A POSSIBLE CASE OF LEK DEMES IN SOME TROGLOPHILIC BATS AND INTERSPECIFIC RELATIONS IN BAT COLONIES FROM SOME ROMANIAN CAVES ?*

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Abstract: Five bat species from the Romanian fauna shelterand hibernate in caves: Mediterranean Horseshoe Bat – *Rhinolophus euryale* Blasius, 1853; Mehely's horseshoe bat – *Rhinolophus mehelyi* Matschie, 1901; the common bent-wing bat/Schreibers' long-fingered bat/Schreibers' bat – *Miniopterus schreibersii* (Kuhl, 1917); the long-fingered bat – *Myotis capaccinii* (Bonaparte 1837) and the pond bat – *Myotis dasycneme* (Boie, 1825). The latter species is probably on the way to become troglophilic. *Rhinolophus euryale* presents the highest degree of stress to the the anthropic disturbances and with preferences for warmer (11–12°C) and higher RH (95–99%) in shelters is. Its colonies can be up to 1000 individuals, usually hanging by caves' walls and ceilings. The Cloşani Cave (Mehedinți Co.) contains the Ghica and the Laboratory galleries. In the first gallery, one of us (V. Gheorghiu) found a colony of *R. euryale* with approx. 1800 individuals. A part of the individuals were fixed on the extremity of a stalactite. Later, both of us observed for years this phenomena and we regarded it as a possible lek process – a sexual behavior, possibly a kind of survival strategy – to mentain genetically heterogeneity for an endangered bat species population. These family groups or demes on the tip of stalactites are mainly in October – November, when bats still have occasionally foraging flights, before retreating for hibernation. Analysing a sample of one deme, there were 96 individuals of *R. euryale* – 39 males and 57 females. Visiting other caves (Topolnița – Mehedinți Co.; Avenul lui Adam – Caraş-Severin Co. – a tropical cave in temperate region, with 31°C–45°C) we found small colonies of *R. euryale*, but without clear lek phenomena. Exploring other caves (Peştera cu Apă de la Moară and Peştera Câmpenească) – Moneasa locality – Bihor Co., some amateur speleologists reported bat demes on the tip of different stalactites. Some cases of simbiotic and altruism realationships between different bat species we recorded in Fuşteica Cave (Vâlcan Mountain – Gorj Co.), *M. capaccinii* and *M. dasycneme* – use to hiden under *Rhinolophus ferumequinum*'s wings to be protected against predators and to use the host's body warm. In Lazului Cave (Gorj Co.) a specimen of *M. dasycneme* was also protected under *R. ferrumequinum*'s wings. In Izverna Cave (Mehedinți Co.) a specimen of *Miniopterus schreibersii* dissmulated between three close together individuals of *M. myotis*. Some examples of caves are reffering to those with mixed colonies of bats in nursery colonies.

Key words: lek, demes, biological cycle, hibernation.

1. INTRODUCTION

In the 7th and 8th decades of the 20th century bat populations in Romania were in a drastic decline. Based on 60ies estimations of bat colonies (DUMITRESCU *et al*.

1962–1963), after 1990, scientists from the "Emile Racovitza" Institute of Speleology started a new programe of inventory, mainly of bat populations from the underground shelters. This programe was continued after 2000, in cooperation with scientists from the "Grigore Antipa" National Museum of Natural History in Bucharest. Thus, the first common survey studied the possibilities to protect and preserve the caves with bats from South-Western Carpathians. The survey was included in the first LIFE 00 NAT/RO/7187 project, cofinanced by the European Union.

Partners in this project were also scientists from the Subterranean Diving and Exploration Group (GESS) and from the Green Cross Romania, as project coordinators.

To protect the chiroptera fauna in Romania there were selected eight important underground refuges, with large nursery and hibernating colonies of bats: Sfântul Grigore Decapolitul Cave from Bistrița Monastery (Vâlcea Co.); Polovraci Cave (Gorj Co.); Cloşani Cave (Mehedinți Co.); Izverna Cave (Mehedinți Co.); Cave Epuran (Mehedinți CO.); Cave Topolnița (Mehedinți Co.); Adam's Aven (Caraş-Severin Co.); Gura Ponicovei Cave, or Liliecilor Cave (Caraş-Severin Co.).

