

Toward a molecular phylogeny for the Molossidae (Chiroptera) of the Afro-Malagasy region

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We present phylogenetic information based on nuclear Rag2 and mitochondrial cytochrome *b* sequence data for six genera of Molossidae (*Chaerephon*, *Mops*, *Mormopterus*, *Otomops*, *Sauromys*, *Tadarida*) and 18 species, primarily from Africa and the Malagasy region (Madagascar and neighbouring islands), and further include sequences of 12 New World and African taxa sourced from GenBank. There is strong support for the monophyly of the Molossidae included in this study. The Malagasy region taxa *Mormopterus jugularis* and *M. francoismoutoui* are supported as a basal clade with an age of ≈ 31.2 MYR, and are not monophyletic with the South American *M. kalinowskii*. Asian *Otomops wroughtoni* and *O. formosus* and Afro-Malagasy *O. martiensseni* and *O. madagascariensis* form a strongly-supported ≈ 19.8 MYR-old clade, whose broader relationships among Molossidae are not clearly defined. There is strong support for a ≈ 17.2 MYR-old combined *Chaerephon/Mops* clade, in which members of these genera show some paraphyly. The monophyly of the genus *Tadarida*, represented in our analyses by *T. brasiliensis* from the New World and *T. fulminans*, *T. aegyptiaca* and *T. teniotis* from the Old World, is not upheld, although there is good support for a geographically-disjunct ≈ 9.8 MYR-old grouping which includes *C. jobimena* (Madagascar), *T. aegyptiaca* (Africa) and *T. brasiliensis* (America). *Sauromys* is maintained as a monotypic genus, although there is moderate support for its association with *T. fulminans* and the *Chaerephon/Mops* clade, the latter of which comprises *M. midas*, *M. leucostigma*, *M. condylurus*, *M. bakarii*, *C. pusillus*, *C. pusillus*, *C. leucogaster* and *C. atsinanana*. An ≈ 8.4 MYR-old New World clade comprising representatives of *Eumops*, *Nyctinomops* and *Molossus* was well-supported.

Key words: Molossidae, Rag2, cytochrome *b*, Africa, Madagascar, Western Indian Ocean, phylogeny

A molecular phylogenetic reevaluation of the tribe Nycticeiini (Chiroptera: Vespertilionidae)

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Monophyly of the tribe Nycticeiini (*Baeodon*, *Nycticeinops*, *Nycticeius*, *Otonycteris*, *Rhogeessa*, *Scoteinus* [= *Scoteanax* and *Scotorepens*], *Scotoecus*, *Scotomanes*, and *Scotophilus*) has been challenged by new datasets over the last two decades including baculum morphology, cytogenetics, and mitochondrial ribosomal sequence data. These studies have resulted in new classifications for the *Nycticeius*-like bats, but only one study has empirically tested Nycticeiini monophyly. In this study, a suite of nuclear markers including both exon (APOB, DMP1, RAG2) and intron (PRKCI, STAT5A, THY) gene regions were used with previously studied mtDNA sequences (12S rRNA, tRNA^{Val}, 16S rRNA) to test Nycticeiini monophyly and develop new hypotheses for relationships of *Nycticeius*-like bats within Vespertilioninae. Although results of these phylogenetic analyses did not fully resolve phylogenetic relationships for all taxa historically included in Nycticeiini, they did reject the validity of Nycticeiini. Taxa historically circumscribed in this tribe were found scattered throughout generated phylogenies, with *Scotoecus* aligning basal to *Pipistrellus-Nyctalus*, *Nycticeinops* with the *Hypsugine* group, *Scotomanes* with *Eptesicus*, and *Rhogeessa* with *Antrozous*.

