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KARYOTYPES OF ELEVEN SPECIES OF MOLOSSID BATS FROM AFRICA (MAMMALIA:CHIROPTERA)

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Abstract

Standard karyotypic data are reported for 11 species of molossid bats collected from Somalia and Cameroun, Africa. Chromosomal data are reported for the first time for *Chaerephon ansorgei, C. aloysiisabaudiae, Mops midas, M. spurrelli, M. thersites, M. brachypterus, M. petersoni, M. demonstrator,* and *M. nanulus* (all were formerly members of the genus *Tadarida*). Karyotypes for two of the species we examined have been reported previously. Although our data corroborate the karyotype of *C. pumila* described by Dulic and Mutere (1973), our karyotypic analysis of *M. condylurus* differs substantially from that presented by these authors. In addition to these data, we provide a summary of the available karyotypic data for molossid bats studied to date.

Introduction

The Molossidae is a group of insectivorous, swift-flying bats that live in tropical and temperate parts of the world. More than half of the 91 or so extant species have been regarded as members of the genus *Tadarida* (Corbet and Hill, 1980); the remaining species are spread among

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Table 1.—*Summary of karyotype morphology for 11 species of African molossid bats. Letter designations are: M—metacentric, SM—submetacentric, ST-subtelocentric, A—acrocentric.*

Species	Large M	Medium M	Medium ST	Small ST	Medium–small A	X	Y	FN
Chaerephon ansorgei	1	3	4	2	13	ST	A	66
Chaerephon aloysiisabaudiae	1	3	4	2	13	SM	A	66
Chaerephon pumila	1	2	3	0	17	SM	A	58
Mops midas	1	3	4	2	13	SM	A	66
Mops condylurus	1	3	4	2	13	SM	A	66
Mops spurrelli	1	3	4	1	14	SM	—	64
Mops thersites	1	3	3	1	15	SM	ST	62
Mops brachypterus	1	3	0	0	19	SM	—	54
Mops petersoni	1	3	0	0	19	SM	A	54
Mops demonstrator	1	2	1	0	19	SM	A	54
Mops nanulus	1	2	1	0	19	SM	A	54

11 other genera. Until recently, taxonomic assignments and systematic relationships among the family members had not been examined worldwide. Freeman (1981), based upon a phenetic study of morphological traits, provided the first major review of the family. She restricted the genus *Tadarida* to include only nine species and assigned the remainder to *Chaerephon, Mops, Mormopterus* and *Nyctinomops* (all former subgenera of *Tadarida*).

Karyotypic data for the Molossidae are available for 25 species, only six of which are inhabitants of the Old World. In this paper we analyze the karyotypes of 11 African molossid species belonging to the genera *Chaerephon* and *Mops,* and summarize the chromosomal data (Tables 1 and 2) now available for 35 species representing 10 of the 12 genera recognized by Freeman (1981).

Methods and Materials

Standard karyotypes were obtained in the field from bone marrow preparations (Patton, 1967) of live caught animals. A minimum of five representative chromosome spreads were examined from each individual to determine diploid (2n) and fundamental numbers (FN). Photomicrographic enlargements of suitable spreads were used in the final analyses.

Chromosomes were divided into large and medium-sized metacentric, medium and small subtelocentric, and medium to small acrocentric morphological classes. Determination of centromere position was difficult because differential contraction of nearly acrocentric chromosomes caused variation in the number of countable arms. We follow Warner et al. (1974) in being conservative in the determination of biarmed versus acrocentric conditions and reiterate their warning that FN values are somewhat arbitrary and subjective.

Taxonomic designations follow Honacki et al., 1982 (see Freeman, 1981).

