Avian biodiversity on *Butea monosperma* tree during spring season and possible role of flavonoids

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Abstract : Present work was undertaken to study avian biodiversity on specific tree *Butea monosperma* during spring season for the year 2012 and 2013 respectively. Observations were carried out thrice a week at twelve sites in and around Nagpur, Maharashtra. Observations indicated that various local and migratory birds were mostly attracted to flowering trees like *Butea monosperma*(BM) variously named as Palas. Birds were observed feeding on nectar from open keel and some birds foraging freshly opened BM flower. FTIR and UV visible spectra of methanolic extract of BM flowers confirmed presence of flavonoids like Rutin, Quercetin, Butin and Isobutin. These flavonoids possibly play a role in reducing oxidative stress. Occurrence of migratory birds like Rosy Starling was found to be dependent on the early blooming of BM flower which also coincided with the rise in temperature and humidity. No such correlation was found with local birds. Conservation of BM tree may help in conserving the biodiversity of local as well as migratory birds.

Key words : Avian biodiversity, spring season, *Butea monosperma*, Flavonoids. Nagpur

Introduction

Avian biodiversity is the richness of bird species. Diet of birds may include insects like grasshoppers, fruits like berries, grapes, variety of seeds, and nectar of some flowers. Wild grain is also a valuable source of food for many birds. Even some birds can be seen foraging in tree bark for insects that apparently provide valuable protein. During spring season various flowers bloom, some of them can be observed where maximum biodiversity of birds can be seen. In Nagpur city various local and migratory birds were observed sucking nectar of Palas (*Butea monosperma*)(BM) and Semal (*Bombax ceiba*) flowers. The flowers are visited by a variety of insects, birds and some mammals. Birds dig into the keel-shaped lower petals of the flower to lick up the nectar. In turn the stamen pops out and smacks pollen on the forehead of the bird and some birds foraging freshly opened BM flower as they pollinate the flowers (Rajesh Tandon et al). Birds have high metabolic rate hence are subjected to oxidative stress (Kevin J. McGraw). The expression of most life history traits, such as immunity, growth and the development of sexual signals, is negatively affected by high levels of oxidative stress. Dietary antioxidants can reduce oxidative stress and have therefore been the focus of numerous studies in behavioral and evolutionary ecology in the last few decades (Xinyan Tang et. al). Oxidative stress reducing flavonoids are found in BM flowers. Flavonoids in food are important for birds as they act as antioxidant and restore intracellular immunity (Carlo Catony, et al.).

Study areas

To study food and feeding habit of birds during spring season 12 sites in and around Nagpur were selected. These sites are - 1. Gorewada lake and forest, 2. L.I.T.college campus, 3. Satpuda botanical garden, 4. Ambazari garden, 5. Surabuldi, 6. Zilpi lake, 7. Telhara lake, 8. Dahegoan, 9. Haladgaon, 10. Paradgoan, 11. Bhandara road and 12.Navegoan bandh.

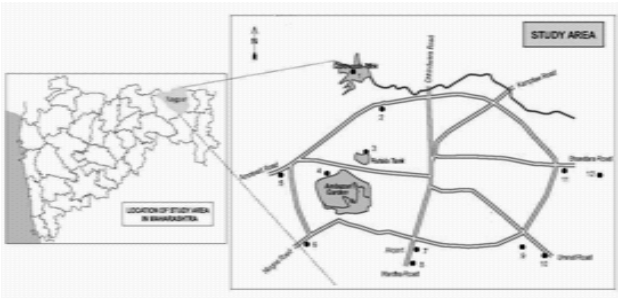

Fig 1-Location of Nagpur in the state of Maharashtra and study areas in Nagpur.