Key words: digenomic sequence data, mitochondrial DNA, nuclear DNA, Nycticeiini, phylogeny, systematics, Vespertilioninae

Effective population size dynamics of *Myotis vivesi* during the Pleistocene and Holocene climatic changes

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Myotis vivesi (Fish-eating Myotis) is an endemic species of the Gulf of California, Mexico. In this study, a 282 bp fragment of the mtDNA control region and six microsatellites loci were used to reconstruct its demographic history using summary and coalescent based statistics. Our results suggest that *M. vivesi* experienced a demographic population expansion between 230,000 to 50,000 years ago. After this expansion, *M. vivesi* experienced a slight reduction in the effective population size between 30,000 to 5,000 years ago and a spatial expansion in the last 5,000 years. Population changes observed in *M. vivesi* could be related to climatic changes that occurred in the Gulf of California in the Pleistocene and Holocene periods.

Key words: *Myotis vivesi*, Gulf of California, mismatch distribution, BSP, msvar

A taxonomic review of *Rhinolophus coelophyllus* Peters 1867 and *R. shameli* Tate 1943 (Chiroptera: Rhinolophidae) in continental Southeast Asia

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Recent field studies have provided new data for a review of the taxonomy, acoustic characters, distribution, and ecology of two often confused rhinolophid species, which have essentially parapatric distributions in continental Southeast Asia. *Rhinolophus coelophyllus* is widespread ranging from northern Myanmar to northern Malaysia, eastern Thailand and provisionally western Lao PDR. *R. shameli* is restricted to eastern Thailand, Cambodia, Lao PDR, and central and southern Vietnam. There are well defined differences in skull morphology, size, and echolocation call frequency, which discriminate between the two taxa.

Key words: *Rhinolophus coelophyllus*, *R. shameli*, Southeast Asia, taxonomy, echolocation

A new species of small *Hipposideros* (Chiroptera: Hipposideridae) from Myanmar and a revaluation of the taxon *H. nicobarulae* Miller, 1902 from the Nicobar Islands

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The taxon *Hipposideros nicobarulae* is elevated to a distinct species and an amended description is included. It is geographically restricted to the Nicobar Islands in the Andaman Sea where it has been found roosting in caves and deserted buildings. It is differentiated by size and external, cranial and dental morphology from *Hipposideros ater* from the Indian Subcontinent. Both taxa are distinguished from a new species, *Hipposideros* sp. nov., herein described from the Rakhine coast of western Myanmar, with referred material from Tanintharyi Division in southern Myanmar. In all cases, individuals were found roosting in human habitation. Information on the conservation status, distribution and ecology of the three species are included.

Key words: *Hipposideros* sp. nov., Myanmar, India, Nicobar Islands, taxonomy, distribution

Morphologically uniform bats *Hipposideros* aff. *ruber* (Hipposideridae) exhibit high mitochondrial genetic diversity in southeastern Senegal

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Two mitochondrial lineages of bats that are morphologically attributed to *Hipposideros ruber* have been shown to occur sympatrically in southeastern Senegal. We studied genetic diversity in these bats in the Niokolo Koba National Park using sequences of mitochondrial cytochrome *b* gene to determine the taxonomic status of the two genetic forms, and included skull morphology for comparison. Detailed multidimensional analysis of skull measurements indicated slight morphological differences between the two genetic forms. Exploration of peak frequency of the constant-frequency echolocation signals in a local population of *Hipposideros* aff. *ruber* was not available for both groups. Phylogenetic comparison with other available West African representatives of *H.* aff. *ruber* revealed paraphyletic relationship of the two Senegalese forms, with the less abundant form from Senegal forming a monophyletic group with that from Benin. Based on genetic divergence and sympatric occurrence, the two forms from Senegal might represent cryptic species. However, absence of nuclear gene flow between them is yet to be investigated to demonstrate their reproductive isolation.

Key words: cytochrome *b*, *Hipposideros caffer* complex, cryptic species, phylogeny

On the presence of pipistrelle bats (*Pipistrellus* and *Hypsugo*; Chiroptera: Vespertilionidae) in Sardinia

