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Seasonal Variations of Quantitative Phytochemical Compositions in the Leaves of *Tridax procumbens* L.

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ABSTRACT

Tridax procumbens L. has several bioactive molecules which can be utilized as medicinal and food supplements. Several researchers have investigated the phytochemical constituents in the leaves in general. In this study seasonal and annual phytochemical constituents from the crude extract of *Tridax procumbens* L. leaves collected from Vetal hill Dist. Pune of phytochemical constituents during two consecutive years i.e. 2017 and 2018.

The crude extract from the leaves of *T. procumbens* L. was subjected to methanol extraction and was phytochemically analyzed for various qualitative and quantitative properties. The investigation revealed alkaloids, terpenoids, flavonoids, carbohydrates, glycosides, phenols and proteins in the leaves. Phenolic content was high in summer (107.27 ± 0.42 mg/g) followed by winter (89. 87 ± 0.47 mg/g) and lowest in mansoon (88.02 ± 0.12 mg/g). Flavonoids were found highest in summer (48.8 ± 0.66 mg/g) followed by mansoon (47.32 ± 0.87 mg/g) and lowest during winter (47.8 ± 0.57 mg/g). While Alkaloids were recorded higher during mansoon (31.01 ± 0.22 mg/g) followed by winter (30.22 ± 0.19 mg/g) and lowest in summer (29.10 ± 0.013 mg/g).

The total annual average of phenolics, flavonoids and alkaloids were found more during 2017 (P 95.05 mg/g, F 47.97 mg/g and A 30.08 mg/g respectively) and recorded less during 2018 (P 94.99 mg/g, F 44.86 mg/g and A 29.57 mg/g respectively). Thus interesting findings have been recorded during this study.

Keywords- Phytochemical, evaluation, phenolics, flavonoids and alkaloids, seasonal variation.

INTRODUCTION

Medicinal plants play an essential role in health care and are the major raw materials for both traditional and conventional preparations of medicines; and people often choose herbal medicines over conventional medicines (WHO, 2002). Medicinal plants attracted the attention of scientists due to their effectiveness, absence of side effects, lack of current alternatives, increasing cost of modern medicines and cultural preferences (Heinrich et al., 2000; Tabuti et al., 2003). Ethnobotanical studies are more significant to educate the people from tribal and modern culture about plants all over the world and documenting original information of medicinal plants. The quantitative ethnobotanical studies were used to identify the uses of plant as food (Pieroni et al., 2001), medicines for human health care (Kim et al., 2013), veterinary medicines (Upadhyay et al, 2011) and economical important plants available at low cost (Reyes-Garcia et al., 2006).

T. procumbens L. is used for the treatment of wound healing, dysentery, epilepsy, hypertension, hepatotoxicity, haemorrhage and metabolic syndrome (Suseela et al., 2002). Conventionally, *T. procumbens* L. is used in India as antifungal, insect repellent and anticoagulant medicine. In folk medicine, leaf extracts are used to treat skin infections and in Ayervedic medicine as a remedy for liver complaints for its hepato-protective nature in addition to use in gastritis and heart burn (Wani et al., 2010). Hence, in this study we have focused on the evaluation of seasonal variations in the phytochemical composition of *T. procumbens* L. leaves.

MATERIAL AND METHODS

Study Area

T. procumbens L., leaves and stem were collected from Vetal hill, Taluka- Haveli, District- Pune, Maharashtra State of India in the Summer, (March and April, 2017 and 2018), monsoon (August and September, 2017 and 2018) and winter (November and December, 2017 and 2018). Vetal Hill is a prominent hill in the city limits of Pune, India. The hill is the highest point within the city limits, with an elevation of 2600 ft. The geographical area is 180 30' to 180 32' N latitude and 730 49' to 730 52' E longitude covering an area of 10.5 square kilometers. It runs North-South with some spurs running perpendicular to this hill. Vetal hill runs across areas like MIT College, near Y.M. College Bharati Vidyapeeth, SNDT Women's University, ILS Law College, Gokhale Nagar, Symbiosis Society and Chatturshrungi. One may rich the hill top from one access road on the south.

