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A case study of hand-rearing and successful rehabilitation of purple sunbird *Cinnyris asiaticus*

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Abstract
Purple sunbird *Cinnyris asiaticus* is an active species frequenting urban garden for drinking nectar from various flowers. The species is also commonly documented to be nesting in backyard gardens where the nest is often vulnerable to attack by feral cats. Nestlings as well as fledglings are rescued by members of public and taken to wildlife rehabilitation centers. Local rescue centres are often not equipped to provide optimum care for such small and delicate baby birds. This is especially true when staff and volunteers are not trained in proper protocols and guidelines. Lack of published literature on caring for many local, native species makes the task even more difficult. In this case study, we present methods of housing, care, diet plan, behavioral conditioning, and release techniques that were used to successfully rehabilitate an orphan purple sunbird. These methods can be used as guidelines for other biologically and behaviorally similar nectarine species in India.

Keywords: sunbird, hand-rearing, rehabilitation

Introduction
Purple sunbird *Cinnyris asiaticus* is one of the smallest bird species in India measuring up to 10 cms (Grimmett *et al*., 2011) [6] and weighing up to 11 grams (Dunning, 2008). They are abundant in localities with high abundance of flowering plants and trees (Ghadirian *et al*., 2008) [5]. They primarily feed on nectar and insects, however, they increase intake of insects when feeding chicks in nest (Bologna, 1984) [2]. They are well-known for their ability to hover like a hummingbird and are sometimes wrongly called one. Their common name comes from the breeding plumage of the male bird with shiny bluish-black feathers. The non-breeding eclipse plumage of male closely resembles that of a female with a broad purple black stripe down from throat to belly. The female purple sunbird is olive brown above, pale yellowish underside and has a pale supercilium beyond the eye, and a dark eye stripe (Grimmett *et al*., 2011) [6]. They are found commonly in semi-arid and woodland habitats, as well as patchy and dense gardens in urban localities. These are mainly resident birds, but local movements occur in drier parts of northwestern India and Pakistan, arriving in large numbers before summer (Dewar, 1908) [3]. In the city of Ahmedabad, they are one of the commonest birds in the urban green spaces, including small backyard gardens. In this case study, we report successful hand-rearing of a single chick that was rescued and brought to us after the nest was attacked by a feral cat. One of the parents and one chick were predated upon by the cat before this single chick was rescued.

Materials and Methods
On the morning of 23rd March 2015, a single purple sunbird chick was brought in after being rescued from a feral cat attack. The age was estimated at around two weeks because of partial feather growth on wings and tail (Jonsomjit *et al*., 2007) [9]. The chick appeared unhurt and healthy, weighing 6.08 grams (figure 1). Assessment for dehydration becomes challenging in birds, more so in nestling birds. Careful observation was made for signs for any clinical changes like decrease in skin turgor, loss of skin elasticity, increased wrinkling of cere, paleness, loss of brightness and roundness of eyes, dryness of oral mucous membranes, and abnormal saliva in the pharynx. No signs of dehydration were detected, however when dehydration is undetected, assuming 5% dehydration is a standard practice in avian rehabilitation (Abou-Madi & Kollias, 1992) [1]. Oral rehydration was carried out by feeding drops of water with dissolved oral rehydration salts (brand name: Electral). Ball-tipped feeding needle of size 18 gauge was used to prevent inadvertent tracheal gavage (Roset, 2012) [12]. Only a few drops (10-15 drops) were given at a time while allowing the chick to swallow the drops comfortably. This was done twice with a gap of 15 minutes before the chick was placed in a nestlike cavity for further rehabilitation. After this, hydration was managed by soaking feeder insects in water and feeding wet insects.

Fig 1: Initial weighing of purple sunbird chick on a "jeweler's digital weighing scale" that measures 1/10th of a gram.

Housing and Environment
An artificial nest-like cavity was setup in a secluded area, free from disturbance and possibility of cross infections from other birds. A plastic container lined with soft, cotton

cloth was used to house the chick. The container was kept open from top (figure 2). The container was kept inside a room that was maintained at around 35° Celsius during the day and at night it was allowed to drop naturally (as low as 22° Celsius). This was done to mimic the natural temperature fluctuations. In nature, mother sunbirds frequently stay in the nests during her visits to provide warmth to babies (Kumar *et al*., 2021) [10]. However, we made no special arrangement as the room stayed warm throughout the day. Full spectrum bulb was kept on during the daylight hours and was turned off in evening till early morning to mimic the natural light cycle. The cotton cloth lining that was used as substrate was changed once every day or twice if needed. The soiling of cloth was greatly reduced by mimicking parent bird's behaviour of nest sanitation (Guigueno & Sealy, 2012) [7] by removing fecal sac every time it is defecated. The chick typically defecated immediately after every meal and so was an easy task to remove the fecal sac before it soiled the lining cloth.

