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Diversity of Ectoparasites Present on some Species of Bats from Navegaon National Park, Maharashtra, India

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ABSTRACT : Ectoparasites are a diverse and highly adapted faunal group of animals which may live permanently on their host or they may occupy host's nest and visit the body of the host periodically. Bat species are often infested with several bat fly species (ectoparasites). A faunal study of the ectoparasites of various bat species was done in the study area i.e. Navegaon Natioanl Park in Navegaon, District Gondia, Maharashtra. Ectoparasite collection and study was done from one Megachiropteran and four Microchiropteran bat sps. roosting in the study area. A *Taphozous* species of bat was found to be most ectoparasite infested species followed by *Megaderma lyra* & *Pteropus giganteus. Raymondia lobulata*, a streblid fly was the most abundant ectoparasite collected.

Keywords : Parasites, Ectoparasites, Bats, Maharashtra.

INTRODUCTION

Parasites infect hosts that exist within their same geographical area (sympatric) more effectively. This phenomenon is supported by "Red Queen Hypothesis", which states that interaction between species (such as host and parasite) lead to constant natural selection for adaptation and counter adaptation (Lively *et al*. 2000).

Ectoparasites are a diverse and highly adapted faunal group of animals which may live permanently on their host or they may occupy host's nest and visit the body of the host periodically. Though ectoparasites live and feed on the external surfaces and provide no known benefit to their host, they in most cases do not cause host mortality (Marshall 1981, Clayton 1991).

Ectoparasites are abundant in natural communities, can have pronounced deleterious fitness consequences to their host and are important vectors of transmissible parasitic disease. The ectoparasites have the potential to affect the health and general well being of wild life and domestic animal population and they may seriously restrict habitat and land resources used, because of stress and reduced performance of animals living in a particular habitat. Ectoparasites can reduce the long term survival (Brown *et al*. 1995, Chapman and George 1991), reduce clutch or brood size (Mappes *et al*. 1994, Moss and Camin 1970), change breeding behaviour (Emlen 1986, Moller 1991, Wimberger 1984), or increase the cost of reproduction in hosts (Moller, 1993).

Bats are among the nature's most beneficial animals and undoubtedly, many are key stone species. Without them thousands of other animals and species could die, threatening entire ecosystem from rain forests to deserts. Bat species are often infested with several bat fly species (ectoparasites) (Wenzel *et al.* 1966; Wenzel 1976; Dick and Gettinger 2005). As blood feeding parasites, bat ectoparasites would appear excellent vector of zoonoses. Generally high degree of host specificity (Marshal 1976, Dick and Gettinger 2005) diminish likelihood of interspecific transfer of bat diseases and pathogens.

Although levels of parasitism can vary greatly among individual bats of same species, little is known about the characteristics of hosts that affect such variations.

There are several groups of Insects and Arachnids, which are recorded as ectoparasites of bats in India. They are the insects belonging to the families Cimicidae, Polytenidae (Hemiptera : Heteroptera); Streblidae, Nycteribiidae (Diptera : Pupipara); Ischnopsylliae (Siphonoptera) and the Arachnids belonging to the families Spinturnicidae, Mocronyssidae, Myobiidae, Trombiculidae, Sarcoptidae, Argasidae and Ixodidae (Acarina).

Insects are ubiquitous as ectoparasites and use as host mainly mammals of the order Rodentia and Chiroptera and birds (Marshal 1981, Clayton and Moore 1997). The arthropod ectoparasites of bats belong to the Siphonoptera, Diptera, Hemiptera, Dermaptera (ticks and mites) but they are not necessarily restricted to bats (Whitker 1988). According to Marshal (1982) 687 bat ectoparasite insect species are known, belonging to Dermaptera, Hemiptera,

Diptera and Siphonoptera order. Six families from these four orders are restricted to bats.

The Diptera includes two families that are exclusively bat ectoparasites, Nycteribiidae and Streblidae (Allen 1967).