Plate: A & B Study Area Vetal Hill, Taluka- Haveli, District- Pune, Maharashtra State.

A - Taluka- Haveli, District- Pune

B - Vetal Hill Collection Spot

Authentication

Our identification of *T. procumbens* L. was authenticated by Botanical Survey of India (BSI) Pune. Subsequently, a sample of the plant with reference number No. BSI/WRC/IDEN.CER. / 2016/135 (A) specimen No.-- PAM 01FHI 1008876 was deposited in the same institute.

Extraction

The collected part was washed thoroughly 2-3 times with running tap water. Leaves were sliced into small pieces, shade dried and then ground into a powder using an electrical blender. Five grams of the leaves powder was subjected to successive solvent extraction

in 100 ml of methanol and kept on shaker for 24 hours to obtain homogenate. This homogenate was filtered by Whatman filter paper-1. The extracts were stored separately in sterile bottles at 10^0C for phytochemical screening.


Plate: C & D, Plant Material of *Tridax procumbens* L.
A - Habit B - Leaves
A- Habit shows root, stem leaves and inflorescence & B- Leaves shows ventral and dorsal side, hairy toothed generally arrowhead-shaped.

Plate: E - Leaves Powder Extraction

1) Determination of Total Phenolics Content

Total phenolic contents of the extracts were quantified using Folin-Ciocalteu method described by Upadhya et al., (2013) with some modification. The plant extract (0.125 ml) with distilled water 0.5 ml was mixed with 0.125 ml Folin-Ciocalteu reagent and kept for 10 min for incubation at 37 ˚C to it 1.25 ml of 7% sodium carbonate was added and kept for 90 min at room temperature. The absorbance was measured at 760 nm on UV-Visible spectrophotometer. Gallic acid (10–1000 mg/l) was used for calibration of a standard curve and the amount of total phenol was calculated as % dry powder as Gallic acid equivalents (GAE).

2) Determination of Total Flavonoid Content

Total flavonoid content of all the plant extracts were quantified by using the aluminum chloride colorimetric method described by Deshmukh et al., (2009). The extract (1 ml) was mixed with 1 ml of 2 % aluminum chloride. The mixture was vortexed and the reaction was kept at the room temperature for 10 min in dark and absorbance of reaction mixture was measured at 367 nm using UV-Visible spectrophotometer. Quercetin (10–200 mg/l) was used for calibration of a standard and the amount of total flavonoid was calculated as mg / 100 g dry powder as Quercetin equivalents (QUE).

3) Determination of Total Alkaloids Content

The total alkaloid content in the samples was measured using 1,10-phenanthroline method described by Singh et al. (2004) with slight modifications. 100 mg material powder was extracted in10 ml 80% ethanol. This was filtered through muslin cloth and centrifuged at 5000 rpm for 10 min. Supernatant obtained was used for the further estimation total alkaloids. The reaction mixture contained 1 ml plant extract, 1 ml of 0.025 M FeCl3 in 0.5 M HCl and 1ml of 0.05 M of 1,10-phenanthroline in ethanol. The mixture was incubated for 30 minutes in hot water bath with maintained temperature of 70 ± 20C. The absorbance of red coloured complex was measured at 510 nm against reagent blank. Alkaloid contents were estimated and it was calculated with the help of standard curve of colchicine (0.1 mg/ml, 10mg dissolved in 10 ml ethanol and diluted to 100 ml with distilled water). The values were expressed as gm.100 gm-1 of dry weight. Total phenolic content (TPC) of the extract was determined by Folin–Ciocalteu method and expressed in mg/ml dry powder as Gallic acid equivalents (GAE). Total flavonoid content (TFC) was determined by $AlCl_3$ method. Results were expressed as mg/100 g dry powder as Quercetin equivalents (QUE). The total alkaloid content of the leaves extract of *T. procumbens* L. was measured using 1,10-phenanthroline method.