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Islands are biodiversity hotspots, often containing numerous endemic species. This makes them also hotspots for conservation. Within the Mediterranean region, Sardinia is known for its comparatively high degree of endemism, including cryptic diversity. In this paper we aim to elucidate the variability of pipistrelles (*Pipistrellus* and *Hypsugo*) on Sardinia. More specifically, we ask which species occur on Sardinia and we describe the geographic affiliations of these evolutionary lineages. We sequenced ca. 560 bp of the 16S rRNA gene from 36 pipistrelle specimens representing 17 localities from all major parts of Sardinia. For comparison we added samples from the entire Mediterranean region as well as sequences stored at GenBank. We constructed Bayesian phylogenetic trees and minimum spanning networks to identify which species occur on Sardinia and to infer their genetic affiliation to lineages occurring throughout the Mediterranean and the Canary Islands. We identified five pipistrelle lineages on Sardinia: *Pipistrellus pipistrellus* (haplolineage II), *P. pygmaeus*, *P. kuhlii/desertii*, *Hypsugo savii* s.str. and *H. cf. darwinii*. Colonization of Sardinia occurred at different times from different geographical sources, namely Europe and Africa. Some lineages may have invaded Sardinia recently. The Sardinian *H. cf. darwinii* may be endemic to the island. Our results highlight the importance of Sardinia as a major Mediterranean hotspot for bat biodiversity. The island harbours a pipistrelle diversity that is higher than that on any other Mediterranean island. Lying geographically at the interface between Europe and Africa, Sardinia combines elements from both continents.

Key words: Mediterranean, cryptic diversity, 16S rDNA, minimum spanning network, Bayesian inference, geographic origin

Acta Chiropterologica, 13(1): 101–111, 2011

PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

doi: 10.3161/150811011X578651

Selection of old stone buildings as summer day roost by the brown long-eared bat *Plecotus auritus*

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Loss of roosting sites is one of the main threats to bat populations and is heightened in species with highly specific roost requirements. *Plecotus auritus* is common, but in the decline in the UK and although there have been studies of its roost use in Scotland, little is known of its roost biology in the milder south-west of England. This study compared five internal and three landscape features of roosts in stone buildings with those of random and paired unoccupied buildings in Cornwall (UK) in order to determine the roost selectivity of the brown long-eared bat. Bats selected roosts mainly for their vicinity, and connection, to foraging habitat. Occupied buildings were thus more likely to be situated closer to deciduous woodland than random control buildings, and were connected through tree lines. Roosts were also found to have a roof space divided into more compartments than paired and random controls and no insulation. These characteristics influence the building microclimate. These findings suggest that *P. auritus* is selective of its roosts both at the building and the landscape levels.

Key words: *Plecotus auritus*, roost selection, artificial roost, conservation

Swarming of bats at different elevations in the Carpathian Mountains

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Swarming bat activity was monitored at three caves at elevations ranging from 880 m to 1,907 m above sea level in the Carpathian Mountains, using an infrared light barrier with data-logger, a video camera with a night-scope system, and subsequently by mist netting. A total of 6,175 bats of 19 species was captured, and over 70,000 passes through cave openings were registered. Caves differed in bat species richness, sex ratio, abundance of particular species and species composition. Peak species richness was observed in the mid-elevation cave. Bat activity was high in all caves, but declined with increasing altitude. Swarming activity occurred earlier at high elevation than at lower elevations. Activity of boreal-alpine species, such as *Eptesicus nilssonii*, peaked at the start of the swarming period, that of species typical of lower elevations, such as *Myotis emarginatus*, peaked in the middle of the swarming season. In a few species, males showed a significant preference for higher altitude caves, in contrast to females. A similar pattern was observed in the proportion of adults to juveniles, which increased with increasing elevation. Our results also suggest that *M. brandtii* and *M. alcathoe* were more often encountered at lower elevations, *M. mystacinus* (*sensu stricto*) at higher ones.

