BETWEEN NORTH AND SOUTH: PROVISIONAL DATA ON BATS (MAMMALIA: CHIROPTERA) FROM GIA LAI - KON TUM PLATEAUS

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1. INTRODUCTION

The Central Highlands of Vietnam (Tay Nguyen) is the southern extremity of the mountain systems of Indochina, in fact being a remote extension of the southeastern outcrops of the Himalayas. In itself, the Highlands, with a certain geological commonality, actually unite several separate mountain plateaus and neighboring mountain ranges. It can be clearly seen from the orographic map of Vietnam that a noticeable lowering of the relief is located between the central part of the Highlands - the Dak Lak plateau - and the northern one (Bac Tay Nguyen), located in the provinces of Gia Lai and Kon Tum. Thus, simply from geographical grounds, it can be assumed that the northern, Gia Lai-Kon Tum part of the Tay Nguyen can be penetrated from the south by faunal elements spreading along lowland and foothill habitats, while the distribution of mountainous and extratropical faunistic elements to the south will be delayed at the border between Gia Lai and Dak Lak (at the lowering mentioned above). At the same time, there are no significant barriers for the penetration of such species into Gia Lai and Kon Tum proper since in the north this territory directly connects to Truong Son mountain range via Ngoc Ling area.

In part bat fauna of this area was once studied in 1997÷2000, in particular - Kon Ka Kinh National park and Kon Chu Rang Nature reserve [12]. Some additional data could be found in other publications [18, 17]. However even brief surveys reveal new faunal records, clearly demonstrating incompleteness of previous knowledge; also since 2001 many changes were made in bat taxonomy and nomenclature, which requires a new look at the old finds.

Short-term faunal surveys were carried out in few parts of Gia Lai - Kon Tum plateaus in 2015÷2017 within framework of the research activity of the Vietnamese-Russian Tropical Center. Surveys were done mainly in late spring in Chu Mom Ray National park (2015), Thach Nham forestry (2015 and 2016), Kon Ka Kinh National park (2016 and 2017) and Kon Chu Rang Nature reserve (2016). Range of surveyed elevations was approximately between 650 to 1300 m. Besides other, certain data on small mammals and in particular bats was gathered. Few records are new to the provinces and to the region on the whole.

Though the detailed analysis of local small mammal fauna is in preparation, here author would like to provide preliminary data on bats, found in the mentioned area.

2. MATERIALS AND METHODS

Bats were observed and captured for proper identification in time period between 18:00÷18:20 (beginning of activity) and 20:30÷01:30; duration of each observation/catching depend on current weather conditions and distance from the base camp. The observations were held with the help of electric lanterns and narrow-band heterodine ultrasound bat detector D-230 Pettersson Elektronik AB. Nylon monofilament mist nets 11×4.5 and 9×2.5 meters put across potential flight paths were used for vital captures of animals; author also used Borissenko's flap trap (net of thin fishing line 2.5×2 meters, put between two five meter long fishing rods) [15, 2]. Those methods were used separately or simultaneously, according to local and momentary conditions. Most of available habitats were covered with study, including almost intact and variably disturbed forest, forest edges, stream valleys and highly anthropogenically modified landscapes, in the diapason of elevations from 650 to 1300 m asl. Five localities were studied across the Gia Lai and Kon Tum provinces: Chu Mom Ray, Kon Ka Kinh (two localities) and Kon Chu Rang, and Thach Nham forestry on Kon Plong plateau.

Captured specimens were weighed and measured (according to widely-used scheme of external measurements), checked for their age, gender and reproductive condition, and photographed. Ectoparasites (mainly parasitic flies from Streblidae and Nycterebiidae families) were collected. In some cases, feces were also collected for further study of the animal's ration. Some of captured animals (one to four individuals per species) was taken as vouchers for more precise identification and taxonomic studies and now are stored in a Zoological museum of Moscow University. Later in laboratory conditions, voucher specimens were visually (qualitative features) or morphometrically (quantitative features) compared with available congenerics. From collected tissue samples mtDNA was extracted and COI gene sequences were analyzed using facilities of the Biodiversity Institute of Ontario (Guelph, Canada).