Butea monosperma (Palas)

Description: It is found throughout India and variously named as Palash, Palas, Flame of Forest etc. It is medium sized deciduous tree belonging to the family Fabaceae, growing up to 15 m tall. The leaves are pinnate with a petiole 7.5-20 cm long with small stipules and three leathery leaflets. Flowers are 2.5 cm long, bright-red, and produced in racemes up to 15 cm long. The fruit is a pod 15-20 cm long and 4-6 cm broad (http://www.worldagroforestry.org). Palas tree loses

its leaves as the flowers develop. Flowers start appearing in February and flowering season lasts up to end of April. The flowers form a gorgeous canopy on the upper portion of tree, giving appearance of a flame from a distance. The flowers show characteristics of bird pollination being large and bright orange red in color with copious amounts of nectar, and exhibiting diurnal anthesis. BM flowers are found to have antihyperglycemic activity (Rahul Somani et.al), (N.Sharma and V.Garg.), anticonvulsive activity(Venna S.Kasture), anthelmintic activity(D.Prashanth and M.K.Asha), antioxidative, and hepatoprotective potential (Neetu Sharma and Sangeeta Shukla).

Material and method

In the present study, twelve sites in Nagpur city have been selected. Observation sites were selected on the basis of presence of flocks of birds which also coincided with blooming of *Butea monosperma* (Palas) flowers. Observations were carried out thrice a week. Feeding behavior of birds was observed for two years (2012-2013) in the months from February to April. Regular field visits were made throughout this period from 7 a.m. to 9 a.m. in the morning. Data on present bird species was collected by direct observation method with the help of Olympus Binocular 10*50 X. For photography Cannon camera – EOS 550 D, Lens 100-400 was used.

Plant material and flower extract: Since birds were mostly observed sucking nectar of Palas flowers, these flowers were collected from Satpuda botanical garden Nagpur. Herbarium was authenticated and deposited at Post Graduate Teaching department of Botany RTM Nagpur University (Ref. No.9814). Flowers were shade dried for 10-15 days and then powered. Accurately weighed 15.0 g of powder was mixed with 150.0 ml of methanol and processed for Soxhlet extraction. Methanolic extract of *Butea monosperma* flower was obtained and used for UV-visible and FTIR spectroscopy.

UV-Vis analysis: 0.5 g BM flower extract was diluted with 10.0 ml methanol and spectra were recorded on Shimadzu UV 2450 spectrophotometer in the range 190-800 nm.

FTIR analysis: About 10.00 mg BM flower extract was mixed with 100.0 mg KBr (FTIR grade) and pressed into a pellet. The sample pellet was placed into the sample holder, and FTIR spectra were recorded in the range 500–5000 cm^{-1} in *Fourier Transform Infrared* (FTIR) spectroscopy (Shimadzu IR Affinity –I Spectrometer).

Observations

Table 1: Avian Biodiversity on *Butea monosperma* during spring season.

Order	Family	Species	Status
Psittaciformes	Psittacidae	Blossom Headed Parakeet	R
		Slaty Headed Parakeet	R
		Rose Ringed Parakeet	R
Columbiformes	Columbidae	Spotted dove	R
		Laughing dove	R
Coraciiformes	Bucerotidae	Indian Grey Hornbill	R
	Upupidae	Hoopoe	R
Piciformes	Picidae	Flame backed woodpecker	R
Passeriformes	Sturnidae	Common Myna	R
		Brahminy Myna	R
		Indian Pied Starling	R
		Chestnut Tailed Starling	R
		Rosy Starling	M
	Pycnonotidae	Red Vented Bulbul	R
	Timaliidae	Yellow Eyed Babbler	R
		Large Grey Babbler	R
	Nectarinidae	Purple Sunbird	R
		Purple–Rumped Sunbird	R

	Aegithinidae	Common Iora	R
	Corvidae	House Crow	R
		Jungle Crow	R
		Drongo	R
		Treepie	R
	Laniidae	Long Tailed Shrike	R
	Passeridae	sparrow	R
	Megalaimidae	Coppersmith barbet	R
	Zosteropidae	Oriental White Eye	R
	Chloropseidae	Leafbird	M
	Phylloscopidae	Greenish Warbler	M
		Tickell's Leaf Warbler	M
	Oriolidae	Golden Oriole	R

R-Resident, M-migrant (Ref- "Birds of the Indian Subcontinent" 2nd Edi, By-Richard Grimmett, Carol Inskipp and Tim Inskipp)