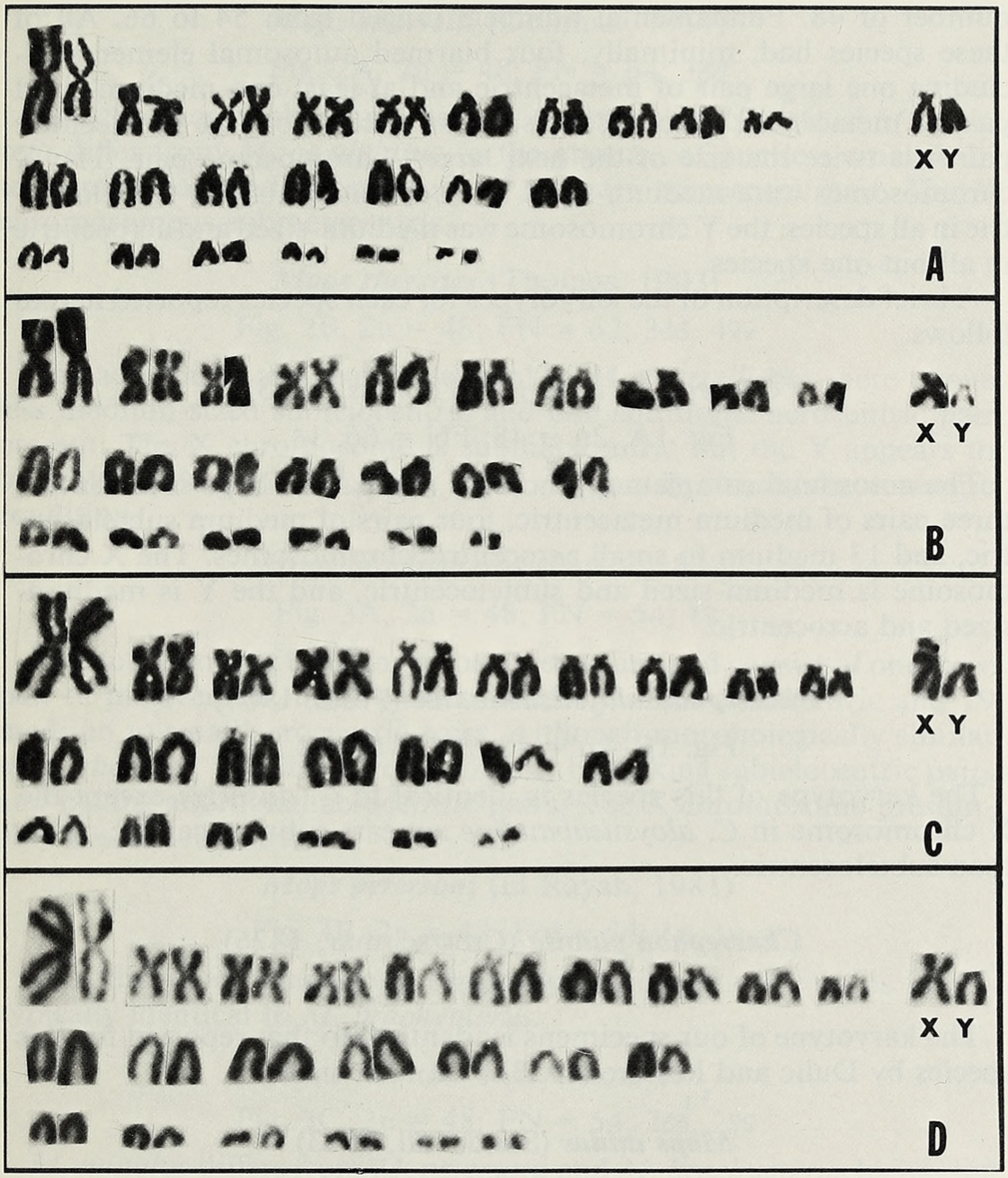

Fig. 1.—Representative karyotypes of A) *Chaerephon ansorgei* from Cameroun, B) *Chaerephon aloysiisabaudiae* from Cameroun, C) *Mops midas* from Somalia, and D) *Mops condylurus* from Somalia.

