ECOSYSTEM STABILITY WITH MEGACHIROPTERAN AND MICROPTERAN BAT

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***Abstract*:** *Stable and healthy environment are providing various ecosystem services like pure water, fresh unpolluted air, rich fertile soil, greater binding capacity of toxic substances, decomposition of waste, recycling of nutrients, continue process of soil formation, reduction of insect-pest numbering, Pollination and seed dispersal etc. All above ecosystem services are provides the advantages to human for his or her well-being. Bats contribute its effective and major role for ecosystem stability like insect-pest suppression, pollinating flower and dispersing seeds. Varied feeding habits of bats like insectivorous, frugivorous, nectarivorous, omnivorous and carnivorous providing its beneficial role.The tongue and papillae structure of this megachiropteran and microchiropteran bats supports their role in several ecosystem services, within the absence ofbats,reforestationof cleared areas will become far more difficult and full system of lifemay die. Most precious plants could also be seriously jeopardized and tropical important trees and shrubs will loss. Bats are playing central roles in maintain the balance and regeneration of forest ecosystem. It also protects the agroforestry crop yield from insect-pest disturbance and provided crucial benefits to the farmers. Thanks to the important role of insectivorous bats in agriculture practices, the share of pesticide uses are often minimize and controlled the health risk of human from abundance uses of pesticide. The frugivorous bats plays vital role within the maintenance of species-rich tropical forests due to long distance dispersers of tropical seeds. Thus it's very essential to guard or restore bat population and associated habits also on improve public perception of bats.*

Key Words: *Stable Environment: Ecosystem Services: Role of bat: Protection and Conservation.*

Introduction:-

Bats are second largest order of mammals. They're valuable natural beneficial resources sleep in almost every habitat. Bats have evolved an incredibly rich diversity of behavioural, roosting and feeding habits. Many species of bats occupy in caves and cave-like structure like tombs, mines etc. Other roosts also are in tree-cavities and foliage, (Lumsden et. al; 2002). Of all the bats round the world, approximately 70% are insectivorous, nearly 30% eat nectar or fruit, 10 species are carnivorous, 2 species are fish-eaters and only three species the common vampire (Altringham, 1996). Two families of bats i.e. Phyllostomidae (New World Bats) and Pteropodidae (Old World

Bats) contain over hundred species of fruit eaters liable for dispersing seeds from many species of tropical trees and shrubs. Many of those bats also pollinate a broad sort of plants, including an outsized number that are commercially valuable. By virtue of their abundance and highly mobile lifestyle, these animals play an important role within the seed dispersal ecology of tropical forests. Tropical forests are notably hooked in to fruit-eating birds and mammals for dispersal of their seeds. Seed dispersal by animal is advantageous in tropical habitats for a minimum of three important reasons; first, it allows seeds and seedlings to flee from such natural enemies as invertebrate and vertebrate seed-eaters, herbivores and fungal pathogens. Second, it reduces the competition seedlings would experience if they germinated at high densities round the parent plant. Thirdly, widespread dispersal by creatures as mobile birds and mammals allows plant to colonize in new habitats.

Megachiropteran bat, Rousettus leschenaultia belong to the order of Chiroptera and family Pteropodidae. They're diversely roosts in fruit trees, roof of old houses and underground dilapidated mines. Flying foxes of the Pteropus (Pteropodidae) are important pollinators and seed dispersers in oceanic-island ecosystem (Cox et. al; 1991, 1992). Singh and Bhatti, (1993) and Jackowiak et. al. (2009), noticed *Pteropus giganteus giganteus* had longer and well muscular tongue for rasping and possess filiform, fungiform and circumvallate papillae for grinding the fruit pulp during consumption of food.

Insectivorous bats, especially play crucial roles in many ecosystems by suppressing insect population in both natural and human-altered landscapes. Bats play key ecological roles as primary predators and are the foremost important natural controllers of night flying insects (Bat Conservation International, 1989). Indian Horse-Shoe Nose bat, *Hipposideros speoris* is aerial insectivorous belong to Rhinolophidae of sub-order microchiroptera. The tongue of *Hipposideros speoris* bat is roofed by filiform, fungiform and circumvallate papillae. Scale-like filiform papillae are very useful in insectivorous bats because it's specially developed for catching insect easily during flight and that they are specially use their high-volume echo-location calls to locate and capture prey (Schnitzler and Kalko,2001). So, that the various sorts of feeding habits of bats i.e. insectivorous, frugivorous and nectarivorous are beneficial for human-being.