Besides these eight caves, the team of scientists selected other 10 caves, also with large bat colonies to be monitored, but without taking special measures to protect them. Both the quantitative and the qualitative evolution of bat populations were surveyed in the protected caves, compared with results from unprotected caves like the following: Muierii Cave (Gorj Co.), Fuşteica Cave (Izvarna locality – Gorj Co.), Bulba Cave (Mehedinți Co.), Liliecilor Cave (Cheile Sohodolului – Runcu locality, Gorj Co.), Podul lui Dumnezeu Cave, (Ponoarele locality – Mehedinți Co.), Izverna Cave (Mehedinți Co.), Hoților Cave (Caraş-Severin Co.); Gaura Ungurului Cave (Herculane locality – Caraş-Severin Co.), Gaura cu Muscă (Moldova Nouă locality – Caraş-Severin Co.), Padina Matei Cave (Hunedoara Co.), Ciclovina Uscată Cave (Mehedinți Co.).

Taking into account the bat's biological cycle, the monitored caves were visited 3–4 times/year.

In three years of observations, an important data base on bat dynamics was realized.

2. CLOŞANI CAVE CASE STUDIES

In the Romanian fauna, there are four bat species recognized as being troglophilic with preferred habitats, both for nursery and hibernating colonies (DECU *et al*., 2003), in the underground shelters: Mediterranean Horseshoe Bat – *Rhinolophus euryale* Blasius, 1853; Mehely's horseshoe bat – *Rhinolophus mehelyi* Matschie, 1901; the common bent-wing bat or Schreibers' long-fingered bat, or Schreibers' bat – *Miniopterus schreibersii* (Kuhl, 1917) and the long-fingered bat – *Myotis capaccinii* (Bonaparte 1837).

Beside these four species, the pond bat – *Myotis dasycneme* (Boie, 1825), could be included astroglophilic . Based on our field observations, the individuals of this species are on the way of adapting to the underground habitats, as *Myotis*

capaccinii has done. Troglophilic bats are very sensitive to any disturbances and especially to the anthropic pressure.

Between the mentioned cavernicolous bat species, *Rhinolophus euryale* Blasius, 1853 is showing the highest degree of stress to any contact with people or with human activities.

Collecting during the night with an entomological net a specimen of *R. euryale* and trying to take it out from the net, it can die because of stress. This is why nets must be frequently controlled and eventually *R. euryale* shoud be immediately released with special care.

Individuals of both sexes and of different ages of *R. euryale* are preferring warm caves, with a temparature of aprox. 12°C. They use to stay grouped either on the ceiling or on cave's walls (Fig. 1 and Fig. 2). The relative humidity in cave must be high, between 90–95%.

In the hibernating period, they form groups of up to 1000 individuals. In many cases these large colonies are mixed with other bat species like *Miniopterus schreibersii, Rhinolophus blasii* Peters, 1866, *R. hipposideros* Bechstein, 1800, *R. ferrumequinum Schreber*, 1774, *Myotis myotis* Borkhausen, 1797, *M. blythii* Tomes, 1857, *M. capaccinii* Bonaparte, 1837, *M. emarginatus* Geofroy, 1806). We never found individuals of *R. euryale* in these mixed colonies. It is known that generally individuals of rhinolophid species, even when grouped, they are not close and don't touch each other (Fig. 1 and Fig. 2).

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Fig. 1. – left and Fig. 2. – right: Hibernating colonies of individuals of *Rhinolophus euryale*, in "Ghica" Gallery inside Cloşani Cave.

In February 1995 we visited Cloşani Cave together with our colleague Dumitru Pegulescu and surprisingly, in each galleries (Ghica and Laboratories) we observed a huge colony of Chiroptera.

This is surprising, as such large bat population have not been previously reported from this location.

This could be because the seasonally visits of speleologists were only in summer and never in winter. Gheorghiu *et al*. (2001) estimated the population between 1,500–2,000 individuals.