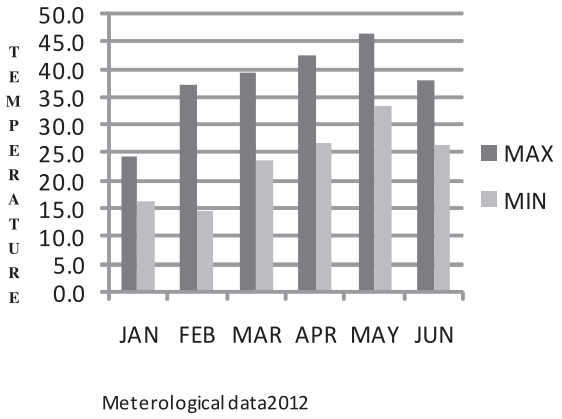

Figure-1.Maximum and minimum temperature for year 2012

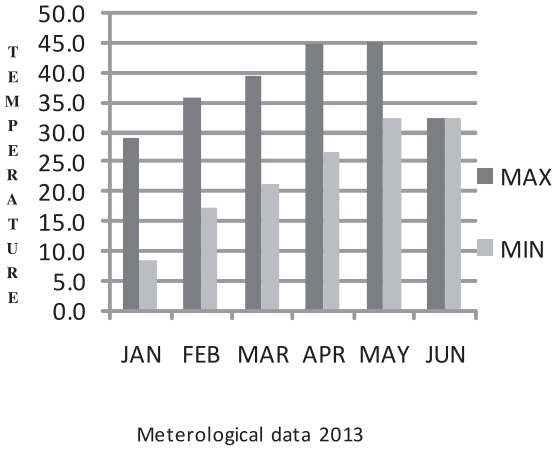

Figure-2. Maximum and minimum temperature for year 2013

Table 2 : Results showing presence of flavonoids in sample by UV-Vis Spectrophotometer

Instrument	Absorbance	Indicates Presence
UV-Vis Spectrophotometer	204nm	Flavonoids
	264nm,	
	372nm	

Table 3: - Results showing flavonoids are Rutin, Quercetin, Butin, Isobutin by FTIR

Instrument	Indicates Presence of flavonoids
Fourier Transform Infrared spectroscopy(FTIR)	Rutin
	Quercetin
	Butin
	Isobutin

Probable Identification of Functional Groups:

Aromatic Hydrocarbons: **Ar-H = 3000-3050 cm^{-1}**

Peaks in fingerprint region**: 500-1500 cm^{-1}**

Figure-3 and figure-4 Bird Photographed while foraging on *Butea monosperma* flower

Results and Discussion

According to the data from the table -1 it was observed that 5 orders, 18 families and 31 species of birds are found on *Butea monosperma* tree .They are either sucking nectar or foraging freshly opened BM flower. These birds are mostly local and some like Rosy Starling (*Sturnus roseus*) are migratory. Generally Rosy Starling sucks nectar of BM flower (Raju Kasambe and Tarique Sani), which arrived quite faithfully in mid-to-end February, and left fairly punctually at the mid to the end of April. From observations it was found that *S.roseus* arrived early in year 2013 i.e. at the end of January. From meteorological data comparative study of occurrence of *S. roseus* and temperature range was made. From figure 1 and 2, it was observed that during January 2012, maximum and minimum temperatures were 24.5°C. and 16.5°C respectively. During January 2013 maximum and minimum temperature was 28.9°C and 8.3 °C respectively. Temperature varied more than the previous year. It could be a possible cause of early blooming of *Butea monosperma* as compared to the previous year, which perfectly coincided with the early arrival of *S. roseus.* Comparatively departure dates were noted to be uniform all around mid to end-April. No such correlation was observed with local birds. According to table-2, absorbance wavelength at 204nm, 264nm, 372nm confirmed presence of flavonoids in sample by UV-Vis Spectrophotometer As evident from table-3 FTIR showing functional groups are aromatic hydrocarbons present on 3000-3050 cm-1. FTIR confirmed that these flavonoids are Rutin, Qurcetin, Butin and Isobutin. It was noted that birds prefer food enriched with flavonoids. Birds can obtain immunological benefits from the ingestion of flavonoids (C.Catoni et.al.). It has been reported that free radicals arising as by-products of normal metabolic activities have deleterious effects on cellular proteins, lipids and DNA, this phenomenon is known as oxidative stress. Since reproduction is an energy demanding activity, which increases both basal and field metabolic rates, hence breeding efforts generate oxidative stress (Alonso-Alvarez,C.et al). It was shown that the radicals scavenging activity may be present in flavonoids (Wolf Bors., et. al). It has been also reported that antioxidant flavonoids could restore the intracellular antioxidant system and promote primordial germ cells proliferation via their antioxidant action involving the protein kinase A (PKA) signaling pathway (Kevin J. McGraw).