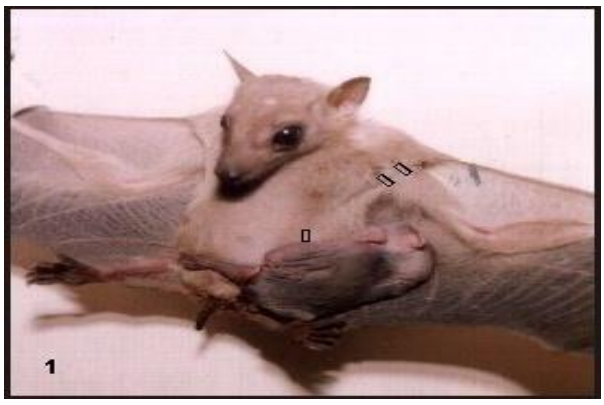
Result:-

The tongue of *Rousettus leschenaultia* shows that the anterior tip of tongue surrounded by scale-like filiform papillae directed laterally towards the posterior region. These scale-like filiform papillae are flat and lie on the brink of the surface of the tongue. Numerous fungiform are distributed between larger tricuspid papillae, these tricuspid papillae with a thick squamous epithelial coating. The massive sized mechanical tricuspid papillae covered the acute antero-dorsal surface of tongue having a skinny parakeratotic layer over a thick central skin cell layer. The scale-like filiform papillae is observed round the tricuspid papillae. The tricuspid papillae are covered by thick keratinized stratified squamous epithelium.

The hook-like and bifid mechanical papillae are located next to every other along the midline of the tongue. The attractive papillae densely cover the dorso-lateral region of the tongue and extended further anteriorly along the lateral margin. The round shaped fungiform papillae were observed on the anterior two-third part of the tongue. The characteristic inverted cup-shaped circumvallate papillae are present at the bottom of the tongue along side well developed taste buds within the lateral epithelium also as within the walls of the circular furrow around them, (Ramteke et. al;2012c).

Insectivorous bat, *Hipposideros speoris* has a small tongue. Triangular anterio-dorsal surface of tongue was covered by a mixture of filiform papillae, i.e. scale-like tricuspid and few pointed hook-like papillae. On the posterior region two circumvallate papillae are observed. The filiform papillae are smaller towards the anterior half while it becomes larger towards the posterior region. Medium sized fungiform papille were scattered between filiform papillae. Scale-like papillae are the main characteristic feature of insectivorous bats. With the help of scale-like papillae, bats are easily catching the insect during flight, (Ramteke et. al; 2012d).

The structural arrangement of lingual papillae of these Microchiropteran and Megachiropteran bats gives their greater support in suppression of insect-pest and disperser of seeds. So, the structural characteristic of papillae are exactly appropriate for their function.



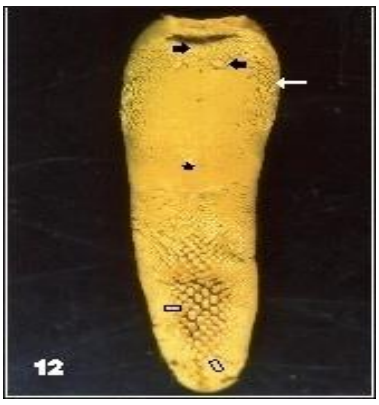


Fig.1. Photograph of female *R. leschenaultia* showing the young one (arrow head) attached;(arrows) point towards the parasite to the fur of bat.

Figs. 2. Photographs showing the dorsal view of the tongue (Fig.12) of *R. leschenaulti* (with a body mass 120 gms). The tongue measures 28mm in length, 9mm in breadth and 0.64 gms in weight. Dorsal surface of tongue consist three types of foliate papilla, viz. filiform, fungiform and vallate papillae. Anterior tip of tongue possesses a cluster of large tricuspid papillae (arrow head) encircled by smaller tricuspid papillae. Scale like papillae (small arrow) was observed surrounding the anterior tip, directed towards the posterior surface. Large conical papillae (long arrow) were noticed on the lateral parts of posterior region; smaller conical papillae are present around three circumvallate papillae (thick arrows). Round shaped fungiform papillae were distributed most part of the dorsum. The ventral surface is devoid the papillae; the lateral margins lined with filiform papillae (small arrows). Figs.2. x 4.

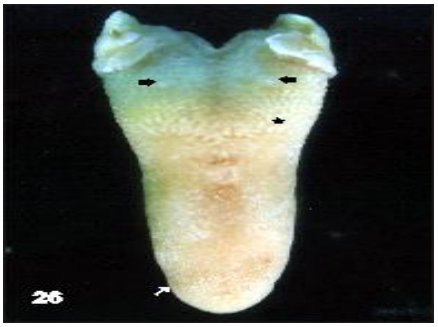


Fig.3. Photograph of female *H. speoris* to show external morphology.

Figs.4. Photographs of the tongue of *H. speoris* to show dorsal and ventral surface. The insectivorous bat had a small anterior blunt tip with a cluster of filiform papillae on the dorsal part of the tongue. The filiform papillae are smaller (small arrow) at the anterior portion and larger (star) towards the posterior region. Fungiform papillae are embedded between the filiform papillae. Two circumvallate papillae (thick arrows) are present at the posterior region .One-third part of anterior tongue was free at the ventral side possessing a prominent central groove (arrow head) in-between the two lateral ridges (arrow).

