



## The bats *chiroptera* fauna of nakhchivan autonomous republic: The role in ecosystem and in spreading of some diseases

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### Abstract

The article provides information on the scientific and ecological significance of bats in the fight against harmful insects, the pollination of plants, the spread of their seeds, the use of fertilizers in agriculture, medicine, the defense industry and so on. On the other hand, there are some data related damages to animals and role of spreading of zoonotic illnesses. Flying to distant areas, spreading all over the world and having lots of numbers according to the study of the spread of diseases is a great importance. The article also includes detailed research on the systematic composition, zoonotic disease factors and zoonotic significance of bats spreading in the territory of the autonomous republic.

**Keywords:** bat, ecosystem, zoonosis, metacarpal, patagium, Lyssavirus, ebola

### Introduction

Bats - a single group of mammals with the ability to fly belonging to the *Mammalia* class of *Animalia* kingdom, which is derived from the greek word *cheiros* – hand and *pteros* – wing, are referred to as “*Chiroptera*” the meaning of “handwinged – armwinged” (4, pp. 6)

Approximately 20% of 5416 species represented in the mammals class are bat species. Within the class bats of 1116 species come after the rodents (2277 species). These creatures are spread in tropical and mild regions except the polar regions and some isolated islands in the world. The number of bats living in some tropical regions is higher than all other mammals in the region (6, pp. 49-51)

Though bats are assimilated to rodents of the size of their bodies and fur, but they have very different properties. On the forelimb, the bones of the *metacarpal* and the *falanga* have extended, and the wing is formed from the thin skins (*patagium*) between falangas (6, pp. 52-53).

The order of bats are divided into two suborders: large bats - *Megachiroptera* (bats of the old world) and small bats - *Microchiroptera*. *Megachiroptera* consist of more than 186 species located in from the Africa to the southeastern of Asia, the forests of India and Australia and the tropical areas of islands located in the ocean. The largest of them are flying foxes and flying dogs. The only family of this suborder is *Pteropodidae*.

The suborder of *Microchiroptera* includes 930 species belonging to the 17 families. The suborder of *Microchiroptera* encompasses of the families such as *Rhinophidae*, *Phyllostomatidae*, *Emballonuridae*, *Rhinopomidae*, *Vespertilionidae*, *Noctilionidae*. The members of the suborder have been spread in countries such as Canada, the United States, Europe, Caucasus and Central Asia, that located in the moderate climate zone.

The flight characteristics of the bats are believed to have been formed during the *Paleogen*, it is assumed that *Dermoptera* (flying lemurs) which is the most similar in flying characteristics of species have been developed in separate line form (7, pp. 57-60).

There have been spread 16 species belonging to the 8 genus (*Rhinolophus*, *Myotis*, *Plecotus*, *Barbastella*, *Pipistrellus*, *Hypsignathos*, *Eptesicus*, *Miniopterus*) of 3 families (*Rhinolophidae*, *Vespertilionidae* and *Miniopteridae*) in the autonomous republic that 1116 species included to the 18 families are available at the moment in the world (6, pp. 53; 7, pp. 63).

Available literatures materials are consist of research works conducted by I.K. Rahmatulina, N.K. Vereshagin, G.N. Guliyev and A.F. Mammadov (1, pp. 429-474; 3, pp. 205-207; 4, pp. 99; 5, pp. 47-59).

Bats play an important role in the pollination of plants, the spread of seeds and the balance of insect populations depending on their biological properties. All bats in the area are active during the night from the first hours of the night until the first hours of the morning in the exception of the time they are in winter sleep (12, pp. 41-42).

Insect-eating bats play a crucial role in preventing their over-reproduction and maintaining a natural balance by feeding many harmful insects, especially mosquitos, which are the carriers of fever.

### Results and discussion

*The role of bats in the ecosystem.* A bat, that feeding malicious insects, can eat approximately 5-6000 mosquitos every night. It has been determined that, the destruction of bats, which feeds on some organisms that harm certain fruits and plays vital role in protecting the ecological balance, will create problems for agriculture for many years (27, 28).

Because of bats fed while they are flying in the air, they can digest approximately 15-20% of the mosquitos and other harmful insects they catch, the rest are removed as excrement. For this reason, the guano of bats is quite rich in nitrogen, phosphorus, potassium, magnesium, iron, copper, manganese, zinc and sodium elements. The manure of certain species are used for the production of barleys in the processing of potassium nitrate (KNO<sub>3</sub>) except farming (28).

Nectar-fed bats are the main pollinator of many plants,

including bananas. Fruit fed bat species play an important role in the spread of seeds of plants such as dates, figs, avocados and mangoes (8, pp. 38-40, 11, pp.41-42).

