring, *i.e.* March, breeding season begins, and the males transform into a beautiful dark purple with a metallic purplish-to green-blue head, mantle, and breast which can sometimes have a maroon shine. It turns back to its original color approximately by June, once the breeding season ends.

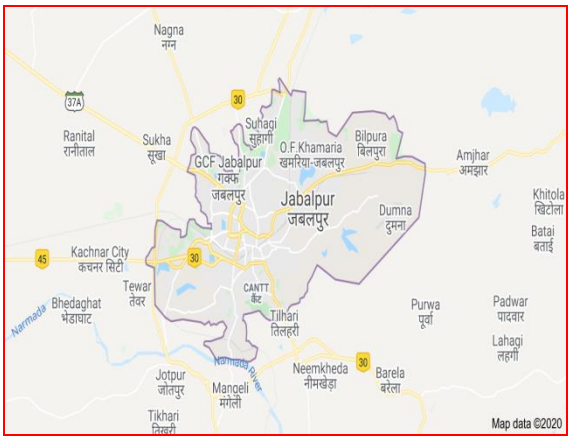

Fig 1a: Map of Jabalpur, M.P

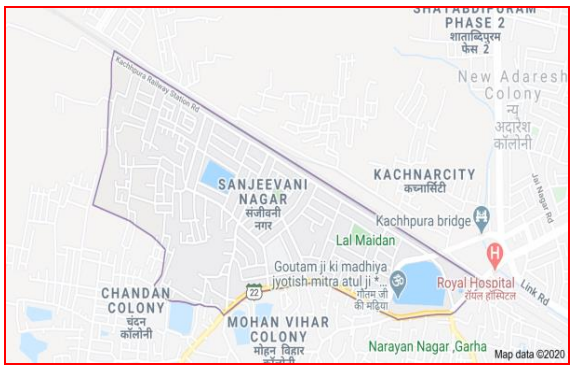

Fig 1b: Map of Sanjeevani Nagar, Jabalpur

The purple sunbird was observed opportunistically collecting material for construction of the nest.

- Field work was carried out in Sanjeevni Nagar (Fig.1b) of Jabalpur city, one of the distinct places in Madhya Pradesh and is situated in the central part of the state (Fig 1a); with longitude and latitude being 23.1815.N and 79.9864.E.
- The present observation was made in the courtyard of my house situated in the city of Jabalpur, Madhya Pradesh. A nest was constructed on the electric cable in the form of a hanging pouch. The nesting was found on 25th February 2020 and was subsequently observed up to 24th May 2020. The nest was observed for at least ten times a day.
- In order to generate data on the breeding parameters (such as pairing, nesting, egg laying, incubation, hatching, provisioning etc.) the activities of each was observed during breeding season with the help of binocular and mobile phone's camera.
- Species identification was carried out with the help of Ali and Ripley (1987) [1].

3. Results

After 90 days, the nesting, feeding and breeding of Purple Sunbird, *Cinnyris asiaticus*, was observed and following points were made:

- Nest was placed on electric wire. It was an oblong purse of soft grass and fibers, small leaves, bark cobweb etc., untidily dropped on the outside with pieces of bark, caterpillar droppings, bits of paper, string and other rubbish. It also had a projection over the entrance hole (Table 1).

Table 1: Dimension and material used for the construction of the nest

Dimension of the nest	Material used
Diameter: 5.7cm Depth: 7cm	Soft grass, fibers, small leaves, bark, bits of paper, strings and other rubbish plastic fibers.

- A special peculiarity of the use of modern technological material like polythene fibers and pieces of thermocol were also observed in the nest construction. This might be only due to its light weight and easy availability. From this observation, one may interpret that like human beings; birds also accepted the modern technology in order to be comfortable from 25th March 2020 to 4th May 2020 (Fig. 2a to 2d).
- The purple sunbird showed less hostility to members of its own species and humans near their nests, possibly due to regular presence of humans as the nest was constructed in the courtyard.
- They did not take defensive maneuvers and did not give any alarming call when people were at 3-4 meters distance from their nests.
- On 15th March 2020, two eggs, were laid by the female in the nest, which were grayish white with chocolate streaks. After the completion of the nest, male was found in the nearby area, but not in the nest. Eggs hatched on 30th March 2020. On that day both male and female were observed in the nest alternatively.
- Construction of nest and incubation of eggs were performed by female but post incubation events like feeding and defending the hatchling were carried out by both of the parents (Table 2).

