= Miniopterus griveaudi =

Miniopterus griveaudi is a bat in the genus Miniopterus found on Grande Comore and Anjouan in the Comoros and in northern and western Madagascar . First described in 1959 from Grande Comore as a subspecies of the mainland African M. minor , it was later placed with the Malagasy M. manavi . However , morphological and molecular studies published in 2008 and 2009 indicated that M. manavi as then defined contained five distinct , unrelated species , and M. griveaudi was redefined as a species occurring on both Madagascar and the Comoros .

With a forearm length of 35 to 38 mm ( 1 @.@ 4 to 1 @.@ 5 in ) , M. griveaudi is a small Miniopterus . It is usually dark brown , but sometimes reddish . The tragus ( a projection inside the ear ) is narrow and ends in a rounded tip . The uropatagium ( tail membrane ) appears virtually naked . In the skull , the palate is concave and the rostrum ( front part ) is rounded . The species occurs up to 480 m ( 1 @,@ 570 ft ) above sea level on Madagascar , often in karstic areas . In the Comoros , it reaches 890 m ( 2 @,@ 920 ft ) and roosts in lava tubes as well as shallower caves . Females collected on Grande Comore in November were pregnant , but data on reproduction is limited and suggests individual and inter @-@ island variation .

= = Taxonomy = =

In 1959 , David Harrison described a small Miniopterus from the island of Grande Comore as a subspecies , Miniopterus minor griveaudi , of the mainland African species M. minor . The name griveaudi honors Paul Griveaud , who collected the specimens on which Harrison based his description . This classification remained for the next few decades ; in 1992 , for example , Javier Juste and Carlos Ibáñez recognized five subspecies , including griveaudi , within M. minor , ranging from São Tomé to Madagascar . In their 1995 review of Madagascar bats , Randolph Peterson and colleagues recognized the small Malagasy Miniopterus as a separate species , Miniopterus manavi , with griveaudi as a subspecies .

In 2007 , Juste and colleagues re @-@ examined the relationships of the M. minor group using DNA sequences from the mitochondrial cytochrome b ( cyt b ) gene . They found that griveaudi from Grande Comoro , manavi from Madagascar , and M. minor newtoni ( currently Miniopterus newtoni ) from São Tomé were not closely related ; however , the representatives of " manavi " used in their study were misidentified specimens of M. majori .

In another molecular study , published in 2008 and using both cyt b and mitochondrial D @-@ loop sequences , Nicole Weyeneth and colleagues found that examined specimens of " Miniopterus manavi " actually grouped in two , distantly related clades ? one including specimens from Madagascar , Anjouan , and Grande Comore , and the other occurring on Madagascar and Anjouan only .

The next year , Steven Goodman and colleagues further explored the relationships of the bats known as " Miniopterus manavi " using cyt b sequences and morphological comparisons . They found five species within " M. manavi " , which are not each other 's closest relatives , forming an example of convergent evolution . Up to four species of the group may occur in a single locality . Miniopterus griveaudi , now recognized as a full species , was found to occur on Grande Comore , Anjouan , and northern and western Madagascar , and M. manavi was restricted to the eastern margin of Madagascar 's Central Highlands . Three other species were newly described : Miniopterus aelleni on Anjouan and in northern and western Madagascar ; Miniopterus brachytragos in northern and western Madagascar only ; and Miniopterus mahafaliensis in southwestern Madagascar . Cyt b sequences suggest that M. griveaudi occupies an isolated position among African and Malagasy Miniopterus .