Information pertaining to ectoparasites of bats is poorly known in the Indian context. Hence, a faunal study of the ectoparasites of various bat species in the study area i.e. Navegaon Natioanl Park was done. An effort was also done to study the many factors, which result in differences in ectoparasite associations among different species of bat.

MATERIALS AND METHOD

Description of Study Area:

The capturing of bats for their ectoparasitic collection and study was done from Navegaon National Park located in Navegaon. The park is situated as Southern part of Gondia district, in Eastern Maharashtra. The National Park spread over an area of 135 sq. kms is one of the most popular forest resorts in the Vidarbha region with GPS location N-20°55 lattitude, E-080°06 longitude. Navegaon National Park exhibits amazing diversity of terrain and altitude ranges from nearly 30 meters to about 702 meters above the mean sea level. The climate here is hot and wet. It receives quite a bit rainfall during the monsoons, which ranges from mid-June to Sept

The National Park has diverse type of vegetation ranging from dry mixed forest to moist forest. The forest type is 5A/C3, Southern tropical dry deciduous forest. The main plant species are Teak, Haidu, Jamun, Kawath, Mahua, Ain, Bel and Bhor etc. In the National Park four different bat roosting sites were visited for the collection of bat ectoparasites.

Site I: The first roosting site i.e. Pratapgad fort is located at a distance of 15 kms form the base station of the National Park. The high altitude Pratapgad fort is a very old and huge fort of king Pratap. Due to its destructive cave type compartmentalization bats have occupied it as their roosting site. This site is located at GPS location N21°00 latitude E080°9 longitude. Bat species were captured for collection of their ectoparasites which were roosting on the walls and big rocks of the Fort.

Site II: The second roosting site of bat was Shrivegaon, 10kms from base station. Here bats were roosting in a rocky cave. This cave serves as a hibernaculum for two species of bats. The cave consists of two passages which were interconnected mainly by a narrow passage internally. Shrivegaon is a low hilly area with a small lake at its foot hills. Temperature varies from 39°C in summer to 5°C in winter. The GPS location of this site is N20°58′ latitude E080°10 longitude.

Site III: The third site was the famous Itiadoh dam, 20 kms from the base station of the park. This is also a very high altitude area about 368.2 meters above the sea level, with GPS location N20°53′ latitude E080°07′ longitude. Here bats had occupied the bushy and long tree's as their roosting site along a water stream.

Site IV: The fourth and last site is Dhabi-Poney, plane area of the National Park about 24 km away from the base station of the park. The area with a rich biodiversity is a home of large number of bat species. Here the captured bats had occupied dry tree cervices as their location. The GPS location of this site is N20°56′ latitude and 080°10′ E longitude.

Capture of Bats and Collection of Ectoparasites: Bat specimens from different primary locations were captured by using hand net and sometimes with hand by wearing bite proof gloves. The study area was visited for sampling at monthly intervals from August to December 2008. Some adult and a few juvenile host bats were captured. Upon capture each bat was held in separate cloth bags until inspected for ectoparasites. All examinations were performed on live specimens within twenty minutes of capture. As the bats were captured from different location of a national park, intense care has been taken to avoid any physical injury and life loss of bats.

For collection of ectoparasites, bats were visually screened. There after a broad brush was dipped in absolute alcohol and it was moved on the body of bat to desensitize the parasites for their effective collection. With the help of forceps all visible ectoparasites were removed and collected. During each bat inspection, the presence or absence of ectoparasites was recorded. After collection of parasites, bats were released. The collected parasites were preserved in vials with 70% alcohol. Separate vials with label were used for collection and preservation of parasites which were present on different parts of each bat. The entire surface of the host was inspected closely with particular attention to areas of the body (e.g. ears, head, neck, nose, axilla, patagia) typically preferred by specific parasite taxa. After collecting the ectoparasites in separate vials they were sealed tightly and labelled for laboratory examination. For the perfect identification of host bat species, all the examined bats were photographed which included the photo's of dorsal and ventral side and particularly their dentition.