Key words: *Myotis mystacinus* group, age structure, elevational distribution, night activity, seasonal activity, sex ratio, swarming, Poland

Mating system of a migratory bat, *Nathusius' pipistrelle* (*Pipistrellus nathusii*): different male strategies*

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The mating system of European bats is often reported as ‘resource-defence polygyny’ where the resource is a male roost and its adjacent territory. With a large amount of field data we tested predictions of that model on the spatial dispersal of males in a resident population of a migratory species, *Pipistrellus nathusii*, well known for its complex vocal advertising by males during the mating season. The study was conducted in southern Bohemia throughout nine seasons (1999–2007) and revealed that (i) pronounced aggregations of male roosts and vocalization sites were affected by the vicinity of the breeding colony, and (ii) dyadic or triadic aggregations were observed in 65% of resident males that shared a common vocalization site. Dyadic or triadic groups were often quite stable over time (for up to seven successive years). No direct agonistic behaviour was observed between group members in contrast to regularly observed synchronization in their activity patterns and advertisement vocalizations. The busy vocalization sites were also visited by alien males that also produced advertisement vocalization and by non-vocalizing males that may have acted as sneaks. All these phenomena suggest considerable diversity in male strategies, suggesting that the mating system does not correspond entirely to ‘resource-defence polygyny’ nor can it be regarded as a lek mating system to which it corresponds in other characteristics (e.g., aggregations of males and the essential role of female choice). We expect that the broad diversity in mating tactics that characterises the species under study may also reveal features relevant to the mating systems of other temperate bats.

Key words: *Nathusius' pipistrelle*, mating system, lek, resource-defence polygyny

Reproductive seasonality of fruit-eating bats in northwestern Yucatan, Mexico

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In the tropics, rainfall seasonality seems to be the most important factor affecting bat reproductive cycles, triggering reproductive activity or by its indirect affect on the availability of food resources. Considering this, we studied the reproductive phenology of three phyllostomid fruit-eating bats (*Artibeus jamaicensis*, *Dermanura phaeotis* and *A. intermedius*) in a markedly seasonal coastal wetland in northwestern Yucatan Peninsula. Bats were sampled with mist nets during a consecutive 3-year period in 16 naturally formed forest islands and we assessed the reproductive condition of captured bats during the dry and rainy seasons. Sampling effort of 196 nights (11,100 net-hours), resulted in the capture of 738 individuals of *A. jamaicensis* (40%), *D. phaeotis* (32%), and *A. intermedius* (28%). At least 91% of the males captured showed reproductive evidence (males with testes descended) for the three species throughout the year. For *D. phaeotis* and *A. intermedius* we detected seasonal changes in reproductive activity of females associated with rainfall seasonality. In these two bat species a higher abundance of pregnant females during the dry season and presence of lactating females in both seasons indicated a seasonal polyoestry pattern (with an emphasis of pregnancy and births in the dry and early rainy season, respectively). In the case of *A. jamaicensis*, a similar abundance of reproductive females (pregnant or lactating) between seasons suggested the existence of an aseasonal polyoestry pattern for this species. Fruit availability in the study area might influence the reproductive patterns observed for the three bat species.

Key words: bat reproduction, polyoestry, seasonal patterns, coastal wetlands, Yucatan

Reproduction and growth in a Neotropical insectivorous bat

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Even though there is an abundance of data regarding the reproductive biology and postnatal growth of bats, comprehensive data on life history is still lacking for most species, particularly for rare families that have unique behavioral and ecological adaptations. In this study we provide a description of reproductive seasonality and length of reproductive activities such as gestation and lactation for *Thyroptera tricolor*, a small (3–4.5 g) Neotropical insectivorous bat and one of only four species in the family Thyropteridae. In addition, we also describe postnatal development, including growth rates and the onset of flight. Our results show that *T. tricolor* has long gestation (at least 3.5 months) and lactation (4 months) periods within a single annual reproductive event. Young are capable of sustained flight at two months of age, and attain adult forearm length at age 90 days and adult body mass at age 120 days. Offspring mortality was high, with 28% of young dying before age five months. Surviving young remained with their mother and natal group for at least one year. In addition, our field observations suggest that males attained sexual maturity earlier than females, at one year of age, while females became sexually active after their first year. These findings suggest that, among bats, *T. tricolor* may have an unusually slow life history, which could be attributed in part to its unique roosting ecology and social behavior.