Durring our winter visit, we estimated 500 individuals of *R. ferrumequinum* spread all along the Laboratories Gallery (Fig. 4) and several tenths of *R. hipposideros, R. blasii*, *Myotis myotis* and *M. blythii*.

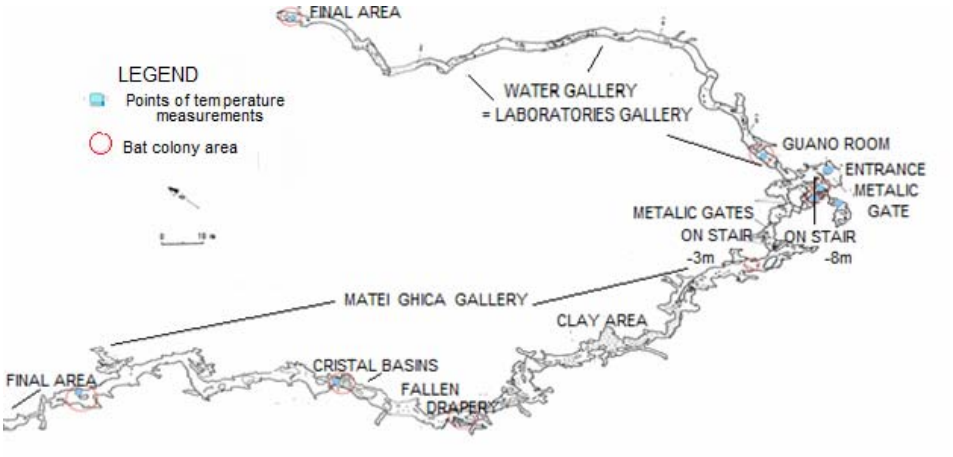

Fig. 3. Cloşani Cave with the main areas hosting hibernating bat colonies in winter 1994–1995 (With additional information from BLEAHU *et al*., 1976).

In Ghica Gallery (Fig. 3, down) there was a colony of approximatelly 1800 individuals, almost exclusively of *R. euryale.* Registered temperature and RH along three years allowed us to explain why *R. euryale* was present only in Ghica Gallery. If RH was almost the same all over the year, in the entire cave, the yearly mean temperature was somewhat higher (10.9–11.1°C) in the Ghica Gallery than in the Laboratory Gallery, with yearly mean temperature of 10.7–10.9°C. Water temperature, limestone walls and air temparture are equal and RH is 98–99% all over the year. Over the winter, as the limestone wall (as a thermic condensator) losses the heat from the entrance in gallery, bats move toward the deeper rooms – as far as possible from the entrance.

During our first visit along Ghica Gallery, we observed on a extremity of a stalactite a globular shape of crowded bats (Figs. 6 and 7). Lighting that formation, bats spread out in other neighbouring, darker places.

This phenomenon of grouping together many individuals on the extremity of the stalactite, was in our attention for several years, checking if this phenomenon repeated and if it happened in the above mentioned monitored caves.

Every year, the agglomeration of bats on the extremity of stalactites are more frequently in the first period (October–November) when bats prepare for hibernation, when they still are continuing their foraging flights after sunset, if the temperature is positive. We also observed that foraging flights are restarting in February–March, when also outside temperature is positive (at least +4°C) in the first part of the night.

These foraging flights are necessary to supplement the bats energetic resources, partly consumed during the mating period inside the cave.

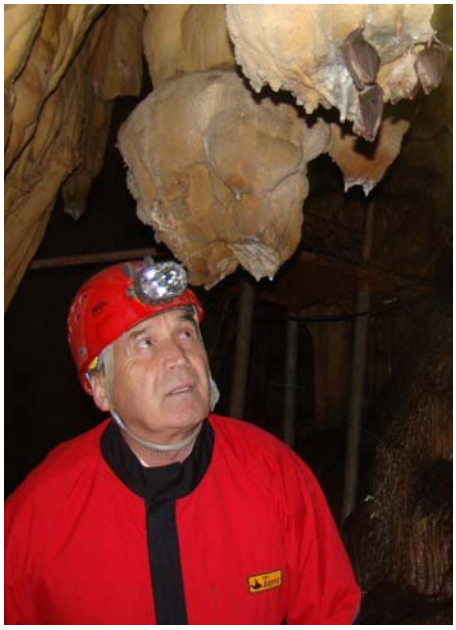

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Fig. 4. *Rhinolophus ferumequinum* from "Ghica" Gallery spread along the Laboratories Gallery, up to End Room.