= = Description = =

Miniopterus griveaudi is a small , dark brown Miniopterus species . M. aelleni is similar in color , but M. manavi is darker and M. brachytragos and M. mahafaliensis are lighter . The upperparts are

occasionally reddish brown ; this color variant occurs more often in the Comoro populations than on Madagascar . In the Comoros , individual colonies or groups sometimes consist exclusively of one color variant , but there is no apparent genetic differentiation between the two forms . The head is usually somewhat lighter than the body and the hairs of the underparts have buffish tips . The tragus ( a projection on the inner side of the outer ear ) is straight and narrow and ends in a rounded tip . Other species have differently shaped tragi . The wing membrane is also brown , but the uropatagium ( tail membrane ) is lighter . The wing membrane and uropatagium are attached to the upper leg at the same level , near the ankle . The uropatagium is sparsely covered with thin hairs that are virtually invisible to the naked eye . In contrast , M. manavi , M. mahafaliensis , and M. brachytragos have densely covered uropatagia and that of M. aelleni is sparsely , but visibly haired . There are some differences in measurements among the island populations ; animals from Grande Comore are generally smallest , those from Anjouan are intermediate , and those from Madagascar are largest .

The animal has a karyotype of 46 chromosomes , with a total of 50 major arms on the autosomes ( non @-@ sex chromosomes ) . The X chromosome is submetacentric ( with one arm slightly longer than the other ) and the Y chromosome is small and acrocentric ( with one very short and one long arm ) . The karyotype is conserved among species of Miniopterus ; the number of chromosomes and arms is identical in M. griveaudi , the Malagasy M. aelleni and M. gleni , and even the Asian M. fuliginosus .

In the skull , the rostrum ( front part ) is rounded . The central groove in the nasal depression ( the lowered area at the nose ) is relatively broad in comparison to M. manavi . The frontal bones ( part of the skull roof ) bear a well @-@ developed sagittal crest ( a crest that provides support for muscles of the head ) . Further back on the braincase , the lambdoid crest ( another such crest ) is also prominent . The middle part of the palate is concave , as in M. brachytragos and M. mahafaliensis , but unlike in M. aelleni and M. manavi , which have a flat palate . At the palate 's back margin is a long , robust posterior palatal spine .

= = Distribution and ecology = =

On Madagascar , the distribution of M. griveaudi extends along the western lowlands north to Ankarana in the far north of the island , and on eastern Madagascar south to the vicinity of Daraina . It is found up to 480 m ( 1 @,@ 570 ft ) above sea level and often occurs in karstic areas . Its range extensively overlaps that of M. aelleni , which is regularly found in the same forests and caves . Although some ecological and behavioral data has been published on " Miniopterus manavi " , the recognition of several cryptic species within this group , which may occur in the same places , renders the association of these data with any of the species now recognized uncertain ; however , species of Miniopterus generally feed on insects . Miniopterus griveaudi was assessed as " Data Deficient " on the IUCN Red List in 2008 , but the account predates the recognition of the species on Anjouan and Madagascar .

Miniopterus griveaudi is known from 15 to 670 m ( 49 to 2 @,@ 198 ft ) altitude on Grande Comore and 5 to 890 m ( 16 to 2 @,@ 920 ft ) on Anjouan . In the Comoros , it roosts in caves , both lava tubes and shallower structures ; it was found to share one cave on Grande Comore with another bat , Rousettus obliviosus . Individuals of M. griveaudi have been found to leave a Grande Comore cave at sunset . Flying M. griveaudi have mostly been recorded in forests , but this may reflect a lack of survey effort in open areas . In caves , individuals either group in large groups of more than 50 bats without reproductive activity or in smaller groups of at most five reproductively active bats . Limited data on reproduction show some notable variation between individuals and islands . In two caves surveyed on Grande Comore in November 2006 , all females were pregnant with single embryos with crown @-@ rump lengths of 14 to 19 mm ( 0 @.@ 55 to 0 @.@ 75 in ) , but none of the males were reproductively active . In another cave , none of the bats examined at the same time ? all males ? were reproductively active . None of the bats captured in one of the caves in April 2007 showed signs of reproductive activity . On Anjouan , no bats were reproductively active in two caves surveyed in late November 2006 .

Although specimens of M. griveaudi differ by only 0 @.@ 6 % in their cyt b sequences , analysis of D @-@ loop data does show some differentiation between the island populations . These data suggest that the species originated on Madagascar , where a large , stable population persists , and independently colonized Grande Comore and Anjouan ; subsequently , the Grande Comore and Anjouan populations came into contact , resulting in inter @-@ island gene flow .