3. RESULTS AND DISCUSSION

In total, about 180 bats were captured and studied in hands during the survey, and at least 27 species from five families were recognized.

Bat assemblage revealed in Chu Mom Ray - the lowest of studied areas - can be divided into the following suppositive ecological groups: "bamboo" fauna, near-water and "moderately sylvan", i.e. forest species that are tolerant to a certain degree of disturbance of primary habitats and capable of living in marginal and secondary biocenoses. The first includes *Eudiscopus denticulus*, *Glischropus bucephalus* and two species of *Tylonycteris* (*Ty. fluvida* and *Ty. malayana*, previously referred to as *Ty. pachypus* and *Ty. robustula*; [19]). Near-water forms are represented by *Myotis horsfieldii*; "moderately sylvan" - by three species of fruit bats (*Cynopterus sphinx*, *Megaerops niphanae* and *Macroglossus sobrinus*), three species of horseshoe bats (*Rhinolophus affinis*, *Rh. shameli* and *Rh*. cf. *pusillus*), leaf-nosed bat *Hipposideros grandis* and a false vampire *Megaderma spasma*. By species composition, the fauna

resembles that of the more southern lowlands, for example, Bu Gia Map National park. Thus it is more Malayan and does not contain elements of northern origin. Records of at least three species: disc-footed bat *E. denticulus*, the thick-thumb pipistrelle *G. bucephalus* and *M. horsfieldii* - were new for the Kon Tum province. Noteworthy, that while author found only one *Hipposideros* species in the area, five extra species of this genus, together with *Aselliscus stoliczkanus* were reported in published data [18].

The Thach Nham forestry on the Kon Plong plateau, was surveyed twice, in 2015 and 2016. Totally here, at altitudes of about 1000 m, nine bat species were revealed. Two of them (horseshoe bats *Rhinolophus affinis* and *Rh. pearsoni*) are typical for the bats fauna of similar elevations in the south of the country (for example, on Dalat plateau). Two further species, namely *Myotis muricola* and *Pipistrellus javanicus*, are ruderal species inhabiting disturbed biotopes, especially in conditions of low number of other bats. *Hipposideros grandis* (also found in Chu Mom Ray) is a form inhabiting the lowland forests of the south of the country. Probably, northern Central Highlands represent the northern distribution limit for this species in Vietnam. The leaf-nosed bats of the "*larvatus*" species group represent a complex with several cryptic taxa; author's find in Kon Plong raises the question of the distributional limits of these forms and the possible boundaries between them. Contrary, the remaining species: *Myotis* cf. *annatessae*, *M. siligorensis*, *Scotomanes ornatus* and *Nyctalus labiata*, - apparently represent northern elements of the fauna, which do not or just slightly penetrate to the southern part of Central Highlands. The record of noctule bats (*N. labiata*) is noteworthy as the first documented for the territory of Vietnam [14], and the fact that the breeding females were captured indicates the resident status of the species in the given area.

It is obviously premature to speak about the fauna of Kon Chu Rang: during author's fieldwork there author reliably confirmed the habitation of only four bar species. Of these, *Rhinolophus affinis*, *Myotis muricola* and *Pipistrellus javanicus* are common species found in other areas within the northern Tay Nguyen. Record of the small tube-nosed bat, *Murina eleryi*, represents particular interest. This is the first finding of this species in the Gia Lai province and, apparently, it is southernmost record of this bat on the whole, although not very distant from the previously known site in the Ngoc Linh mountains [17]. Also, in Kon Chu Rang author visually recorded large bats resembling noctules, which could be *N. labiata*. That is consistent with the above mentioned find, but requires confirmation.