OBSERVATIONS AND RESULTS

Phytochemical analysis of *T. procumbens* L. leaves revealed following results. The interesting findings were documented during summer, winter and monsoon season, 2017 and 2018. These findings revealed highest concentration of phenolics during summer season (107.27±0.42 mg/g in 2017 and 105.18 ± 0.49 mg/g in 2018), followed by winter season (89. 87 ± 0.47

mg/g in 2017 and 92.14 ± 0.54 mg/g in 2018), and the minimum concentration during monsoon season (88.02 ± 0.12 mg/g in 2017 and 87.67 ± 0.47 mg/g in 2018).

Quantitative estimation of TFC of *T. procumbens* L. leaves and stem were recorded during summer, winter and monsoon season, 2017 and 2018. *T. procumbens* L. leaves showed highest concentration of flavonoids during summer season (48.08 ± 0.66 mg/g in 2017 and 45.87 ± 0.45 mg/g in 2018), followed by monsoon season (47.32 ± 0.87 mg/g in 2017 and 44.17 ± 0.57 mg/g in 2018), and the minimum concentration during winter season (47.08 ± 0.57 mg/g in 2017 and 44.17 ± 0.57 mg/g in 2018).

T. procumbens L. leaves showed highest concentration of alkaloid during monsoon season (31.01 ± 0.22 mg/g in 2017 and 30.94 ± 0.25 mg/g in 2018), followed by winter season (30.15 ± 0.23 mg/g in 2017 and 30.22 ± 0.19 mg/g in 2018), and the minimum concentration during summer season (29.10 ± 0.013 mg/g in 2017 and 27.56 ± 0.29 mg/g in 2018).

The total annual average of phenolics, flavonoids and alkaloids were found more during 2017 (P 95.05 mg/g, F 47.97 mg/g and A 30.08 mg/g respectively) and recorded less during 2018 (P 94.99 mg/g, F 44.86 mg/g and A 29.57 mg/g respectively). Thus interesting findings have been recorded during this study.

Fig. 1, 2 & 3: Observations of quantitative phytochemical compositions of *T. procumbens* L. leaves and stems depicted graphically.