Second week (chick age: four weeks) onward a potted plant with comfortable perching was provided to the chick to imitate a shrub. By this age it was able to perch and hop around the branches. Later, mid-fifth week (chick age: six weeks) onward the chick was moved to an outdoor enclosure for pre-release conditioning.

Diet and Nutrition

It was interesting to note that the chick at one week of age did not have the characteristic long and slender beak like adults. It rather had a broader beak, much like a passerine bird. Purple sunbirds feed small insects and spiders to their nestling young along with some plant matter and sometimes nectar (Kumar *et al*., 2021) [10]. The authors were active wildlife rehabilitators at the time and had maintained cultures of feeder insects like house cricket *Acheta domesticus* and lobster roach *Nauphoeta cinerea*. These two feeder insects were fed as staple diet along with some supplementary nutritionally balanced dog and cat food. The dog and cat food dry pellets were soaked in water till they absorbed water and became soft. Feeding was done using a tweezer (figure 2). In our experience, unfeathered chicks with closed eyes need to be fed every 15 to 20 minutes throughout the daylight hours. At one week and above, once they have opened their eyes and their feathers start sprouting, they need to be fed every 30 to 45 minutes. Since the chick was above one week of age, it was initially fed 5 to 6 pin head crickets or one small lobster roach in each meal. Soaked dog/cat food was fed twice or thrice a day in amount equivalent to approximately the same as insects. Amount of food given was not fixed. We tried to increase the amount at each feeding while simultaneously increasing interval time between two meals. At each mealtime, the chick was fed until it was not hungry anymore. The chick was allowed to indicate that it was not hungry anymore. It would indicate by slinging out the food morsel, and by stopping to beg for food and keeping the mouth closed.

Fig 2: Purple sunbird chick being fed a small lobster roach with the help of a tweezer.

Third week onward the chick was fed every hour with mid-sized crickets and lobster roaches. The chick had developed most of the feathers and was now comfortably hopping around. By fourth week onward the chick was being fed every two to three hours. At this time, nectar water was introduced to the chick. We used the same recipe that is commonly used for hummingbird feeders – mixing 1 part sugar in 4 parts water until the sugar is dissolved completely (Smithsonian's National Zoo). This was offered in a shallow dish and kept close to the bird's beak. It readily started to consume the nectar water. Nectar water was provided in the morning and was kept available throughout the day. It was taken out in the evening and remaining content was discarded. Nectar water was freshly prepared every time.

Monitoring growth

Altricial species like purple sunbird can grow 3-4 times the rate of precocial species, sometimes more (Starck *et al*., 1998) [13]. Physical characters like growth stage of various feathers, measurements of culmen, tarsus, total body length, gape, and weight of chicks is often used to monitor growth (Jonsomjit *et al*., 2007) [9]. Unless this is to be done for a research study specific to growth monitoring, it is unfeasible and unnecessary. We only monitored key visual indicators, weight, and behavioural characteristics (figure 3).

Fig 3: Monitoring growth of chick using visual indicators like feather growth, weight, and behavioural characteristics. Growth monitored in days A=14 days (initial age estimation on admission was two weeks), B=14 days, C=20 days, D=24 days, E=30 days, F=34 days, G=38 days, H=44 days, I=50 days.

At four weeks of age, the chick had started to fledge and feather plumage started to appear. This is when it also started to hop on the rim of the plastic container and would perch on it. It never returned to the nest cavity after this. It was always perched up on the rim (image D in figure 3). Between four and five weeks of age, the fledgling sunbird had started to vocalize extensively. Before this it would only squeak a little during feeding. This is also when a small plant was provided for the bird to perch on. It readily started using the plant for perching and hopping around (image E in figure 3). The nest container was now removed and never used again. Between fifth and sixth week the bird started taking short flights (image G in figure 3) and this is when it was shifted to a larger outdoor enclosure (image H in figure 3).