Aspects of the protocol for mammal collection (Presley, 2007) mammal specimen processing and ectoparasite collection, handling and storage were designed (Gordon and Owen, 1999) to reduce the likelihood of contamination (i.e. assignment of ectoparasites to the wrong host individual). Permanent slides of the collected ectoparasites were prepared in the laboratory. The camera lucida drawing of all ectoparasite species were drawn. The permanent preparation of ectoparasites were then photographed using trinocular fluorescent microscope. Ectoparasites were identified with the help of authorized keys. The identification of host bat

species was carried with the assistance of Scientists of Zoological Survey of India (ZSI), Pune, Maharashtra.

OBSERVATION AND RESULTS

A microchiropteran bat *Taphozous melanopogon* Temnick (Black Bearded Tomb Bat Fig. 1 and 2) was captured from the first roosting site. This captured species of bat was found to harbour a single species of ectoparasite identified as *Trichobius costalimai* (Fig. 11 and 12). Though the bats were found in huge number at the roosting site, the frequency of ectoparasite occurrence was very less. An average number of two ectoparasites were found on each host bat. As the number of ectoparasite found on this host species was very low as compared to body size of host which is large, indicating that prevalence of ectoparasites bears no relation with body size of host. The mobility of ectoparasites (*Trichobius costalamai*) on the host body was found to be very high. The occurrence of parasites was more prominent on the furry area on ventral side of thorax.

The second roosting site harboured a bat species identified as *Megaderma lyra* Geofferey (Fig. 3 and 4). The captured bats were infested with large number of ectoparasites, identified as *Raymondia* (*Brachyotheca*) *lobulata* species belonging to class Insecta (Fig. 13 and 14). The average number of parasites found on bats were 18 – 20 in number. Male bat was found to harbour more ectoparasites as compared to the female bat. The prevalence and the mobility of ectoparasites on the host body was found to be very high. The parasites were found to occur all over the body.

The second species identified from the same site (cave) was *Taphozous* sp. of the Family Emballonuridae belonging to suborder Microchiroptera (Fig. 5 and 6). Ectoparasites were abundant in all three captured bats with average number of 20–22 ectoparasites mainly located on head (1–2 ectoparasites), pinna (3–4), neck (10–12) and pategia (2–3). The parasite identified on *Taphozous* species was *Raymondia lobulata* (Brachyotheca) Speiser (Fig. 15) which was also found on Megaderma lyra Geofferey. On visual screening for ectoparasites it was observed that female bats harboured more parasites than male. The ectoparasites on this host were highly mobile and more prevalent. The reason for occurrence of same species of ectoparasite (*R. lobulata*) on two different species of bats may be due to same roost preference by which cross infestation may have occurred, confirming the stenoxenous nature of the ectoparasite.

Bats belonging to suborder Megachiroptera were observed at the 3rd roosting site. Around 395 bats were found, to roost on this site. The roosting site were the bushy and long trees along the stream of famous Itiadoh dam. From this roosting site the bat species identified was *Pteropus giganteus* (The Indian flying fox) (Fig. 7 and 8). A single species of ectoparasite was found to infest the bat *Pteropus giganteus*, identified as *Basillia* sp., a Dipteran insect belonging to family Nycteribiidae (Fig. 16). The prevalence of ectoparasite on host bat was moderate (average 11 in no.) and their mobility was very less. Parasites were more prominent on head and furry area of dorsal and ventral side of thorax. As *Basillia* species is associated with single host species it is monoxenous in nature.

The host bat from the fourth site was identified as *Pipistrellus sp.* (evening bats) of the Family Vespertilionidae (Fig. 9 and 10). All the seven bats screened visually were found to be free of any parasitic infestation. These bats were observed to be highly mobile.