Discussion:-

Bats are very vulnerable and most beneficial creatures among natures. Bats are playing the critical economic and ecological roles in ecosystems. Evidence shows that bats perform a number one role within the complex web of life. They're essential allies among in delicate nature system of checks and balances. Without them, entire system of life may die with them. Bats provide value to ecosystem as primary, secondary and tertiary consumers that support and sustain both natural and human dominated ecosystem. Bat pollination occurs in approximately 250 genera. Bat pollination is comparatively common in certain angiosperm subfamilies. alittle but ecologically and economically important group of plants are classified in 28 orders, 67 families and about 528 species of angiosperms are pollinated by nectar-feeding bats, (von Helversen 2003).

Nectar bats play a crucial role in maintaining the genetic continuity of plant populations and thus have considerable conservation value. Flower-visiting bats provide two important benefits to plants, (Marshall, 1983). They're deposite large amounts of pollen and a spread of pollen genotype on plant stigmas as compared with many other pollinators, like insects. Many of our cultivated crop plants still believe bats for his or her survival, these includes fruit like banana, avocades, dates, figs, peaches and mango. One early study describing the economic importance of bats, during which identify 289 Old World tropical plant species that believe the pollination and seed dispersal services of bats for his or her propagation. These plants, successively contribute to the assembly of 448 bat-dependent products during a sort of categories, including timber and other wood products (23%), food drinks and fresh fruit (19%), medicines (15%), dyes, fiber, animal fodder, fuel wood, ornamental plants. .

However, bat-provided services represents one input within a multi-input production process, therefore the expansive role plays by bats within the production of products that contribute to human well-being. Majority crops species i.e. 87 primary crop species depends to a point on animal pollination; i.e. bees, birds, bats and other insects. especially , bats are important pollinator for durian (Durioziberthinus), caimito and cowage . Fruit tree is an example of a bat-dispersed tree with many human uses. In India, it's important in coastal communities where it provides shades, fuel-wood and edible nuts. The timber derived from almond trees makes an ornamental general-purpose hardwood and making furniture. Tannin is extracted from the bark, leaves, roots and therefore the fruit-shell. In India, the Mahua tree (Madhuca Indica), also called the Honey tree, Sugar tree or Indian butter tree is pollinated by Pteropus giganteus, Rousettus leschenaultia and Cyanopterus sphinx. Mahwa is incorporated into soaps, candles, cosmetics (e.g. Lipstick, lotions) andmedically utilizedin thetreatmentofLeprosy.

Insectivorous bats is that the natural predators, which provided the advantages to the agro forestry by the consumption of millions crop-insects. So, the value of the pest suppression service is provided by insectivorous bats. Successively migration of insectivorous bats, *Hipposideros speoris* towards the open land space and increased the cultivation rate of yield. One bat can eat thousands of insect each night (ranging from 1,000 to 3,000). Bats can eat up to half their weight in insects during a night. One colony of 20 millions Mexican free-tailed bats in Central texas consumes nearly a half million pounds of insects each night (BCI, 1989). So, the bat provided pest-control services i.e. reduced the pesticide application and avoid crop from damage by insect-pest.

The share of the appliance of synthetic pesticide become minimized from farmers and safer the human health risks from harmful toxicity. Pimentel et. al; (1997) concluded that fifty reduction in pesticide use and as long as biological, cultural and environmental pest control technologies in replacement of pesticides. Pesticide application rate reduced thanks to high bat predation rate and bats provide an immediate contribution of regulating service on pest-control for the good agricultural production. They're also maintaining their population and supply a crucial ecosystem service to the farmers (Estrada and Coates-Estrada 2002). Today, these valuable mammals often go unnoticed because they're small, largely silent and minimum their roost sites. Roost sites are a key habitat requirement for bats and should be a limiting resource in highly modified environments. Land-holders and Land-managers are frequently unaware of the range of bats on their properties, their beneficial nature and therefore the habitat requirements for his or her continued survival.

Insectivorous bats are the natural pest controller, so highlighting on the importance of trees within the rural land-scapes as foraging habitat for bats, protect the bat populations and improve public perception of bats. Loss of insectivorous bats, the insect-pest enormously multiplied due to the unchecked control by their natural predator. So, farmers are totally hooked in to pesticides for controlling crop-pest, which already suffered our surroundings and private health.

Information on the ecological and value of ecosystem services provided by bats are often wont to inform decision regarding where and when to guard or restore bat population and associated habits also on improve public perception of bats. It's very essential to providing the habitat protection, conservation and monitoring of roosts also as providing all the essential information to local localities.

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