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Fig. 5. Groups of bats on the ceiling.

To identify the bat species, we examined one specimen from a group of 96, captured with an adapted entomological net (Fig. 5). The entire group was composed exclusively of *R. euryale*. Between them, 39 individuals were males and 57 females. We repeated identifications with same results.

This behaviour of grouping of *R. euryale* on the extremity of stalactites we explained as a possible "*lek*" phenomena – a sexual behaviour, possibly a kind of survival strategy – to maintain genetically heterogeneity for an endangered bat species. The word is from Sweden *leka* = to move faster, to play, to hop, to sing. The lek phenomenon was already reported for some other mammal species.

Bats are heaping up mostly in October, but occasionally adults are continuing to mate over the hibernating period. Young individuals (up to two years) in a colony are approximately 1/3 and are not disturbing from hibernation (Gheorghiu and Murariu, 2006).

The size of an agglomeration on the extremity of stalactites in Ghica Gallery from Cloşani Cave is not larger than a basketball (Figs. 6–11 and Figs. 7–12).

In the breeding period, bats are in a permanent movement and bustle. More, due to the human presence, the group is spreading out in more quiet and darker places, setting on the extremities of other stalactites (Fig. 13).

All stalactites with groups of bats are black because of urine pheromones absorbed in limestone structures. Those pheromones are important messages for adult individuals.

Figs. 6, 8, 10, 11. Globular group of mating *R. euryale* bats in Closani Cave.
Figs. 7, 9, 12. Stalactite support with black extremity, due to the impregnation with pheromonal secretions.

Fig. 13. Globular groups of *R. euryale*, fixed on ceiling protuberances along "Ghica" Gallery in Closani Cave.

To identify the species based on ultrasounds, we used a Bat detector BATBOZ DUET. For *R. euryale* we found the constant frequency of 102 kHz – with clear sound and Doppler effect We also observed that in red light, bats do not release ultrasounds, and they are in so called "blind flight", sometimes for relatively long distances.

OTHER INVESTGATED CAVES

Monitoring *R. euryale* individuals in other underground sites from South-Western Carpathians, we found the largest nursery colony in "Avenul lui Adam" – the only cave in the Palaearctic Region with tropical conditions (Fig. 14). The yearly mean temperature is about 31°C, but in the "Galeria cu Aburi" (Steams Gallery) can be up to 45°C (POVARĂ *et al*., 1972).

The nursery colonies in this pothole consist of more than 15,000 bats and the colony of *R. euryale* alone was estimated to about 5000 individuals.

Fortunately in last two decades, the bat population in Avenul lui Adam doubled. On 28 of May 1992 we observed an increasing number of individuals in the nursery colony of *R. euryale* too. This species was observed in Guano Room, both on cave walls and on its ceiling. At the end of "Ghica" Gallery they were on the walls, juveniles of *R. euryale*, still without fur, like in a crèche.

Due to the high temperature of the Avenul lui Adam, the bats do not remain here for hibernating and therefore we didn't observe here something suggesting the lek phenomenon for individuals of *R. euryale*, as we mentioned for Closani Cave.

We identified another nursery colony of *R. euryale* in Topolnița Cave (Mehedinți Co.). Bats formed the colony on the ceiling of the gallery at about 40 m distance from the entrance.