Fig.1 : *Taphozous melanopogon* Temminck (Black- Bearded Tomb bat)

Fig.2 : Showing ventral view of *Taphozous melanopogon* Temminck

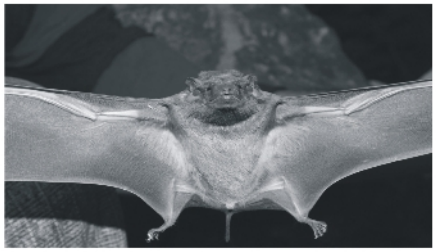

Fig.3 : Frontal view of *Megaderma lyra* Geoffroy (Greater False vampire Bat)

Fig.4 : Showing flat dorsal view of *Megaderma lyra* Geoffroy

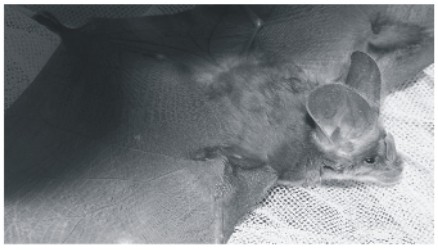

Fig.5 : *Taphozous species* (Sheath tailed bat)

Fig.6 : Showing ventral side of *Taphozous species* (Brown- bearded)

Fig.7 : *Pteropus gigantus* (Indian Flying Fox)

Fig.8 : Showing a roosting colony of *Pteropus gigantus*.

Fig.9 : Showing dorsal view of *Pipistrellus species* (Evening Bat)

Fig.10 : Showing Ventral view of *Pipistrellus species*

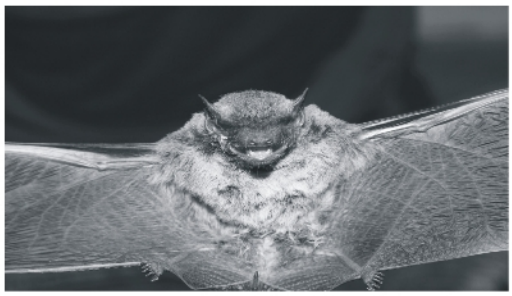

Fig.11 : *Trichobius Costalimai* - (Dorsal View) an ectoparasite found on *Taphozous malanopogon* Temminck

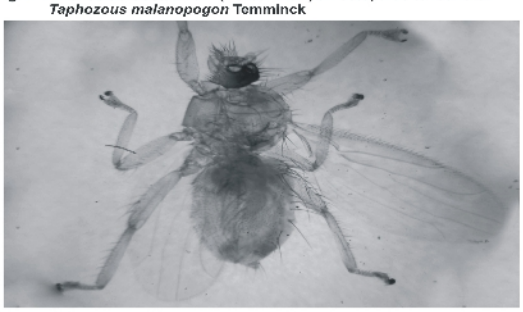

Fig.12 : Showing Ventral View of *Trichobius Costalimai*.

Fig.13 : *Raymondia (Brachyotheca) lobulata speiser* - (Dorsal View) an ectoparasite found on *Megaderma lyra Geoffroy*

Fig.14 : Showing Ventral View of *Raymondia lobulata speiser*

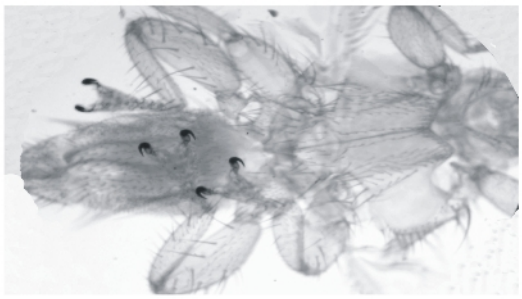

Fig.15 : *Raymondia (Brachyotheca) lobulata speiser* found on *Taphozous species*