Fig. 1a, 2a & 3a: Standard calibrations

Fig. 1: Total phenolic content

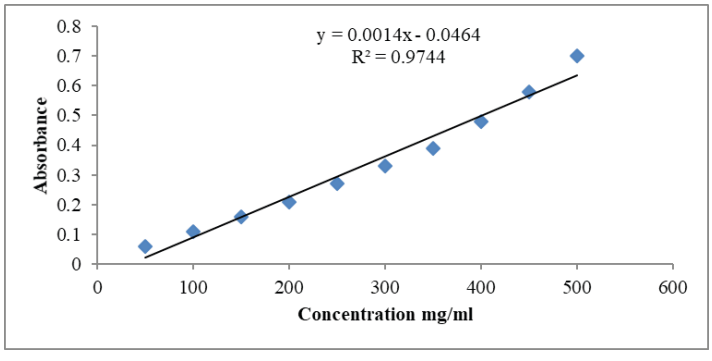

Fig. 1a: Standard calibration of total phenolics

Fig 2: Total flavonoid content

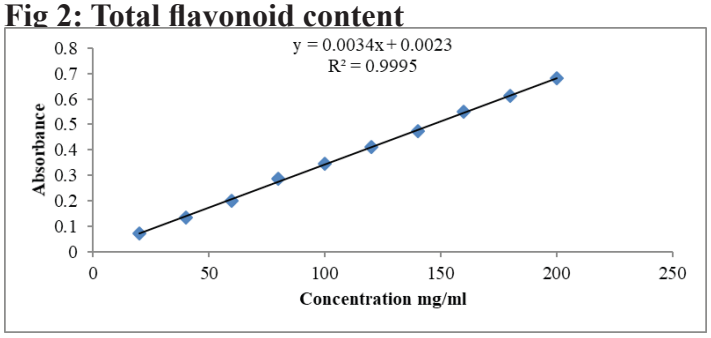

Fig. 2a: Standard calibration of total flavonoid

Fig 2: Total alkaloids content

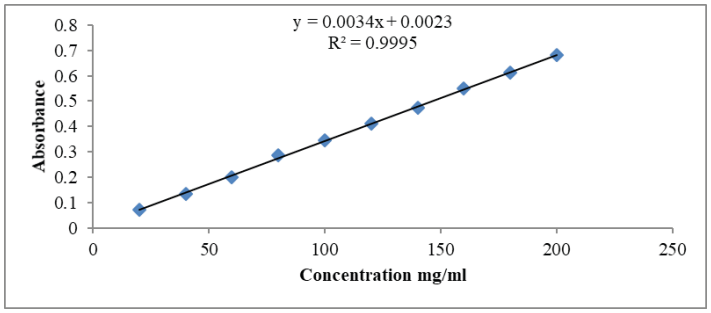

Fig. 1a: Standard calibration of total alkaloids

DISCUSSION

The evaluation of total phenolics in the leaf extract revealed higher phenolics during summer, moderate during winter and minimum in monsoon during both the years i.e. 2017 and 2018.This study indicates that increased level of phenolics during summer naturally protect the plant from diseases thereby augmenting disease resistance. Okereke et al. (2017), has recorded similar findings. Total flavonoid content in *T. procumbens* L. methanolic plant extracts was found more in leaves during summer followed by monsoon and winter of both the years i.e. 2017 and 2018. Okereke et al. (2017), has similarly results. The alkaloid content is higher in leaves extract of *T. procumbens* L. during monsoon followed by winter and summer in both the years i.e. 2017and 2018.

SUMMARY

Different disciplines like ethnobotany, Unani medicine, Ayurveda and herbal treatment modalities use *T. procumbens* L. for treating a variety of diseases. Our results about the phytochemical seasonal fluctuations in the levels of phenolics, flavonoids and alkaloids in *T. procumbens* L.during summer, winter and monsoon

seasons in 2017 and 2018 may be helpful for the use of this plant in pharmacological perspective and future physiological research.

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Unusual Nesting Of Mottled Wood Owl *(Strix ocellata)* In An Abandoned Nest Of Bird Of Prey In Orchha Nature Reserve, Madhya Pradesh

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Mottled Wood Owls are widely distributed in Indian Sub-continent; however few studies have been undertaken on various aspects of this species (Pande et al 2018). They are found in thin deciduous forest adjacent to dry thorn forests or agricultural areas and on indigenous trees like banyan, tamarind, mango and other large trees (Pande et al 2018, Siva & Neelanarayanan, 2018). Further, according to BirdLife International 2019, the Mottled Wood Owl is one of the least studied owls in India and hence the present observation gives a new insight on the breeding behavior of Mottled Wood Owl.

The species' is known to specifically nest in large, old trees, including dead trees. Interestingly, a Mottled Wood Owl was recorded nesting in a deserted nest of a raptor. The geographical location of the nest was N 25°16′52.64″ and E 078°36′15.32″. It was observed on 2nd May 2018 in Orchha Nature Reserve, on a teak (*Tectona grandis*) tree 131 cm in diameter and approximately 40 feet in height (Fig.1). Such nesting is an unusual behavior of Mottled Wood Owls that are

Fig.1:Nest located on a Teak (Tectona grandis) tree

Fig.2: An abandoned raptor nest with a chick of Mottled Wood Owl

Fig.3: Mottled Wood Owl with chick in a n open abandoned nest of a raptor

known to nest in natural tree hollows open to the sky harbored in old trees that have large trunks with an average diameter at breast height (DBH) of 520.5 cm (686.4; n¼14) (Pande *et. al*., 2018). The present nest had a chick that fledged successfully (Fig.2). One of the parents was observed with the chick in the nest (Fig.3). Care of young ones in an open nest is a difficult task for owl species due to continuous mobbing by other birds particularly the crows and parakeets. The nest was probably a deserted nest of either Oriental Honey Buzzard Pernis ptilorhynchus or Crested Serpent Eagle *Spilornis cheela* that are seen nesting in the Orchha Nature Reserve. In 2019, the site was revisited but no owl nesting was found in the area.