Key words: gestation, lactation, life history, post-natal growth, reproduction

Seasonal and geographic trends in acoustic detection of tree-roosting bats

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Migratory routes, timing, and behavior are some of the least studied facets of bat biology, and possibly play roles in bat mortality rates observed at commercial wind energy facilities. We used acoustic detectors to record seasonal activity of silver-haired (*Lasionycteris noctivagans*), hoary (*Lasiurus cinereus*), and eastern red (*Lasiurus borealis*) bats above the forest canopy at one existing and 13 proposed wind energy facilities in seven eastern U.S. states between April and November 2007 and 2008. We correlated species detection rates between surveys located within three predetermined geographic regions, and correlated species detection rates from two survey locations with mortality reported from a nearby commercial wind facility. We identified 2,603 *L. noctivagans*, 1,908 *L. cinereus*, and 6,802 *L. borealis* calls during 6,153 detector-nights. We found a greater number of significant correlations between sites for silver-haired and hoary bat detection rates than in eastern red bat detection rates. Each species exhibited unique seasonal trends in detections among geographic regions. Previously reported mortality rates of *L. noctivagans* and *L. cinereus* from a wind energy facility were positively correlated with detection rates of those species at one of our survey locations within 50 km ($r = 0.65$, $P < 0.001$ and $r = 0.28$, $P < 0.01$, respectively; in both cases $d.f. = 94$) and with another location within 100 km ($r = 0.44$, $P < 0.001$ and $r = 0.28$, $P < 0.01$, respectively; in both cases $d.f. = 81$). These data indicate that seasonal detection rates of all three species under study reflect their different migratory patterns that may be useful in predicting the timing of mortality events at wind energy facilities.

Key words: Anabat, bat migration, *Lasionycteris noctivagans*, *Lasiurus borealis*, *Lasiurus cinereus*, wind power

Variation in the use of harmonics in the calls of laryngeally echolocating bats

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The echolocation calls of bats may contain a single acoustic element (the fundamental frequency or a harmonic) or multiple acoustic elements that may (or may not) include the fundamental element. We hypothesize that the detection of harmonics is affected by three factors: 1) species, 2) situation, and 3) recording quality. To test our hypotheses, we recorded and analyzed approximately 2,300 calls from 17 species and 1 subspecies in 6 families of bats using a 1-channel and 4-channel microphone array. The percentage of calls with multiple acoustic elements varied from 0 to 83% across species. Furthermore, recordings from a 4-channel microphone array (1 m tetrahedron arrangement) revealed that the percent of calls with multiple acoustic elements varied across channels by up to 50%, indicating the effect of bat position relative to the microphone. In some species, presence of multiple acoustic elements was predicted by call energy: calls with sufficient energy (threshold varied by species) had multiple acoustic elements above the noise floor of the recording system. In the remaining species that produced calls with multiple acoustic elements, we found two clusters of calls. In one cluster, the presence of multiple acoustic elements was predicted by received call energy. In the 2nd cluster, call energy was lower, and almost all calls included multiple acoustic elements. The detection of harmonics independent of recorded energy suggests the intriguing possibility that harmonics are used differently in these species. Finally, to test the effect of situation, we recorded the echolocation calls of big brown bats (*Eptesicus fuscus*) flying in three settings: an anechoic flight room, during roost emergence, and foraging in an open area. Call energy shifted to lower frequencies and fewer acoustic elements as the recording distance and the volume of the flight environment increased (i.e., as clutter decreased). Comparing flight room with foraging calls revealed that the second harmonic of open air foraging signals decreased by about 30 dB (relative to the fundamental). Overall, our results show that detection of echolocation signals with harmonics varied significantly across species. We also demonstrate that relative harmonic intensity varies according to the flight situation within a species, and when combined with the effects of call directionality and relative position of bat and microphone, these factors influence harmonic detection in echolocation recordings.

