Foraging in nectar feeding bats biology essay

Science, Biology

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Abstract

Bats are mammals from the Chiroptera order and the only mammal species that can truly fly. They are mostly divided as bats of The New World and bats of The Old World. Their dietary diversity has led to wide variation in their morphology and ecology. (повторение, избери едното само) The diversity in their dietary requirements eventually resulted in wide variation in terms of morphology and ecology. They can respectively be divided into: insectivores, carnivores, piscivores, sanguivores and bats that feed on fruits and nectar. Nectar-feeding bats are one of the most interesting groups, given that their diet is probably being one of the most complicated and specialized among mammals. The bats from the family called Phyllostomidae are associated with specialization in nectar feeding. Amongst the members of this family are the long-nosed, hog-nosed, long-tongued or tube-lipped bats. They depend almost all of the time on nectar, pollen and in some cases fruits as alternative food source. Сфетофар светофар

Introduction

In order to be able to exploit this food source efficiently, bats of the family phyllostomidae developed various adaptations: morphological, anatomical, physiological and behavioural. Bats that prefer to feed on nectar depend largely on the simple carbohydrates extracted from the plant, because, similar to hummingbirds, most of them use energetically costly hovering flight technique. However, this also means that energy costs increase with weight, so fat storage would not be a very appropriate strategy. Instead, the bat relies on developments such as high rate of absorption of sugar (much higher than in other mammals) and the presence of the enzyme sucrose in its digestive tract that helps the sugar-rich nectar to be digested. The ingestion itself is regulated by the changes in sugar concentrations. It is estimated that a small feeder with a weight of about 20g requires at least 4-5g of sugar per day. This is an example of the importance of physiological adaptations, which enable for this niche to be exploited. One of the most important morphological adaptations is size reduction. Differences in size play huge role in the foraging strategies of bats. Nectar - feeders are small seized in comparison to the other species of bats, which is a reason for them to build different strategy when looking for food. Large species often search for resources in patchy spaces, whereas smaller once utilize resources which are in abundance. Size reduction is not the only change. Traits like long tongue, two-chambered stomach, change of the skull shape and sort and unspecialized intestines are linked to the specialization of the bats to feeding with nectar. The tongues have structural modifications for efficient uptake of carbohydrates. These anatomical adaptations allow maximum ingestion in a

minimum time. The morphological changes as well as the hairs on all plant-eating bats make them exceptional pollinators. All these changes are complemented by some behavioural adaptations as well. The foraging behaviour of nectarivorous bats is often constrained by the type of nectar they consume. Dilute or concentrated nectars can limit the amount of energy that can be assimilated. The more diluted is the nectar the larger quantity is needed to satisfy the energy budget (Korine et al., 2004; Ramírez et al., 2005) and so the bat needs to consume more of it. What is more, nectar – feeding bats forge mostly in groups, ether for preventing predation or for maximizing the efficiency of the act (E. Raymond Hethans, 1975).

Discussion

Phyllostomidae family species are mostly micro-bat plant-eaters and because of their small size they often forage in flocks. Long – nosed bats such as Leptonycteris curasoae are a perfect example for group foraging. L. curasoae spends most of its (the) time feeding on/most of the time feeds on desert succulent plants. If a bat finds a flower all of its fellow bats circle around the plant and take turns randomly to drink from it. The group does not break even if one of them leaves the plant permanently in search for new one. Most often in cases like this no one makes attempt for feeding further from that flower. Optimal-foraging theory predicts that an organism should leave a food patch when its rate of food intake in the patch drops to the average rate of intake for the entire habitat. In theory the switching point corresponds to a marginal intake rate, and each patch has a " marginal foraging value" that is detectable by feeding animals. When this value is reached, the animal should change sites to improve its foraging efficiency.