Dusky Eagle Owl *Bubo coromandus* is known to nest in open abandoned nests of corvids or raptors in Bharatpur sanctuary (per. Com. Pande, S). The observation may indicate unavailability of suitable nesting sites for the Mottled Wood Owls in the study area. The region lacks thick and stout trees that have the potential open to sky natural holes/cavities to sustain the nesting pairs. The main reason is uncontrolled wood cutting by the local people who are residing in villages (Singhpura and Lotana) inside the Nature Reserve. Due to the disturbances and wood cutting in the reserve area, Lotana village has been relocated by the Forest Department and soon Singhpura will also be relocated. It is recommended to implement conservation strategists that promote the marking and protection of all trees and particularly old and nest bearing trees, whether alive or dead, that could be used for nesting by birds including Mottled Wood Owls.

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A report of Temminck's Stint *Calidris temminckii* stuck in a bivalve shell from Indore, Madhya Pradesh

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Citation: Khabia Ritesh (2019), A report of Temminck's Stint Calidris temminckii stuck in a bivalve shell from Indore, Madhya Pradesh

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- **Name of Species: - Temminck's stint**
- **Scientific Name.** – *Calidris temminckii*
- **Status: -** Winter Migratory
- **Date of sighting:-** 3rd June 20119
- **Time of sighting:-** 08.23 am
- **Weather parameters: -** Sunny
- **Number of times sighted: -** The species is a regular rare species encountered in winter months (November to March)
- **Number of birds rescued: -** Single
- **Gender of bird:** Male
- **Locality: -** Sirpur Lake, Indore, Madhya Pradesh
- **Habitat description: -**; Wetland and Lake
- **Distance from human habitation:-0** km.
- **Any other bird/animal associates:** Black-winged Stilts, Ducks, Waterhen
- **Bird Behaviour: -** The stint was found helplessly stuck in an old broken bivalve shell on the dried shore of the lake. The birds was quickly rescued and successfully released in the same habitat. There was no major injury.
- **Threats to the habitat: -** Pollution and human disturbance
- **Photographs: -** Attached.
- **Previous records: -** This is probably the first such rescue and release record for this species.

Beach Stone-Curlew/Beach Thick-knee (*Esacus neglectus*) in Hutbay, Little Andaman

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- **Name of species:** Beach Stone-Curlew *(Esacus neglectus)*
- **Status -** Near Threatened as per the IUCN Red List of Threatened Species 2016
- **Date of sighting-** 26 Dec 2018
- **Time of sighting-** 12:24 p.m.
- **Weather parameters-** Afternoon with clear skies.
- **Number of times sighted-** Once
- **Number of birds-** 1
- **Gender of bird-** NA
- **Locality-** Hutbay beach, Little Andaman, Andaman Islands, India
- **Habitat description-** The individual was sighted sitting in plastic trash of fishing nets and bottles on Hutbay beach.

- **Distance from human habitation-** 1-2 km.
- **Any other bird/animal associates:** There were many other birds seen. To name a few recorded at that time are Pacific Swallow, Barn Swallow, Eastern Yellow Wagtail and White-bellied Sea Eagle.
- **Bird behaviour-** When the bird was first sighted, it was standing near the plastic trash preening itself. After sensing human presence, it walked over and sat in the trash (felt like it was trying to camouflage). Over time, the bird moved onto a grass turf near the beach which was also covered in trash, where it was seen stretching its wings. Bird did not appear shy but was very alert.

- **Threats to the habitat-** Human presence because of beach combing and boating. The beach was also littered with plastic and other waste. This littering could be a result of garbage thrown by locals/tourists and garbage thrown back by the ocean on to the beach.
- **Previous record-** As per OrientalBirdImages.org
- **Posting by -** Manjusha Savant in Hutbay, Little Andaman, Andaman Islands, India on 26 Dec 2018 Gaurav Kataria in Chidiya Tapu, South Andaman, Andaman Islands, India on 15 Dec 2016

Collared Owlet *(Glaucidium brodiei)* predating upon Red billed Leiothrix *(Leiothrix lutea)* in Sattal, Uttarakhand

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Citation: Tamhankar Sneha (2019). Collared Owlet *(Glaucidium brodiei)* predating upon Red billed Leiothrix (Leiothrix lutea) in Sattal, Uttarakhand