Key words: acoustic elements, callViewer, echolocation, *Eptesicus fuscus*, links detector

Plasticity in the echolocation inventory of *Mormopterus minutus* (Chiroptera, Molossidae)

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We recorded the echolocation behavior of the molossid bat *Mormopterus minutus*, a species that uses a plastic call inventory. During its foraging activity, *M. minutus* searches for insects emitting rather long and narrow-band echolocation calls. Search call design however, can vary noticeably even in a continuous foraging pass. While echolocating in different flying conditions *M. minutus* uses several other call designs such as short CF, QCF, FM/QCF, FM and multi-harmonic FM, with or without harmonic overlap, and QCF/FM. Call plasticity characterizes most echolocation sequences, particularly in bats flying in open spaces. Call variation was also influenced by the presence of conspecifics. In those sequences containing echolocation calls from more than one bat, signals from different individuals were reliably identified. In contrast to other small molossids, the call designs in the echolocation inventory of *M. minutus* show a high level of plasticity. Our results suggest that *M. minutus* has combined the advantages of emitting several call designs, as shown by molossids, with the advantages of manipulating one signal design as shown by vespertilionids within the same sonar inventory.

Key words: echolocation, k-means clustering, *Mormopterus minutus*, vocal plasticity

***Noctilio albiventris* (Noctilionidae), a potential seed disperser in disturbed tropical dry forest habitats**

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The lesser bulldog bat, *Noctilio albiventris*, is a species widely distributed in Tropical America that feeds mainly on insects; however, a few studies have revealed that this bat can have broader dietary habits, including plant items. In this study we examined the feeding habits of *N. albiventris* in a dry forest in the Central Llanos of Venezuela, and determined variations in its diet across a successional gradient. We analyzed fecal samples from 28 out of 41 individuals captured during two years of sampling. Most samples came from pastures and early successional growth plots (88.9%), the rest came from samples obtained in intermediate (3.7%) and advanced (7.4%) successional stages. About 74.1% of the samples contained only insects, 18.5% a combination of insects and fruit remains with seeds, and 7.4% only fruit and seeds. Three species of plants were identified in the feces: *Ficus* sp., *Maclura tinctoria*, and *Piper* sp. Our results suggest that *N. albiventris* can be considered a potential seed dispersal agent in disturbed areas close to dry forests in the Neotropics. Temporal adoption of plant-feeding habits in a member of the Noctilionoidea lineage is concordant with the close phylogenetic relationship demonstrated for bat species within the families Noctilionidae, Mystacinidae and Phyllostomidae.

Key words: frugivory, *Noctilio albiventris*, pastures, seed dispersal, succession, Venezuela

Acta Chiropterologica, 13(1): 195–199, 2011

PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

doi: 10.3161/150811011X578741

Folivory in the giant fruit-eating bat *Artibeus amplus* (Phyllostomidae): a non-seasonal phenomenon

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Folivory has been reported in only five species of microbats, and described as a seasonal phenomenon. Bats feed on leaves by chewing a portion of leaf, extracting the liquid, and discarding the fibrous material. In the course of a study on the reproductive pattern of *Artibeus amplus* in the Venezuelan Andes, leaves were frequently observed in a cave used by this species as a roost. We took this opportunity to (1) identify the leaves consumed by this poorly known Neotropical bat species, and (2) test whether folivory is a temporal phenomenon, such as in other leaf-eating bat species. *Artibeus amplus* consumes the leaves of seven species of plants, and four of these were found in every month of the year during the study. We report for the first time: (1) folivory in *A. amplus*, (2) five plant species never reported before in the diet of a bat, and (3) folivory as a non-seasonal phenomenon.

Key words: Chiroptera, behavior, feeding habits, forest, leaves, Phyllostomidae, Stenodermatinae, Venezuela

Deliberate insectivory by the fruit bat *Pteropus poliocephalus* by aerial hunting

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The diet of the Old World fruit bats (Pteropodidae) has been well studied with a large inventory of nectar and fruit bearing plant species known to be consumed. It is far less certain, however, whether pteropodid bats intentionally supplement their diet with insects in a similar fashion to many other frugivorous and nectivorous species, including some New World fruit bats of the family Phyllostomidae. Several reports of pteropodid bats consuming insects in captivity exist, and insects have been found in the faeces and digestive tracts of some wild pteropodid bats, although their ingestion was initially thought to be accidental. However, more recent observations of large insects in faeces of wild bats, coupled with two reports (one anecdotal) of observed intentional insectivory in the wild, suggest that intentional insectivory by pteropodid bats may be more common than previously thought. In addition, reports of intentional insectivory to date have been of bats catching insects from a stationary position, and a large question still remains as to the ability of pteropodid bats to catch insects in flight without the use of laryngeal echolocation. Here, we report on an observation of intentional insectivory by a group of grey-headed flying foxes (*Pteropus poliocephalus*) actively preying on, and consuming, numerous (> 20) cicadas (*Psaltoda* sp.) by aerial hunting in southeastern Australia. We conclude that deliberate insectivory is likely an evolved and fixed component of the grey-headed flying fox's dietary ecology, and suggest that this may be an adaptation more common among pteropodid bats than previously thought.