SPECIES ACCOUNTS

A summary of the chromosomal morphology for the species examined in this study is presented in Table 1. Representative karyotypes are presented in Figs. 1–3.

All species examined in this study were characterized by a diploid

number of 48. Fundamental numbers ranged from 54 to 66. All of these species had, minimally, four biarmed autosomal elements including one large pair of metacentric and at least one medium-sized pair of metacentric chromosomes. In all cases the large metacentric pair was twice the size of the next largest chromosome pair. The X chromosomes were medium-sized and submetacentric or subtelocentric in all species; the Y chromosome was medium-sized and acrocentric in all but one species.

A brief description of the karyotypes for each species reported herein follows.

Chaerephon ansorgei (Thomas, 1913)

Fig. 1A, 2n = 48; FN = 66; 1♂

The autosomal complement includes one pair of large metacentric, three pairs of medium metacentric, four pairs of medium subtelocentric, and 13 medium to small acrocentric chromosomes. The X chromosome is medium-sized and subtelocentric, and the Y is medium-sized and acrocentric.

Chaerephon aloysiisabaudiae (Festa, 1907)

Fig. 1B, 2n = 48; FN = 66; 1♂

The karyotype of this species is identical to *C. ansorgei* except the X chromosome in *C. aloysiisabaudiae* appears submetacentric rather than subtelocentric.

Chaerephon pumila (Cretzschmar, 1826)

2n = 48; FN = 58; 8♂♂, 6♀♀

The karyotype of our specimens is identical to that reported for this species by Dulic and Mutere (1973).

Mops midas (Sundevall, 1843)

Fig. 1C, 2n = 48; FN = 66; 3♂♂, 3♀♀

This species is karyotypically identical to the above-mentioned *Chaerephon* species and shares the submetacentric condition of the X chromosome observed in *C. aloysiisabaudiae.*

Mops condylurus (A. Smith, 1833)

Fig. 1D, 2n = 48; FN = 66; 4♂♂, 5♀♀

The karyotype of *M. condylurus* is identical to both *M. midas* and *C. aloysiisabaudiae.*

Mops spurrelli (Dollman, 1911)

Fig. 2A, 2n = 48; FN = 64; 3♂♂

The chromosomal complement from female specimens of *M. spurrelli* differ from *M. condylurus* in the absence of one less small subtelocentric pair and the presence of an extra acrocentric pair. The X chromosome is submetacentric.

Mops thersites (Thomas, 1903)

Fig. 2B, 2n = 48; FN = 62; 3♂♂, 4♀♀

The autosomes are nearly identical to *M. spurrelli* but there is one less medium-sized subtelocentric and one additional acrocentric pair present. The X chromosome is submetacentric but the Y appears to be subtelocentric instead of the more commonly observed acrocentric condition.

Mops brachypterus (Peters, 1852)

Fig. 3A, 2n = 48; FN = 54; 1♀

The autosomes of the female specimen examined consist of one large pair of metacentric, three pairs of medium-sized metacentric and 19 medium to small acrocentric pairs. Although morphologically similar to *M. thersites,* it differs chromosomally by lacking subtelocentric pairs and having additional acrocentric pairs. The X chromosome presumably is submetacentric.

Mops petersoni (El Rayah, 1981)

Fig. 3B, 2n = 48; FN = 54; 1♂, 1♀

In addition to being morphologically similar, this species is karyotypically identical to *M. brachypterus.*

Mops nanulus J. A. Allen, 1917

Fig. 3C, 2n = 48; FN = 54; 2♂♂, 2♀♀

M. nanulus differs from *M. petersoni* and *M. brachypterus* by having one less medium-sized metacentric pair and the presence of a medium-sized subtelocentric pair. The sex pair is identical to *M. petersoni.*

Mops demonstrator (Thomas, 1903)

Fig. 3D, 2n = 48; FN = 54; 1♂

The karyotype of this species is identical to *M. nanulus.*

DISCUSSION

Until Freeman's (1981) recent revision of the Molossidae, phylogenetic relationships and taxonomic assignments within the family