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- Name of species: Collared Owlet (*Glaucidium brodiei*)
- Status- Least Concern as per the IUCN Red List of Threatened Species
- Date of sighting- 17/12/2018
- Time of sighting- 07.47 a.m.
- Weather parameters- Morning with clear skies.
- Number of times sighted- Once
- Number of birds- One of each species.
- Gender of bird- Unknown.
- Locality- Sattal , Uttarakhand
- Habitat description- The Owlet was sighted on ground with Red billed Leiothrix kill.
- Distance from human habitation- About. 4 kms.
- Any other bird/animal associates: A lot of bird activity was concurrently seen that morning.
  The other birds sighted were Red billed Leiothrix *Glaucidium brodiei* on trees, Chestnut-bellied Nuthatch *Sitta cinnamoventris*, Grey-headed Woodpecker (Male and Female) *Picus canus*, Khalij Pheasant (Male and Female) *Lophura leucomelano*, White Throated Laughingthrush *Pterorhinus albogularis*,, Rufous Throated Partridge *Arborophila rufogularis*, White Crested Laughingthrush *Garrulax leucolophus*, Grey Tree Pie *Dendrocitta formosae*..
- Bird behaviour- Collared Owlet is most active during daylight. This bird can be seen perching, hunting and calling during most parts of the day, and sometimes during the night. It is often mobbed by other small birds when roosting, Several species of birds appeared disturbed. They were coming on ground and were wary. This happened several times. Finally we realised that the Collared Owlet was the reason for disturbance.
- Photographs- Attached
- Note – This is probably the first photographic record of the Collared Owlet predating on Red billed Leiothrix.

Relocation of Striped Hyena *Hyena hyena* to resolve hyena-human conflict in Nimach district, Madhya Pradesh, India

Gopal Bandhu*

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Citation: Bandhu Gopal (2019), Relocation of Striped Hyena Hyena hyena to resolve hyena-human conflict in Nimach district, Madhya Pradesh, India.

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- **Name of species**- Striped Hyena.
- **Scientific Name-** *Hyena hyena*.
- **Status**- Near Threatened. (IUCN Red List, 2015).
- **Date of trapping**- 03 March 2016.
- **Time of trapping** – Around 10.00 AM.
- **Weather parameters**- Sunny, warm.
- **Reason for trapping**- The Striped Hyena had taken recent residence in a road side drain pipe near urban fringe. It was lifting poultry, goats and pet dogs from surrounding human habitation. It was entering backyards of homes at night and was a cause of fear and economic loss. There repeated complaints from people to solve the hyena-human conflict.
- **Number of animals**- Single.
- **Gender of animal**- Male.
- **Locality**- Near Manasa town, Nimach district, Madhya Pradesh.
- **Habitat description**- Proximity of human habitation with grassland, scrub and dry arid land. This is a part of the Kathiawar-Gir dry deciduous type of forests
- **Distance from human habitation**- Approximately 0.5 km.
- **Steps taken**- The residence of the hyena in the pipe was confirmed by our observations. Its residence in road side large drain pipe was already noticed by local shepherds. After the hyena retired to the pipe just before dawn, we formulated a plan and in the morning, a cage was kept in front of the opening of the pipe. The second opening on the other side of the road was blocked. The hyena entered the cage and was trapped.
- **Animal behaviour and release** – The caged hyena was restless for one day and attempted to bite through the cage. It suffered minor abrasion on the lip with bruising and bleeding that were treated by veterinarian. The hyena was fed flesh that it consumed readily and was relocated and released on 09 March 2016 at Parda-Kanjarda boundary of the Manasa sub-range, Nimach district, several km away from the town.
- **Subsequent problem**- The hyena was not reported

to come back to the same area near Manas town. No subsequent conflict was reported.

- **Photographs**- Attached.
- **Previous records**- Presence of Striped Hyena is known from the region but the present report was the first instance when hyena-human conflict was reported and resolved successfully by the Forest Department.

Incomplete Albinism in Spotted Owlets *(Athene brama)*: Observations and Rehabilitation in Western India

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Introduction:

The Spotted Owlet (*Athene brama*) is a common resident of the Indomalayan and Palearctic realms, from tropical Asia, across India through South East Asia. It nests in various cavities in human-altered habitats including agricultural cropland, degraded deciduous forests and is categorized as Least Concern (Duncan 2003; Pande et al. 2007; Mikkola 2012; del Hoyo et al. 2014; Birdlife International 2018). We present the first report on the rehabilitation and measurements of two incomplete albino wild-born Spotted Owlet fledglings from Sangli district, Maharashtra, India.