Key words: *Pteropus poliocephalus*, Pteropodidae, dietary strategies, insectivory, nitrogen acquisition, aerial hunting

The dorsal patch of males of the Curaçaoan long-nosed bat, *Leptonycteris curasoae* (Phyllostomidae: Glossophaginae) as a visual signal

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The seasonal dorsal patch of males of the Curaçaoan long-nosed bat, *Leptonycteris curasoae*, which exhibits variability in size, shape, and chemical complexity, is a trait associated with courtship and mating in this species. This recently discovered structure develops exclusively during the mating season that occurs once a year between November and December in populations of *L. curasoae* from northern Venezuela. Although the dorsal patch that develops in males has unique chemical characteristics possibly involved in female attraction, we suggest that this trait also sends distinct visual cues regarding the health status of males. We evaluated the postulated association between dorsal patch shape (symmetry) and ectoparasite load (streblid batflies) in males of *L. curasoae*. To do so, we quantified the shape of dorsal patches on males to test the hypothesis that streblid load was related to this variable. Over 2,000 streblid batflies of two different species (*Nycterophilia coxata* and *Trichobius sphaeronotus*) were recovered from 130 individuals (\bar{x} = 16 streblids/bat). Among these batflies, *N. coxata* was the most abundant species found on *L. curasoae* (2,042 individuals, 95.0% prevalence). Males with dorsal patches had significantly lower batfly loads when compared with males without dorsal patches and with females. Males with the most symmetrical dorsal patches also had the lowest batfly loads. Our results suggest that the odoriferous dorsal patches produced in males of *L. curasoae* also convey visual cues to female mates as signals of good health.

Key words: *Leptonycteris curasoae*, morphology, symmetry, parasites, *Nycterophilia coxata*, *Trichobius sphaeronotus*

Effect of sample preservation methods on the viability of *Geomyces destructans*, the fungus associated with white-nose syndrome in bats

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Geomyces destructans is a fungus directly associated with white-nose syndrome (WNS), a recently discovered disease that has caused the death of over one million bats in North America and therefore has prompted intense scientific investigation into its biology. If precautions are not taken, the spread of *G. destructans* by human transportation for scientific study may be a substantial threat to bat populations. We investigated the viability of *G. destructans* after being exposed to commonly used DNA/RNA preservation methods. Our first experiment revealed that *G. destructans* is able to germinate after an eight day storage period in RNAlater or kept dry but could not germinate after storage in 70% or absolute ethanol for the same time period. Storing *G. destructans* samples at different temperatures did not substantially affect the results. In a second experiment, we showed that *G. destructans* conidia were only killed after being stored in 70% ethanol for a minimum of 24 hours while only 30 minutes were necessary when stored in absolute ethanol. Our results suggest that the DNA/RNA preservation method has an important impact on the ability of *G. destructans* to remain viable and should therefore be considered before samples are transported, especially to regions where the fungus has not yet been documented. Our results also strongly advocate the use of high concentrations (i.e., absolute ethanol over 70% ethanol to rapidly kill *G. destructans*).

Key words: *Geomyces destructans*, white-nose syndrome, conidia germination, Chiroptera, DNA/RNA preservation

Acta Chiropterologica, 13(1): 223–225, 2011

PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

doi: 10.3161/150811011X578787

FORUM

Recommended methods for bleeding small bats ...Comment on Smith *et al.* 2009

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Recommended methods for bleeding small bats ... Comment on Smith *et al.* 2009 — letter in reply

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