Author visited Kon Ka Kinh Natinal park twice, in 2016 and 2017. The field work was carried out in two its parts, south-west and east, differing in elevation and peculiarities of the landscape and vegetation. It can be immediately note that the eastern part of the park gives the impression of a significantly stronger anthropogenic pressure and has a poorer local fauna (not just bats). Nevertheless, interesting findings were made here also. Work at the same point in different years has shown how significantly the local population of bats can change from year to year.

In total, 18 species of bats were found in Kon Ka Kinh - almost as much as in the other mentioned territories put together. Among them there were already mentioned widespread species, both ruderal (*Myotis muricola*, *Pipistrellus javanicus*, *Cynopterus sphinx*), and "moderately sylvan" (*Megaerops niphanae*, *Murina cyclotis*, *Myotis ater*, *Rhinolophus affinis*, *Rh*. cf. *pusillus*, *Megaderma spasma*). The latter one represents is the first documented record of this, otherwise widespread, species in the Gia Lai province. The small serotine, *Hesperoptenus blanfordi*, also was found in the Gia Lai for the first time. This record in Kon Ka Kinh is the northernmost one for that species; the nearest one was made in Lam Dong province (Loc Bao; orig.). Round-leaf bat, *Hipposideros pomona*, has wide distribution in South-East Asia and, in particular, in Vietnam. But its finding is of special interest due to the significant intraspecific diversity in this bat, which has not been studied sufficiently. Most of other species are probably confined to mountain forests: *Rhinolophus pearsonii*, *Murina fionae*, *Mu. eleryi*, *Harpiocephalus harpia*, *Myotis siligorensis*, *My. annectans*. The most remarkable are records of two species. For *Cynopterus horsfieldii*, the discovery in Kon Ka Kinh is the third made in Vietnam. Within the country, this is definitely the northernmost record, and also that is the highest elevation (ca. 1000 m asl.) where that bat was found [13]. On the contrary, discovery of the large mouse-eared bat, *Myotis rufoniger*, one specimen of which was captured on the forest trail in 2016, is the southernmost point of the range of this species in Vietnam and, probably, in the world.

It should be noted that among the bat species found in Kon Ka Kinh no direct or indirect signs of reproduction in this territory were found in *Hipposideros pomona*, *Megaderma spasma*, *Murina fionae*, *Harpiocephalus harpia*, *Myotis rufoniger*, and *My. annectans*. That makes one doubt in their resident status in the park.

On the whole, known bat fauna of Gia Lai - Kon Tum plateaus (south from Ngoc Ling mountain range) looks as listed below. Species, mentioned in literature, but not confirmed by us, marked with '•', species, representing significant new records, marked with '*'.

Pteropodidae: *Cynopterus sphinx*, **C. horsfieldii*, *Megaerops niphanae*, *Macroglossus sobrinus*.

Hipposideridae: •*Aselliscus stoliczkanus* [18], •*Hipposideros griffini* [18], *H. grandis* (most probably '*H. larvatus*' in [12] belong to this species), •*H. alongensis* [18], •*H. galeritus* [18], *H. pomona*, •*H. cineraceus* [18].

Rhinolophidae: *Rhinolophus affinis*, *Rh. pearsoni*, •*Rh. sinicus* [12], •*Rh. stheno* [12], •*Rh. macrotis* [18], *Rh. shameli*, *Rh. pusillus*/*lepidus* (this species group is too complicated, and require serious special study; therefor here author count both forms together).

Megadermatidae: *Megaderma spasma*, •*Me. lyra* [12].

Vespertilionidae: •*Kerivoula harwickii* [12], •*K. titania* (as *K. flora* in [12]), *Murina cyclotis*, *Mu. fionae*, •*Mu. beelzebub* [17], •*Mu. feae* [17], **Mu. eleryi*, **Harpiocephalus harpia*, **Myotis rufoniger*, **My. annectans*, •*My*. "*montivagus*" [12], *My. muricola*, *My. ater*, *My. siligorensis*, *My. horsfieldii*, **Eudiscopus denticulus*, *Pipistrellus javanicus*, **Glischropus bucephalus*, **Nyctalus labiata*, •*Hypsugo cadornae* [12], *Tylonycteris fluvida*, *Ty. malayana*, •*Hesperoptenus tickelli* [12], **Hes. blanfordi*, *Scotomanes ornatus*.