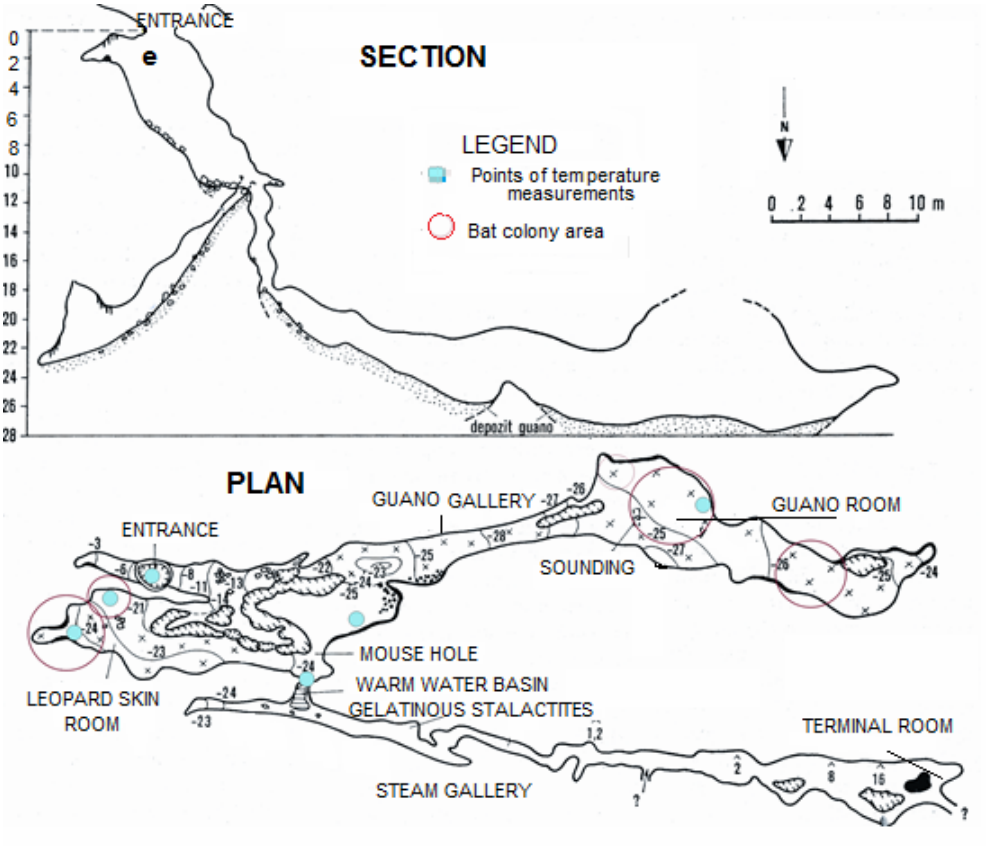

Fig. 14. Main areas from the Adam Aven Cave, with bat nursery colonies
(With additional information and modifications after I. Povară *et al*. (1972).

This cave is inside Mehedinti National Park and rangers there control and reduce cave visits during the presence of the maternal colony. Just walking beneath the colony is very disturbing for individuals of *R. euryale* and soon they change their location or even leave the site.

The nursery colony of *R. euryale* in the Topolnița Cave is estimated at 1200–1400 individuals. We observed also some individuals of the species before hibernation, but here without the presumed lek phenomenon. These few individuals are coming for hibernation in Topolnița Cave from neighbouring Avenul lui Adam. However, it is possible that at least a part of the bats from the nursery colonies in Avenul lui Adam to migrate for mating and hibernation in Closani and Topolnita Caves (Daniela Borda, *in verbis*).

Some other information about “lek phenomenon” are from the amateur speleologists who observed globular groups of individuals of *R. euryale* on the extremity of stalactites in Peştera cu Apa de la Moara (Moneasa locality in the

Codru-Moma Massif of Mountain – Bihor Co.). In the same area, with similar globular groups of bats, were reported from the Peştera Câmpenească. Information is credible because both caves present high and constant temperature and high relative humidity.

In comparison with bats preferring tree hole shelters, the troglophilic species have better chances against the anthropic pressure, because:

– They are gregarious – with a greater security for individuals, even in alarming situations for the entire colony.

– With their medium size, these bats can be closer by larger size bats, being beneficiaries of the heat and of higher security.

– In the nursery periods they check and they are able to dissemble their presence when they take care and feed the young, often hiding between larger size bats.

More observations and field experiments are needed to argue for and prove the existence of lek phenomenon in bat species.

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