Observations:

On 29 May 2018, early in the morning, a Spotted Owlet fledgling with white plumage was noticed perching on the ground while being mobbed by House Crows (*Corvus splendens*) in Ghalwad village, Shirol taluka, about 10 km from Jaysingpur (16.867634 N, 74.570389 E), Sangli district, Maharashtra, India. Concerned for its well-being local resident Nitish Kengar collected the bird. In the early morning the next day another Spotted Owlet fledgling with white plumage was found and collected from the same location in similar circumstances. Both birds were kept in a box and handed over to GS, after informing AP and other officials from the Forest Department. GS took and sent photographs to SP, who identified the birds as recently fledged Spotted Owlets and offered advice for their immediate care.

On 01 June 2018, SP travelled to Jaysingpur to observe and measure the birds and further assess their condition. The Spotted Owlets had readily consumed chicken flesh, vocalized, were active and did not show any injuries. The owlet calls were digitally recorded.

The owl's facial disc, crown, nape, mantle, back, scapulars, breast, belly, flanks, remiges and rectrices; legs, eye rings, gape, beak, tarsus, toes and talons was white. However, their eyes had lemon yellow irises, consistent with the definition of incomplete albinism (Alaja and Mikkola 1997).

A summary of recorded measurements of the birds is presented in Table 1. Gender was ascertained based on presence (male) or absence (female) of the cloacal protuberance. (Svensson 1992). The fledglings were banded with a red colored ring on the left tibio-tarsus prior to their release.

Adult Spotted Owlets have 12 rectrices (personal observation, SP). In our study, the 1st owlet had five tail feathers missing but the central tail feathers were intact and the second owlet had one missing, presumably as a result of encounter with crows. The measurements of the fledglings, and their behavior, suggested that they had previously branched (Pande et al. 2011) and were mobbed by crows after the first flight. SP returned with the owlets to Ghalwad village and located a pair of adult Spotted Owlets perching on one of several tall trees. Because the light was rapidly fading, SP placed the fledgling owlets in a nest box 6 m above the ground on the tree where the adult owlets were perching. SP had successfully rehabilitated Barn Owl chicks (*Tyto alba*) in this manner (Pande et al. 2005b). When the fledgling owlets were placed in the nest box they vocalized and the adult owlets immediately flew to a low branch close by. We were encouraged by this behavior and assumed that they were the parents of the fledglings. We then retreated to a safe distance for further observations. The adults immediately perched on the nest box and subsequently fed the fledglings. One adult had a white patch on the abdomen devoid of any markings and a white patch on the leading edge of each wing, indicating a possibility of patchy albinism. Later in the night, the fledglings left the nest box and flew to and perched on branches near the adults.

During the day on 02 June 2018, the fledglings were not seen and we assumed that they were either in the natural nest cavity or roosting in dense foliage. That evening both the fledglings and adults were heard and photographed foraging together. For the next 3 weeks the juvenile incomplete albino Spotted Owlets were seen successfully foraging and flying with the adults at night while remaining hidden during the day.

Discussion:

The color of avian plumage depends on the enzyme tyrosinase which acts on the amino acid tyrosine to produce the dark pigment melanin. A recessive gene in some birds may inhibit the enzyme tyrosinase thereby producing altered plumage colors (albinism), rutilism (excessive red), flavinism (excessive yellow) or melanism (dark colors) and the entire spectrum is termed as leucism or isabellinism (Gross 1965; Holt et al. 1995; Mueller and Hutt 1941; Pawashe et al. 2006). In birds, albinism is imperially classified in to four morphological categories. 1) Total Albinism: The rarest form, where there is a simultaneous complete absence of melanin from eyes, skin and feathers; 2) Incomplete Albinism: Melanin is not simultaneously absent from eyes, skin and feathers; 3) Imperfect Albinism: Melanin is reduced in the eyes, skin and feathers; and 4) Partial Albinism: White patches due

Table 1. Gender and Measurements of two Incomplete Albino Fledgling Spotted Owlets (Athene brama) from Sangli District, Maharashtra, India.