Miniopteridae: •*Miniopterus pusillus* [12].

Comment: *My. montivagus* was reported for Kon Chu Rang [12]; however, later authors [7, 8] did not mention this record. One may suppose that Hendrichsen's record actually represent *My. annectans* or *My. indochinensis* [16] or was a misidentification.

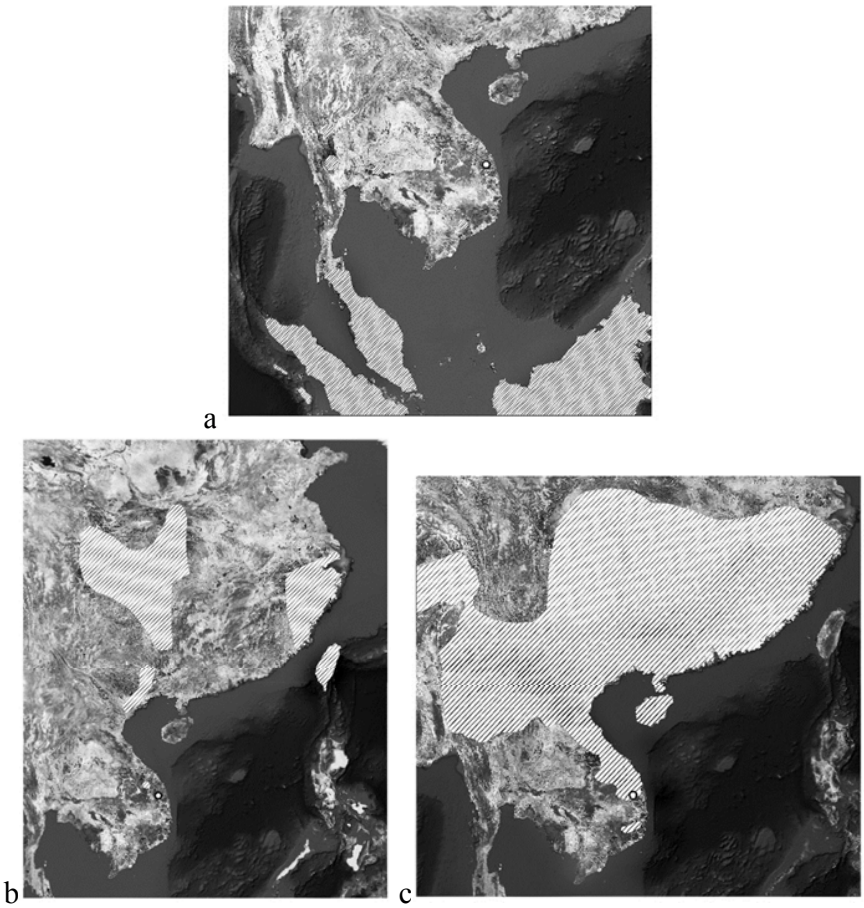

Figure 1. Examples of distribution areas of bats with presumable southern and northern origin [1, 5, 6, 9]: a - *Cynopterus horsfieldii*; b - *Myotis rufoniger*, c - *Scotomanes ornatus*. Empty circle - species location in Gia Lai - Kon Tum.

As noted above, the presence of both northern and southern faunistic elements can be expected for the area under consideration. Many bats found here are difficult to be classified in the terms of "southern-northern". In part, these are forms with extensive distribution areas, inhabiting a significant part of Southeast Asia (such as *Myotis muricola*, *Murina cyclotis*, *Rhinolophus affinis* or *Cynopterus sphinx*). Others have scattered distribution ranges or their distribution is studied insignificant to be able to judge its patterns. However, based on the known pattern of distribution or distribution of closely related forms, author can classify at least part of the species [3, 1, 5, 6, 9, 10].