Experiments showed that (the) most of the time/in most cases the bats like Glossopaga soricina optimise the time which is spend on different patches so that the future feeding success would not be hindered (Lemke, 1984). Lemkes experiment in 1984 on Glossopaga soricina (това трябва да ти е името на вида прилеп дето са го изследвали, иначе ще е нещо от сорта на involving the plant..., one of their preferred food sources) different foraging tactics showed that by assessing the nectar availability the bats changed their feeding strategies and actually adopting the optimal-foraging theory (тази част може да отиде накрая, виж по-долу)./ The optimal-foraging theory was proved in an experiment made by Lemkes in 1984 on Glossopaga soricina. He used several methods to tray and predict the pattern in which G. soricina looked for food.(Figure…) During his course of work he noticed that nectar or pollen are the primary sores sources? of food for the species isnstead of the more commonly used and accordingly expected insects or fruit. (and the do not often relate to eating insects or fruit.) The insects and fruit only become source of nutrition when the foraging rate was increased and thus lowering the available nectar levels of the plants they mostly feed off. But even then most of them would prefer diluted nectar. This showed that bats could assess the nectar availability and accordingly change their foraging behaviour/tactics to maximise their energy intake. By assessing/Bats can also assess the sugar levels of the flower Glossopaga soricina can/and change their feeding strategy (too) and can/so that they can easily compensate the energy they are going to lose if feeding stays on the same patch. Switching from: ether feeding on dilute nectars and increasing the total time spend on the same patch, or feeding on

concentrated ones (but losing more energy trying to find and go to them?) (Jorge Ayala-Berdon, 2011). They apparently evaluate the current situation and change from energy maximisers to time minimisers and leave/leaving patches when the rate of gain of energy in that patch falls below the long term maximum rate of energy gain for the patch quality. (яко има някаква схемичка относно това тука ще е чудесно)The life of a nectar-feeding bat is energetically expensive, due to the small body size and thermoregulation costs and because of that most of them can cover no more than 60km per night. That and the energy loss during nectaivory make them constrained to the supplies they have. This may lead to a different kind of strategy: changing to fruits and insects. Changing the diet (however,) may not be as successful as maintaining low energy levels with diluted nectar. Nectarivorous have different morphological structure in comparison to the other bats. Diet specialization and natural selection have formed anatomical traits specifically for this group of bats. Because of that most of the bats have narrow jaws with week muscles and only canines as teeth. The lower incisors are missing and the upper are pushed aside. Moreover the front part of the skull is shaped like a tube and may form channels to guide the tongue (Freeman, 1995). Anatomically the skull of the bats is adapted to their way of foraging and can also predict the feeding performance of the species (Figure 1)(Dumont et al., 2012). Figure този текст се прави като кликнеш на картинката, после references -> insert caption и после си го пишеш (не че не може и иначе де), само че трябва да го посочиш и в текста. The skulls and faces of a nectar-eating bat (left) an insect-eating bat (middle) and a fruit bat (right).(Picture from http://www. sciencedaily.

com/releases/2011/11/111123133520. htm)The tongue of the nectar-feeders is elongated for extraction of the nectar, well supplied with blood vessels and the upper surface is covered with papillae. Muscles force the blood forward to the tip by circular contraction. Some may have small channels for guiding the nectar. The papillae play the role of a sponge which sucks the nectar by capillary action. Most of the time the tongue is nearly as long as the entire length of the animal. Anoura fistulata , also known as a tube-lipped bat, is the mammal with longest tongue known for its size . It allows access to the long cup of the plant and afterwards is coiled inside the ribcage. These morphological adaptations are considered to not only a way to help/assist foraging for the animal, but also help the pollination of the plants on which they feed. That is why nectar-feeding bats are considered to be very important pollinators. (important ecological meaning) When comparing the hairs of non-plant eaters and nectarivors, it could be clearly seen that the hair is scale and not smooth, this way helping the collection of pollen. Some plants are entirely dependent on bats for their pollination and specifically have modified anthers for easy deposition of the pollen. Although they aid and help decreasing the competition for pollination between the plant species, most of the pollen is used as a source of nitrogen in their diet (Howell and Hodgkin, 1976).

Conclusion

To sum up, the family Phyllostomidae show notable differences from other bath families, related mainly to the food source they exploit – nectar. Sugars are very rapidly absorbed, digested and metabolised by them for a maximum energy intake. These animals have one of the highest metabolic

costs among the mammals. In order to be able to cope with that they can change their foraging strategy so that they always have positive or neutral intake – output relationship. Nectarivorous bats are selective of what they eat and can optimise (intake?) depending of the sugar levels. This type of diet also led to anatomical changes in the traits associated with nectar feeding that have evolved with the specialization of the species.