Description of body part	Spotted Owlet 1	Spotted Owlet 2
Gender	Female	Male
Biomass	108 g	110 g
Hand length	128 mm	130 mm
Stretched Wing	R and L: 205 mm	R and L: 200 mm
Wing width	100 mm	100 mm
Alula length	55 mm	45 mm
Wing span	410 mm	460 mm
No. of primaries	R and L: 10	R and L: 10
No. of secondaries	R and L: 12	R and L: 12
No. of rectrices	7	11
Tail length	55 mm	55 mm
Wing web	27 mm	30 mm
Beak length	19.2 mm	18.8 mm
Beak width	6.4 mm	6.8 mm
Tarsus length	35 mm	35 mm
Middle toe	17.7 mm	20 mm
Middle talon	9.3 mm	10.6 mm
Spread claw	29.6 mm	32.8 mm
Ring	Left leg: Red-1	Left leg: Red-2

to absent melanin are localized to certain areas of the body. Injury, physiological disorders, diet deficiencies or circulation disorders may lead to partial albinism (Alaja and Mikkola 1997). At the same time, white plumage in Snowy Owl (*Bubo scandiaca*) is not due to albinism but an expression of schemochrome feather structure (Holt et al. 1995).

Albinism is reported in several avian families (Pande et al. 2003; Mahabal and Pande 2006a,b; Pawashe et al. 2006), but reports in owls are uncommon. True albinism in owls is reported in Barred Owl (*Strix varia*), Eastern Screech-owl (*Otus asio*), Brown Wood Owl (*Strix leptogrammica*). Tawny Owl (*Strix aluco*) and Short-eared Owl (*Asio flammeus*) (Alaja and Mikkola 1997). Incomplete albinism is reported in Burrowing Owl (*Athene cunucularia*), Great Horned Owl (*Bubo bubo*), Short-eared Owl (*Asio flammeus*), Eastern Screech-owl (*Otus asio*), Western Screech-owl (*Otus kennicottii*), Little Owl (*Athene noctua*), Spectacled Owl (*Pulsatrix perspicillata*), Barn Owl (*Tyto alba*), Indian Scops Owl (*Otus bakkamoena*) (Alaja and Mikkola 1997). The photograph of an incomplete albino Spotted Owlet (*Athene brama*) was sent to Deane Lewis in September 2011 by Golap Gogoi from village Raidongia-Gaon in Golaghat, Assam, India (D. Lewis, pers. comm.). Therefore, albinism has been reported in 14 species of owls, and our report of incomplete albinism in wild Spotted Owlets is the second report for this species in the world.

Though albinos may survive several years and produce young with normal colored mates, their overall life expectancy is thought to be lower due to higher predation risk due to conspicuous plumage, intra-specific conflict due to rejection by congeners, and poor eye sight in bright light in complete albinos with pink eyes (Alaja and Mikkola 1997). Albino individuals of nocturnal species of owls may be less noticeable in low light conditions, and their abnormal eye color may be less likely to affect their eyesight at night; this, together with their use of sound to detect prey at night, may lessen the potential negative effect of albinism on predation success (Sayers 1996). However, we note in this study that the newly fledged incomplete albino Spotted Owlets were mobbed by the crows early in the morning. They could have been morbidly injured or killed if not rescued. The post-fledging dependence period is a

high-risk phase in the life of most birds (Sunde 2005; Rahman 2015), when flight and foraging abilities begin to develop (Donazar and Ceballos 1990). We suggest that the risk may be relatively high for albino or oddly colored fledglings during their first flights compared to more camouflaged, normally colored fledglings since many predators select oddly colored prey (Rutz 2012).

This study suggests that a human intervention (rescue, rehabilitation) enabled the conspicuous incomplete albino fledgling Spotted Owlets to avoid a predation attempt by crows enabling them a second chance to gain flight and survival skills to live freely in the wild. We shall monitor the next breeding attempt of the adult Spotted Owlets to determine if they produce more young exhibiting albinism.

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