Only 3 of 1116 bats in the world are vampire bats and live in Latin America. Vampire bats do not attack humans, and they mainly prefer pets (17, pp. 2-15).

There are many species of bats is endangered, that have a major role in the ecological balance, so the Organisation of United Nations has declared the year of 2011 to be a bat, and has decided to protect many bat species (18, pp.1-27)

The bats that fed with fat insects during the life period, there have not been observed any concern by the researchers. There have not been found fat concentration in the blood-vessel system on both of 20-year-old bat and a one-year-old bat. Significant results have been obtained for the prevention of cardiovascular disease during the studies on bats that were kept in the refrigerator (19, pp. 138-142).

In the treatment of paralysis diseases, there have been used the drug that confirmed by the American Food and Drug Industry (FDA) until recently. Recent studies conducted by the University of Cleveland have given a great deal of hope for the treatment of the disease (28).

According to the results, a type of protein in the saliva of vampire bats is of great importance in the treatment of paralysis. The proteins in the saliva of these types of bats are used to open veins that are blocked by the blood clot (thrombus). The use of this treatment method has been found to be more effective than drugs in modern times (28). Although it was necessary to repeat the treatment for every three hours with normal medication, the bat saliva was effective nine hours after paralysis (6, pp. 52).

Although they play an important role in transmitting zoonotic diseases and being major carriers, there is still a lack of information about the causes and features of these diseases associated with bats. There are reports the play a role in the spreading of zoonotic diseases such as viruses (rabies), bacteria, parasites (histoplasmosis), fungi and rickets in worldwide.

In addition to vampire bats, which is the main carriers of rabies virus, there are numerous research, experiments and reports that different types of bats play a role in the spread of this disease (6, pp. 97-100). At the same time, vampire bats sucking small amounts of blood from farm animals over every night and extending the bleeding time with the antioxidant substances in the saliva, act as an ectoparasite. Bats also lead to death by the spread of infectious diseases such as rabies (12, pp. 613-615; 21, pp. 265-274).

There have been identified approximately 60 diseases of virus causing, as zoonotic nature carrying by bats. Majority of these diseases have come from viruses that can cause recurrent infections, can pass on to generations in humans. These are mainly *Lyssavirus* and *Henipa*. Relationships between *Lyssavirus* and *Corona* viruses in some species of bats have been found the correlation viruses with their unique bat species. As a result of cross-infections formed among bat species there can be emerged new viruses that break out of species border over time. In modern times, certain species of bats belonging to *Pteropodidae*, *Molossidae*, *Phyllostomidae*, *Vespertilionidae* have been associated with pathogens of human diseases (24, pp. 301-303).

Recent studies have revealed that *Megachiroptera*, *Pteropus*, *Chiroptera* generas of zoonotic viruses such as *Hendra* and *Morbilli* viruses that caused encephalitis (brain

inflammation), have been spread from fruit bats (24, pp. 305-306). *Lyssavirus* belonging to the *Rhabdoviridae* family causes rabies and severe encephalitis.

The bats relationship with rabies have been emerged in a patient indicated nonsuperative encephalitis symptom and rabid sign of *Lyssavirus* infection in Australia. Of the ongoing infections, 2 people have been killed and survivors have also been identified as viruses (10, pp. 239-270).

Researches on mass deaths in some bat species in the United States have been reported that, deaths often occurred between West Virginia and New England approximately 500,000 bats have been reported to be "white nose syndrome". It has been used "white nose syndrome" due to the appearance of white fungus around the nose of dead or sick bats, however, the fungus is probably not the cause of this disease, but the result is (<http://www.dnr.state.md.us/>). The factor is identified as the *Geomyces destructans* named fungus. While there is no information that, the disease is only observed between bats and being able to spread through people, there have been emphasized people can play a carrier role in the spread of the disease, as well as not to enter into the caves where there are dead bats. The increasing number of mass deaths observed in bats highlighted a significant barrier to the regulation of populations of harmful insects in agriculture and horticulture (wheat and apple gardens) (15, pp. 147-150).

As a result of recent studies, a new flu virus has been identified in bats. Genetic material of type A influenza virus has been found accidentally in more than 300 rabies suspected bats collected during 2009-2010 in Guatemala. Although this new virus is similar to other influenza viruses, the H antigen differing from the H16 antigen that is known so far is renamed H17. The first bat influenza viruses identified in winged mammals have not yet been cultivated in cell cultures and the forms of infection have not been fully defined. There is no indication bat influenza viruses transmitting to human and the likelihood of causing a danger to humans (14, pp. 69-80; 23).