Pre-release Conditioning

Interaction with the bird was only limited to feeding, sanitation, and enclosure management. No associations were actively made but some degree of imprinting on caretaker is inevitable. In nature, birds imprint on their parents and other social interactions during the sensitive period of their growth stage. Sensitive period for both filial and sexual imprinting in unknown in sunbirds, but in some other birds the onset of sensitive period is as early as 10-15 days of age often correlating with locomotor ability and offset can be as late as second year of bird's life (Immelmann, 1972) [8]. Much care was taken to avoid filial imprinting as much as possible. It was however important to facilitate social interactions with wild adults so the hand-reared bird can learn social behaviours including sexual imprinting, foraging, songs, etc. A special enclosure was setup that had a fresh bunch of blooming flowers of Rangoon creeper *Combretum indicum* (known as "Madhumalti" in Hindi) inside the enclosure as well as around it (image A in figure 4). The enclosure had half inch weld mesh on all sides. This was purposefully organized so that the hand-reared bird can easily interact with wild conspecifics. Calls by the hand-reared bird immediately attracted adult wild sunbirds as well as fully fledged offspring probably raised by the wild sunbirds. Tremendous amount of social interaction was observed with no evidence of aggression (image C in figure 4). The hand-reared sunbird was now evidently identified as a female because of her coloration (image B in figure 4). She soon learnt how to feed on nectar from flowers by observing the wild sunbirds doing the same. We introduced live feeder insects and the bird again learnt to hunt by observing the wild sunbirds. In our opinion, social and behavioural imprinting was occurring in this stage as the hand-reared sunbird started to behave more and more like wild sunbirds including display of predator avoidance and fear. This was further reinforced by attack attempts by feral cats and wild shikra *Accipiter badius* from outside of the cage. Upon satisfaction of the bird's flight abilities, foraging ability, social and behavioural learning, we decided to release the bird after one week from the same location.

Fig 4: Pre-release conditioning and soft release of hand-reared purple sunbird.

Release and Post Release Monitoring

We wanted to monitor the bird for up to two weeks post release, but we did not have access to leg rings. We decided to use nontoxic marker pens to colour its chest feathers. We used red colour as it was giving bright contrast against the pale-yellow coloured feathers (images D, E, F in figure 4). Soft release was the method of choice for rehabilitation of the hand-reared sunbird back in nature. In this method of release, "backup" food is offered for up to two weeks after the bird is released. This is also a slow form of release where a hand-reared bird is allowed to adapt to the wild more gradually (Mukherjee & Mukherjee, 2021) [11]. On first day of release, the bird was offered live feeder insects and the shallow dish of nectar water. After it has taken its meal, the door of the enclosure was opened, but the bird was not forced out of the enclosure (image D in figure 4). The bird avoided going near the open door and spent the entire morning inside the enclosure. At early afternoon, approximately 1400 hours, it stepped out of the enclosure for a little while and perched on a branch nearby. Within a few minutes the bird went back inside the enclosure and did not come out for remaining of the day. The enclosure door was shut and secured for the night. Next morning, the same routine was repeated and this time the bird spent more time outside during the day. It however did not leave proximity of the enclosure, not even for foraging. It kept going inside the cage to sip nectar water every 15-20 minutes. On the morning of third day, the door was opened without food being provided. The bird was allowed to come outside of the enclosure and then live feeder insects were released near it. It hunted and ate the insects on its own. After this, the nectar water was provided in a shallow dish outside the enclosure. The bird readily started drinking from it. It returned to the enclosure every hour or so for a few minutes of rest and remained inside as it got dark. It was once again secured inside for the night. Same routine as previous days was repeated on day four. The bird started spending more time outside, exploring the locality and interacting with wild sunbirds. Its trips to rehydrate from the nectar water remained same but it started avoiding going inside the enclosure (image E in figure 4). This was the first day it did not return to the enclosure in the evening. From next morning onward, the live insects were discontinued after we observed self-hunting and foraging by the bird. We continued to provide the nectar water as weather had started to get hot as we entered the summer months. The bird was routinely observed for two weeks post-release and was found to be active and healthy. It eventually stopped drinking nectar water altogether and was now feeding on nectar from flowers in the vicinity (image F in figure 4), and hunting invertebrates.

Results and Discussion

To the best of our knowledge, this is the first documentation of successful rehabilitation of a hand-reared purple sunbird. Local wildlife rescue organizations report over 120 species of birds that are admitted in their centers however there are very few literatures available on local, native species. This, combined with the fact that countries like India do not have the necessary infrastructure for successful rehabilitation of wildlife makes the activity even more challenging. In absence of proper infrastructure, the cost of rehabilitation increases exponentially to the point where it becomes almost unfeasible to exercise good practice guidelines for rehabilitation centres and individual rehabilitators. This ultimately results in low success rates while still being an

expensive activity. The authors receive many requests from across the globe after a video documenting this case study was posted on YouTube. Unfortunately, the minimum infrastructure needed to care for a single sunbird chick includes feeder insect cultures, enclosures, temperature management, implementation of a caretaker for several days, access to viable habitat, time for careful observations, etc. and there is no quick fix to it.

This case study can be used as guidelines for hand-rearing and rehabilitation of nectarine species that are biologically and behaviourally similar to purple sunbird.

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