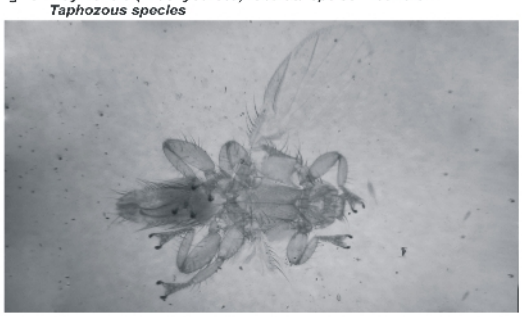

Fig.16 : *Basilia species* - an arthropod ectoparasite found on *pteropus giganteus*

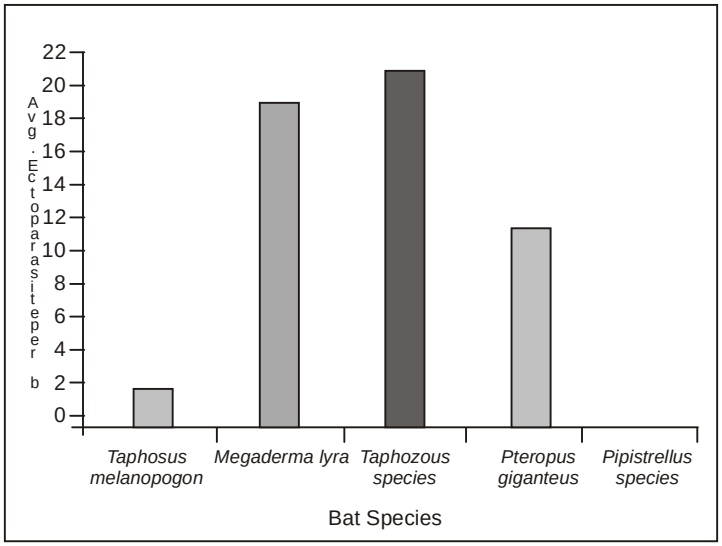

Fig. 17. Average Ectoparasite Occurrence on Different Host Bat species.

Table 1: Details of host bat species captured from four different areas of Navegaon National Park.

Sr. No.	Name of Species	Total Host Bat Captured M	F	Forea rm Length in cm	Average Weight in Kgs	Habitat	GPS Location
1.	*Taphozous melamopogon*	2	2	6–6.2	0.025–0.030	Cave type compartments in Pratapgad Fort	N-21°00' latitude E-080°9' longitude
2.	*Megaderma lyra*	1	1	5.4–7.1	0.026–0.028	Rocky cave cervices in Sherigaon	N-20°58' latitude E-080°10' longitude
3.	*Taphozous* sp.	1	2	5.3–6.3	0.028–0.032	Rocky cave cervicesin Sherigaon	N-20°58' latitude E-080°10' longitude
4.	*Pteropus giganteus*	1	1	15.1–18.2	0.8–1.60	Bushy and long trees of Itiadoh dam	N-20°53' latitude E-080°07' longitude
5.	*Pipistrellus* sp.	3	4	2.5–3.4	0.020–0.024	Dry tree cervices in Dabhi-Poney	N-20°56' latitude E-080°10' longitude

Table 2: Ectoparasite abundance on host bats from study area.

Sr. No.	Identified Ectoparasite	Host Bat Species	No. of Bat Individuals Captured	Total Ectoparasites Collected	Ectoparasite Abundance (Mean ± S.E.)
1	*Trichobius costalimai*	*Taphozous melanopogon*	4	6	1.5 ± 0.5774
2	*Raymondia lobulata*	*Megaderma lyra*	2	38	19 ± 1.4142
3	*Raymondia lobulata*	*Taphozous* species	3	61	26.33 ± 1.5275
4	*Basillia* sp.	*Pteropus giganteus*	2	23	11.5 ± 0.7071
5	No parasite found	Pipistrellus species	7	–	–

DISCUSSION

The primary host of *Trichobius costalimai* Guimaraes was found to be *Phyllostomus discolor* in Venezuela (Wenzel, 1976). Wenzel *et al*. (1966) reported that the primary host of *Trichobius diphyllae* in Paraguay was *Diphylla ecuadata*. Eight streblid species were collected from eight phyllostomid bat species from Minas Gerais, Brazil (Azevedo *et al*. 2002). Out of these eight streblid species three belonged to genus *Trichobius* i.e. *Trichobius longipes*, *Trichobius lonchophyllae* and *Trichbius joblingi* found to be ectoparasitic on *Phyllostomus hastatus, Glossophaga soricina* and *Desmodus rotundus* respectively.