It have been closely linked with the the fact that, this new virus can be emerged by mutations and the virus infected with carried animals centuries ago (23).

Scientists have reported that the yellow shoulder bat species identified by the virus was fed with fruits and insects and did not bite humans. However, it should be taken in mind that eating fruits infected by bats can spread through human (13, pp. 900-901).

There have been detected that rabies, SARS, and Ebola viruses can infected to humans and animals by bats (16, pp. 1690-1700). Another virus that has recently emerged and linked to bats has been identified as Mers. The new virus that has emerged in the Middle East and affecting respiratory tract has been found to be more dangerous than SARS. In general, more than 40 people have been passed away in a widespread disease in Saudi Arabia. Virus was not so rapidly disseminated as SARS virus that killed 800 people in 2003. It has been found the infecting SARS virus from bats to cats to humans.

Contrary to SARS, the source of Mers virus has not been clearly identified. It is said that viruses are linked to viruses isolated from some species of bats, but the disease is based on the likelihood of being infected by camels or goats. It is also recognized that the bats carrying the MERS virus can spread human by contaminating palm trees (25, pp. 69-90; 26)

Surveys show that bats are an integral part of many ecosystems and are of great importance to humans. The measures taken to protect and utilize bats in the international arena are increasing. For example, many caves used as a major hibernation are equipped with doors that can not afford people's access, but only bats can pass.

### Findings

In the modern times, if the threat to bats persists, their generations will come to an end in 50 years. The biggest danger is the reduction of the living habitat of these animals. The collapse of roofs and floods creates a great danger to bats which living in the caves.

While natural hazards are regulated, human beings are always potentially hazardous for bats. Deaths have been observed as a result of awakening of winter sleeping of bats by sound or light. For this reason, researchers who go to the caves to explore their sleeping winters should be very careful.

People break the balance as pollute the river bank where bat live, cut trees, float of agricultural medicines and sewerage into these rivers.

Not all bats carry the rabies virus and are highly resistant to the disease and only 0,5% of bats are caught disease. Patient bats do not bite people unless bothering them. The number of deaths infected by bats considerably smaller than the number of deaths per year of dog bites, bee sting and food poisoning in history.

Only 0,3% of the bats (*Desmodontidae*) are actually blood sucking, but they do not attack humans and do not suck blood by their bite sharp teeth under skin. Vampire bats open a small hole on the victim's skin in the night and suck the flowing blood. The victims do not die or become vampires.

There is very little information about the lives of bats we see around us in many parts of the country at night. We are not aware that they carry out very important functional duties in the ecosystem. In recent years, there have been observed significant reduction of bats population by the removal of bats fertilizers from their habitat, the implementation of investments in the areas they are spread, the decline of forests and nature by different reasons.