Disc-footed bat, *Eudiscopus denticulus*, and both species of *Tylonycteris*, which distribution is strongly associated with bamboo forests, can be classified as "southern". *Rhinolophus shameli* and *Rh. stheno* (not confirmed by author) are fairly widespread on the Asian mainland, but their closest relatives are likely to be Malay species [4]. Finally, *Cynopterus horsfielsdii* is definitely a Malayan faunal element (fig. 1 a). It can be seen that the fauna of the Chu Mom Ray National park among the surveyed territories most closely resembles the more southerly parts of Vietnam.

At the same time, a number of species occur on Gia Lai - Kon Tum plateaus, on or nearby the southern boundaries of their distribution ranges. These are *Murina eleryi*, *Myotis annactans*, *M. rufoniger*, *M.* cf. *annatessae*, *Harpiocephalus harpia*, *Scotomanes ornatus* (fig. 1 b, c). *Nyctalus labiata* deserves special attention, representing the real Palaearctic element in the fauna of Central Highlands. The question of the origin of species with a vast cryptic diversity, such as *Hipposideros pomona*, *Rhinolophus pusillus* s. lato, *Myotis siligorensis* or *Pipistrellus javanicus* [11] remains unresolved. Its decision is closely connected with their low-level taxonomy and phylogeography, which are not currently studied enough.

In conclusion, it can be noted that the geographical position, variety of elevations and mosaic landscapes made the Gia Lai - Kon Tum plateaus a polygon for the formation of a unique and rich bat fauna of mixed origin. This should be taken into account when planning both further scientific research and environmental protection activities in the given area.

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TÓM TẮT

GIỮA BẮC VÀ NAM: DẪN LIỆU BAN ĐẦU VỀ DƠI (MAMMALIA: CHIROPTERA) CAO NGUYÊN GIA LAI-KON TUM

Vị trí địa lý của cao nguyên, độ cao và địa hình của chúng cho phép giả thiết về sự quần cư trên cao nguyên Gia Lai - Kon Tum các loài có nguồn gốc phía Nam, Malaysia cũng như phía Bắc, Himalaya. Bài báo này bao gồm những mô tả về khu hệ Dơi của vùng dựa trên tài liệu tham khảo cũng như dữ liệu của chính tác giả thu được trong các nghiên cứu điều tra từ 2015 đến năm 2017 trong chương trình nghiên cứu của Trung tâm Nhiệt đới Việt - Nga. Trong các chuyến nghiên cứu thực địa này, đã khẳng định sự cư trú của nhiều loài cũng như tìm thấy những thông tin khu hệ mới đối với tỉnh Gia Lai, Kon Tum cũng như toàn vùng nói chung. Trong đó, thú vị nhất là quan sát thấy loài *Nyctalus labiata* vào năm 2015, đây là lần đầy tiên tìm thấy giống *Nyctalus* tại Việt Nam và tìm thấy loài *Cynopterus horsfieldii* vào năm 2016. Các loài *Eudiscopus denticulus, Tylonycteris malayana, Glischropus bucephalus, Rhimolophus shameli* và *C. horsfieldii* có nguồn gốc phía Nam. Các loài *Murina eleryi*, *Myotis annactans*, *M. rufoniger*, *M*. cf. *annatessae*, *Harpiocephalus harpia* và *Scotomanes ornatus* có nguồn gốc phía Bắc, còn *N. labiata* thuộc khu hệ cao nguyên miền Trung. Cho đến nay, đối với khu hệ động vật cao nguyên Gia Lai - Kon Tum, đã ghi nhận được ít nhất 46 loài Dơi thuộc 6 họ.

Từ khóa: Việt Nam, Cao nguyên miền Trung, Dơi, Khu hệ động vật, phân bố, Вьетнам, Центральное нагорье, рукокрылые, фауна, распространение.

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Hoàn thiện ngày 29 tháng 10 năm 2017

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