In the present work the occurrence of the ectoparasite *Trichobius costalimai* of family Streblidae on *Taphozous melanopogon* is reported virtually for the first time on this host bat species as there is no citation available in literature for this occurrence.

Simultaneously in the present work it has also been found that other *Taphozous* species of bat was heavily infested with ectoparasite *Raymondia lobulata* Speiser of the family Streblidae.

In the present investigation the host bat species *Megaderma lyra lyra* was also found to be heavily infested with ectoparasite *Raymondia* (*Brachyotheca*) lobulata Speiser of family Streblidae. Some records of the presence of ectoparasite *Raymondia* (*Brachyotheca*) lobulata Speiser of family Streblidae were made by Vazirani and Advani (1976). They also found maximum parasitism 97.7% on the same host bat species *Megaderma lyra lyra.*

In the present work *Pteropus giganteus* a megachiroptera bat species was found to be infested with *Basilla* species (Nycteribiidae flies), however Vazirani and Advani (1976) found the same bat species *Pteropus giganteus* was heavily infested (almost 100 %) with a ectoparasite *Cyclopodia syhessi* belonging to family Nycteribiidae. Gustavo Graciolli (2004) recorded three *Basilla* species of family Nycteribiidae on host bat *Myotis* species in Meraca island Roraima.

Similarly from the state Gujarat (Dist. Bharooch) and Rajastan (Dist. Ajmer) Vazirani and Advani (1976) found an ectoparasite *Basilla* (tripsela) *Blainvilli amiculata* (Speiser) of family Nycteribiidae located on host bat *Pipistrellus* species.

In the present studies, *Pipistrellus* species of sub-order microchiroptera was found free of any parasitic infestation, but Vazirani and Advani (1966) recorded the presence of ectoparasite of different families on this bat species. They recorded *Cacodmus bhati* an ectoparasite belonging to family Cacodminae as well as another parasite *Steatonyssus quadrisetosus* of family Macronyssidae from the host *Pipistrellus dormi* Dobson, from the Gujrat State (Balasor Dist.).

Vazirani and Advani (1976) also recorded some new ectoparasite species *Spintruix bakeri* of family Spinturnicidae residing on host *Pipistrellus dormi* Dobson and parasitic *Argus* (caris) soneshineri of family Argasidae. Chiton *et al.* (2000) and Usinger (1966) recorded *Cimex pilosellus* (Horvath) on bat species *Pipistrellus* from Western North America.

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REFERENCES

Allen, G.M. (1967). The parasites of bats. Museum of Comparative Zoology, 360.

Azevedo, A.A. and Linardi, M. P. (2002). Streblidae (Diptera) of Phyllostomid Bats from Minas Gerais, Brazil. *Rio*

de Janeiro, **97**(3): 421-427.

Brown, C.R., Bombergor, B. M. and Rannala, B. (1995). Ectoparasitesreduce long term survival of their avain host. *Proceeding of the Royal Society of London, Series*, B262: 313-319.

Clayton, D.A. (1991). Coevolution of avian grooming and ectoparasite avoidance. In J.E. Loye and M. Zak (eds.), *Bird parasite interactions: Ecology, evolution and behaviour*. Oxford University Press, 259-289.

Chapman, B.R. and George, J.E. (1991). The effects of ectoparasites on cliff swallow growth and survival. Loye J. Zuk M. (eds.). Bird-parasite interactions. *Ecology, evolution and behaviour*, 69-92.