Fig 2a: Bird with the nest (15th March 2020)

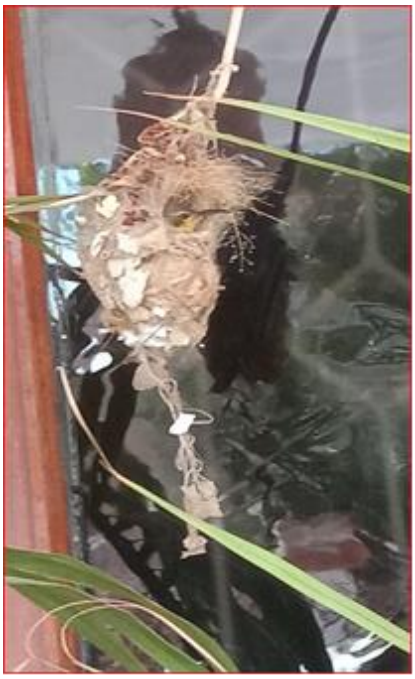

Fig 2b: Bird with the nest (25th March 2020)

Fig 2c: Bird with the nest (30th March 2020)

Fig 2d: Bird's view (4th May 2020)

Table 2: Details about Nesting Stages

Nesting stage	Date
Building of nest starts	25th Feb 2020
Completion of nest	5th March 2020
Egg laying	15th March 2020
Incubation period	15 days
Egg hatching	30th March 2020 (10.30 AM to 2.00 PM)

The average nest building period was 10±1 days. The egg laying started after completion of the nest. The average incubation period was 15±1 days in this study. Before pairing the Male showed courtship behaviour by singing during morning hours. On the first day of hatching, hatchlings were unable to stretch their gapping mouth for feeding but from the second day, they could easily straight up their mouth. The nestlings were fed by both the parents. They fed nectar usually but sometimes fed insects also for their young ones.

- Also, it was observed that the female left the nest for feeding and promptly returned to the nest. Although male was not found at the period of nesting as well as incubation but remained within an area to guard the nestlings. This appearance of the male during both these periods is unknown.
- Male and female were observed in tending the young ones. In the present investigation, no faecal matter and other dropping were observed. After egg laying eggs, the birds are rather depleted of calcium, so the birds eagerly eat the shells to compensate the calcium defiance. This suggests the best sanitary practice by birds.

4. Discussion

Sunbird species breed in winter when most flowers are out and when it is colder as mentioned by Jackson, (1999) [10]. It is only because of the large number flowering plants like China rose that the purple Sunbird might nest in this locality. This ornamental plant is available for about eight months of the year**.** Usually, the nests are suspended from branches of thorny plants (a defense mechanism to safeguard the nest), but considering the commonness of this bird in urban settlements, they make use of wires and other manmade things for nesting quite frequently as explained by Whitfield *et al.*, (2014) [24]. They may even choose an indoor space, in places that are not frequented, similar to the present study. Also, the nest was constructed in human locality and is just a couple of meters up from the ground. These findings are in contrast with findings of Raval (2011) [15].

The selection of long, slender bough, which is swaying in the winds to build a nest, might be due to keep eggs stealers from the venturing close to the nest. The direction of the nest entrance was kept in the North that could be to avoid the direct radiation of the sun (Ghadiran *et al.*, 2007; Cheke *et al.*, 2001) [7, 5]. The Sunbird in the present study breeds from January to March. For nest construction, it uses the materials which were easily available. Use of polythene fiber and pieces of thermocol might be due to its light weight and easy availability, also use of cobweb to envelope the nest to is enjoying additional cryptic value and concealment. The incubation has taken exactly fifteen days similar to that with another species of purple-rumped sunbird, *Nectarinia zeylonica* (Birds of India).

5. Conclusion

In urban areas, insect food has been diminished to a great extent but it can be found still in plenty in rural and undeveloped localities. Increased pollution and changed climatic conditions are adversely affecting the survival of birds. These are the some major factors that contribute to the decline of birds in urban areas. Along with the high noise and automobile pollution in urban areas it has been observed that a lot of lead is being released into the atmosphere which might have a residual effect on the eggs of Sunbird making them thin shelled, as it has been observed in other countries in their research on other birds. So, residential areas are now becoming safer and suitable for the nesting ecology of these birds. The encouraging thing is one can still find the much loved and beautiful sunbird in the rural hamlets and also in the urban areas in isolated pockets where the environment is still congenial to them in their basic requirements.

The lockdown following the Covid-19 pandemic has many positive impacts on biodiversity, environment, climate change and global warming (Verma and Prakash, 2020b) [22]. A large number of birds are clearly started to appear. Insect pollinators have appeared in abundance on crops and other plants. All these are good indication for ecological balance and biodiversity because ecological balance is necessary for survival of all living organisms including humans (Verma, 2017, 2018c) [20]. Almost total lockdown due to Covid-19 outbreak has minimized the anthropogenic activities including overexploitation of natural resources (Roy *et al.*, 2020) [16]. The major human population was bound to live in their homes, automatically prevented to cause various types of pollution. The surrounding environment is reflecting clean and green. However, it is hampering education, employment, business and economy.

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