Conclusion

Butea monosperma plant was found to be requisite for local and migratory bird. Possibly it provided immunological support and reduced oxidative stress produced due to various physiological activities. The arrival period of Rosy Starling on BM appeared to be related to flowering, which in turn was found to be dependent on fluctuation in temperature. Therefore it is necessary to plant more and more trees. Conservation of existing trees is equally important.

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References

Carlos Alonso-Alvarez, Sophie Bertrand, Godefroy Devevey, Josiane Prost, Bruno Faivre, Gagriele Sorci, (2004), Increased susceptibility to oxidative stress as a proximate cost of reproduction, Ecological Letters, 7(5), pp 363-368

Carlo Catony, (2008), Anne Peters, H. Martin Schaefer., Life history trade-off are influenced by the diversity, availability and interactions of dietary antioxidants., Animal Behavior, Elsevier, 76(4), pp 1107-1119

Carlo Catony, (2008), Anne Peters, H. Martin Schaefer., (2008); Fruit for Heath: the effect of flavonoids on humoral immune response and food selection in a frugivorous bird., Functional Ecology., 22(4), pp 649-654

D.Prashanth and M.K.Asha., (2001); Anthelmintic activity of *Butea monosperma.,* Elsevier; Fitoterapia, 72(4), pp 421-422

http://www.worldagroforestry.org/treedb2/AFTPDFS/Butea_monosperma.pdf

Kevin J. McGraw.,(2011), Avian Antioxidants and Oxidative Stress: Highlights from Studies of Food, Physiology, and Feathers; *Oxidative* Stress in Applied Basic Research and Clinical Practice, Volume 5, Studies on veterinary medicine, Volume 5, pp 161-174.

N.Sharma and V.Garg.,(2009), Antihyperglycemic and antioxidative potential of hydroalcoholic extract of *Butea monosperma* Lam flowers in alloxan-induced diabetic mice., Indian Journal of Experimental Biology (IJEB), 47(07), pp 571-576

Neetu Sharma and Sangeeta Shukla,(2011), Hepatoprotective potential of aqueous extract of Butea monosperma againt CCl_4 induced damage in rats., *Elsevier*; Experimental and Toxicologic Pathology., 63(7-8), pp 671-676

Rahul Somani,Sanjay Kasture, Abhay Kumar Singhai, (2006), Antidiabetic potential of *Butea monosperma* in rats.;Elsevier, Fitoterapia., 77(2) pp 86-90

Rajesh Tandon, K.R.Shivanna and H.Y.Mohan Ram.,(2003), Reproductive Biology of Butea monosperma (Fabaceae), Oxford Journals, Life sciences, Annals Botany, 92(5), pp 715-723

Raju Kasambe and Tarique Sani, (2009)., Avifuna in and around Nagpur city of Maharashtra –anannotates, authentic, contempoay checklist.; Newsletter for Birdwatchers, 49(3); pp 35-40

Venna S.Kasture.; (2002); Anticonvulsive activity of *Butea monosperma* flowers in laboratory animals. Elsevier; Pharmacology Biochemistry and Behavior.,72(4); pp 965-972

Wolf Bors, Werner Heller, Christa Michel, Manfed Saran., (1990), Flavonoids as antioxidants: Determination of radical-scavenging efficiencies., Elsevier, Methods in Enzymology, vol 186, pp 343-355

Xinyan Tang, Caiqiao Zhang, Weidong Zeng, Yuling Mi and Hongyun Liu., (2006), Proliferating effects of the flavonoids daidzein and quercetin on cultured chicken primordial germ cells through antioxidant action. Cell Biology International, 30(5), pp 445–451