Chiton, G., Vonhof M.J., Peterson, B.V. and Wilson (2000). Ectoparasites insects of bats in British Columbia. *Canada Journal of Parasitology*, **86:** 191-192.

Clayton, D.H., and Moore, J. (1997). Host Parasite Evolution, rinciples andAvian Models, Oxford University Press, Oxford. *Olkos*, **96**(2): 245-250.

Dick, C.W. and Getinger, D. (2005). A faunal survey of streblid bat flies (Diptera: Streblidae) associated with bats in Paraguay. *J. parasitol*., **91:** 1015-1024.

Emlen, J.T. (1986). Response of breeding cliff swallows to nidicolousparasite infestation. *Codor*, **88:** 110-111.

Graciolli, Gustavo (2004). Nycteribiidae (Diptera Hippoboscoidae) in the Southern Region of Brazil. *Rev. Bras. Zool*. **21**(4): 971-985.

Lively, C.M. and Dybolahl, M.F. (2000). "Parasite adaptation to locally commonnumbers genotypes". *Nature*, 405.

Marshalla, A.G. (1976). Host specificity among anthropods ectoparosite upon mammal and birds in the New Hebsides. *Entomology*, 189-195.

Marshall, A.G. (1981). The ecology of ectoparasitic insects. Academic press, London 1982. *Ecology of insects ectoparasites on bats*, 369-401. In T.H. Kun 2(ed), E*cology of bats, plenum* New York.

Marshall, A.G. (1982). Ecology of insect ectoparasite on bats. In J.H. Kunz, *Ecology of Bats, Plenum London*, 369-481.

Mappes, T., Mappes, J. and Kotaiho, J. (1994). Ectoparasites, nest site choice and breeding success in the pied flycatcher. *Oecologia*, **98:** 147-149.

Moss, W.W. and Camin, J.H. (1970). Nest parasitism, productivity, and clutch size in purple martins. *Science*, **168:** 1000-1003.

Moller, A.P. (1991). Parasite load reduces song output in a passerine bird. *Animal Behaviour,* **41:** 723-730.

Moller, A.P. (1993). Ectoparasites increase the cost of reproduction in their hosts. *Journal of Animal Ecology*, **62:** 309-322.

Presley, S.J. (2007). Streplid pot fly assemblage structure on Paraguayan *Nocti lio lepopinus* (Chiproptera : Noctillionidae) : nestedness & species co-occurence. *Journal of Tropical Ecology*, **23** : 409-417.

Sheelep-Gopdon, L.L. & Owen, R.D. (1999). Host tracking or pesourcet tracking ? The case of *Periglischus* wing mites (Acarina : Spinturnicidae) of peaf nosed parts (Chiroptera : Phyllosotowidae) from michoacan, Mexico. *Acta Zootogica Mexicana*. (nuera series) **76** : 85-102.

Usinger, R.L. (1966). Monograph of cimicidae (Hemiptera-Heteroptera). The *Thomas say foundation*, **7:** 585.

Vazirani and Advani (1976). Some ectoparasites of bats from Rajasthan (Diptera : Streblidae) with description of a new species. *Orient. Ins*., **10**(3): 453-457.

Wimberger, P.H. (1984). The use of green plant material in bird nests to avoidectoparasites. *Auk*, **101:** 615-618.

Wenzel, R.L. (1976). Two name changes for Neotropical Streblidae (Diptera). *Proceedings of the Entomological Society of Washington*, **86:** 647.

Wenzel, R.L. and Tipton, V.J. (1966). Some relationships between mammals hosts and their ectoparasites. In R.L. Wenzel and V. J. Tipton (eds.),Ectoparasites of Panama. *Field Mus. Nat. Hist., Chicago*, 677-723.

Whiteker (1988). Collection and preserving ectoparasite for ecological study. In J.H. Kunz, Ecology Behavioural methods for the study of Bats, *Smithsonian Institution Press, Washington*, P.O. 459-474.