### References

1. The kingdom of Azerbaijan animals. Vertebrated. Volume III. Baku: Science, 2004, 32-332
2. Mammadov AF. The *Chiroptera* fauna of caves of Nakhchivan Autonomous Republic // ANAS The News of Nakhchivan Branch. The series of Natural and Technical sciences. Nakhchivan, №4, 2015, 194-203.
3. Mammadov AF. The Mammalia fauna of Nakhchivan Autonomous Republic // (ANAS The News of Nakhchivan Branch. The series of Natural and Technical sciences. Nakhchivan. 2016; 2:205-217.
4. Raxmatulina IK. The flying mammals of Azerbaijan. Baku: ANT, polygraphic firm, 2006, 6.
5. Talibov TH, Mammadov AF. The taxonomic spectrum of vertebrated fauna of Nakhchivan Autonomous Republic. Baku, 2016, 47-57.
6. Albayrak İ, Ün, H, Aşan N, Ünal N, Müller T, Freuling C, Aylan O. Phylogenetic Relationships of Three Bat Species from Turkey. *Etlik Vet. Mikrobiyol. Derg.* 2011; 22(2):49-53.
7. Alp H. Yarasaaların özellikleri ve Yarasaalarla mücadele yöntemleri. *Dicle Üniv. Vet. Fak. Derg.* 2009; 2(4):57-63.
8. Boynukara B, Gülhan T. Kedi zoonozları. *Tabiat ve insan dergisi.* 2011; 45(4):38-45.
9. Mackenzie JS, Field HE. Emerging Encephalitogenic Viruses: Lyssaviruses and Henipaviruses Transmitted by Frugivorous Bats. *Arch. Virol. Suppl.* 1999; 18:97-111.
10. Banyard AC, Hayman D, Johnson N, McElhinney L, Fooks AR. *Advances in Virus Research.* Chapter 12, Bats and Lyssaviruses. 2011; 79:239-289.
11. Boyles JG, Cryan PM, McCracken GF, Kunz TH. Economic Importance of Bats in Agriculture. *Science* . 2011; 332:41-42.
12. Breed AC, Meers J, Sendow I, Bossart KN, Barr JA, Smith I, Wacharapluesadee S, Wang L, Field HE. The Distribution of Henipaviruses in Southeast Asia and Australasia: Is Wallace's Line a Barrier to Nipah Virus? *PLOS ONE.* 2013; 8(4):613-616. (doi:10.1371/journal.pone.0061316).
13. Dlugolenski D, Jones L, Tompkins SM, Cramer G, Wang LF, Tripp RA. Bat Cells from *Pteropus alecto* are Susceptible to Influenza A Virus Infection and Reassortment. *Influenza Other Resp. Viruses,* 2013, 900-902 (27. doi: 10.1111/irv.12128). *Emerging Infections in Humans. Rev. Med. Virol.,* 17(2): pp. 67-91.
14. Gargas A, Trest MT, Christensen M, Volk TJ, Blehert DS. *Geomyces destructans* sp. nov. Associated with Bat White-Nose Syndrome. *Mycotaxon.* 2009; 108:147-154.
15. Gouilh MA, Puechmaille SJ, Gonzalez JP, Teeling E, Kittayapong P, Manuguerra JC. SARS-Coronavirus Ancestor's Foot-Prints in South-East Asian Bat Colonies and the Refuge Theory. *Infection, Genetics and Evolution.* 2011; 11:1690-1702.
16. Hayman DTS, Bowen RA, Cryan PM, McCracken GF, O'shea TJ, Peel AJ, Gilbert A, et al. Ecology of Zoonotic Infectious Diseases in Bats: Current Knowledge and Future Directions. *Zoonoses and Public Health.* 2013; 6:2-21.
17. Kunz TH, Torrez EB, Bauer D, Lobova T, Fleming T.H. 2011. Ecosystem Services Provided by Bats. *Ann. N.Y. Acad. Sci.,* 1223: pp. 1-38.
18. Liam P, McGuire M, Fenton B, Guglielmo CG. Seasonal Upregulation of Catabolic Enzymes and Fatty Acid Transporters in the Flight Muscle of Migrating Hoary Bats, *Lasiurus cinereus*. *Comp. Biochem. Physiol., Part B.* 2013; 165:138-143.
19. Luis AD, Hayman DT, O'shea TJ, Cryan PM, Gilbert AT, Pulliam JR, Mills JN, et al. A Comparison of Bats and Rodents as Reservoirs of Zoonotic Viruses: are bats special? *Proc. Biol. Sci.,* Feb 1. 2013; 280(1756):20122753. Doi.
20. Massad E, Coutinho F.A., Burattini M.N., Sallum P.C., Lopez L.F. 2001. Mixed Ectoparasite-Microparasite Model for Bat-Transmitted Rabies. *Theor. Popul. Biol.* 60: pp. 265-279.
21. McCallum K.P., McDougall F.O., Seymour R.S. 2013. Review of the Energetic of Pollination Biology. *J. Comp. Physiol. Oct;* 183(7): 8 pp.67-76. doi: 10.1007/s00360-013-0760-5.
22. Tong S., Lia Y., Rivaller P., Conrardya C., Castillo D.A.A., Chen L., Recuenco S., Ellison J.A., Davis C.T.,

- York I.A, Turmelle A.S., Moran D., Rogers S., Shi M., Tao Y., Weile M.R., Tang K., Rowe Lia., Sammons S., Xu X., Frace M., Lindblade Kia., Cox N.J., Anderson L.J., Rupprecht Ce, Donis R.O. 2012. A Distinct Lineage of Influenza A Virus from Bats. [www.pnas.org/cgi/doi/10.1073/pnas.1116200109](http://www.pnas.org/cgi/doi/10.1073/pnas.1116200109).
23. Wilson M.R. 2013. Emerging Viral Infections. *Curr. Opin. Neurol.* 26(3): s.301-306.
  24. Wong S., Lau S., Woo P., Yuen K.Y. 2007. Bats as a Continuing Source of Source of Emerging Infections in Humans. *Rev. Med. Virol.*, 17(2): pp. 67-91.
  25. <http://www.yenihabergazetesi.net/2009-2010/uluferrisan19022010.html>.
  26. <http://www.keskinbatguano.com/?islem=icerik &id=9>.
  27. [http://www.dnr.state.md.us/wildlife/plants\\_wildlife/bats/nhpbatdisease.asp](http://www.dnr.state.md.us/wildlife/plants_wildlife/bats/nhpbatdisease.asp).