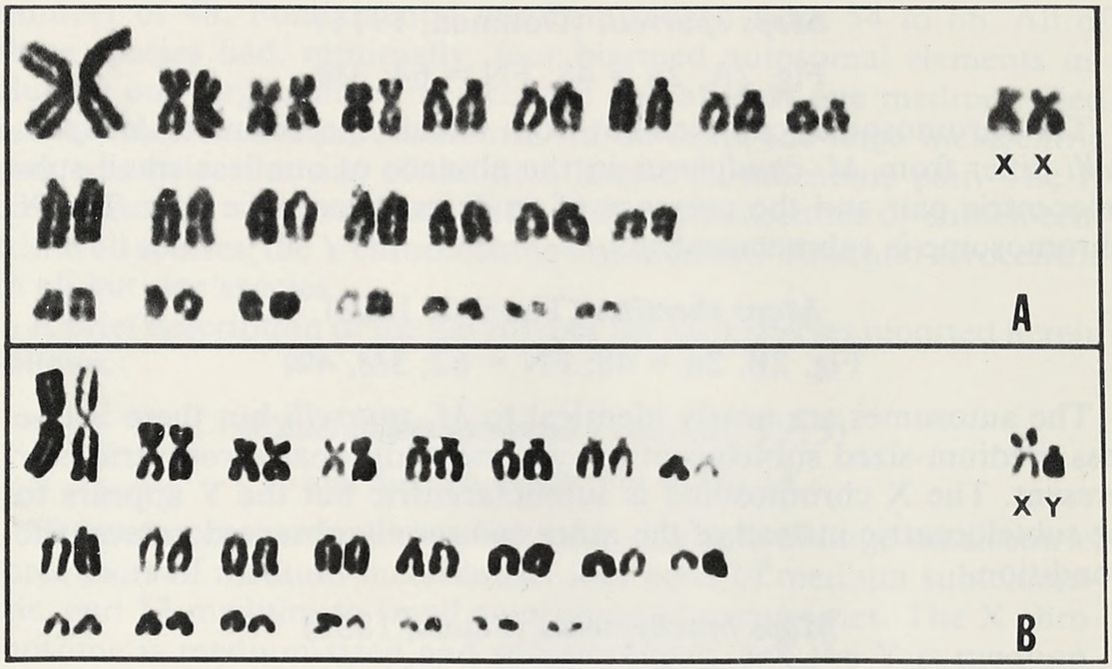

Fig. 2.—Representative karyotypes of A) *Mops spurrelli* from Cameroun, B) *Mops thersites* from Cameroun.

were largely unexplored. Warner et al. (1974) suggested that chromosomal studies might be beneficial in evaluating these relationships. Chromosomal data now available for 36 molossid species representing 10 of 12 genera recognized by Freeman (1981) are summarized in Table 2.

We detected no intraspecific chromosomal variation within any of the species examined in this study. This is noteworthy for two reasons. First, our karyotypes of *M. condylurus* (FN = 66) from Afgoi, Somalia, differ substantially from the karyotype of this species (FN = 56) reported from Kisubi, Uganda, by Dulic and Mutere (1973). These localities are several hundred kilometers apart and this suggests either that considerable geographic variation in the karyotype occurs within this species or there are two species currently recognized as *M. condylurus.* Secondly, our data support the specific distinctiveness of *M. spurrelli* and *M. nanulus.* Freeman (1981) recognized the morphological similarity between these two taxa and noted Koopman's (1975) suggestion that they might be conspecific. Our data indicate that *M. nanulus* (FN = 54) and *M. spurrelli* (FN = 66) differ by five pairs of biarmed chromosomes, and considering the scarcity of intraspecific karyotypic variation within this family, it would seem likely that the two taxa are specifically distinct.

Variation in FN for the species we examined ranged from 54 to 66 (Table 1). These karyotypes can be conveniently divided into three

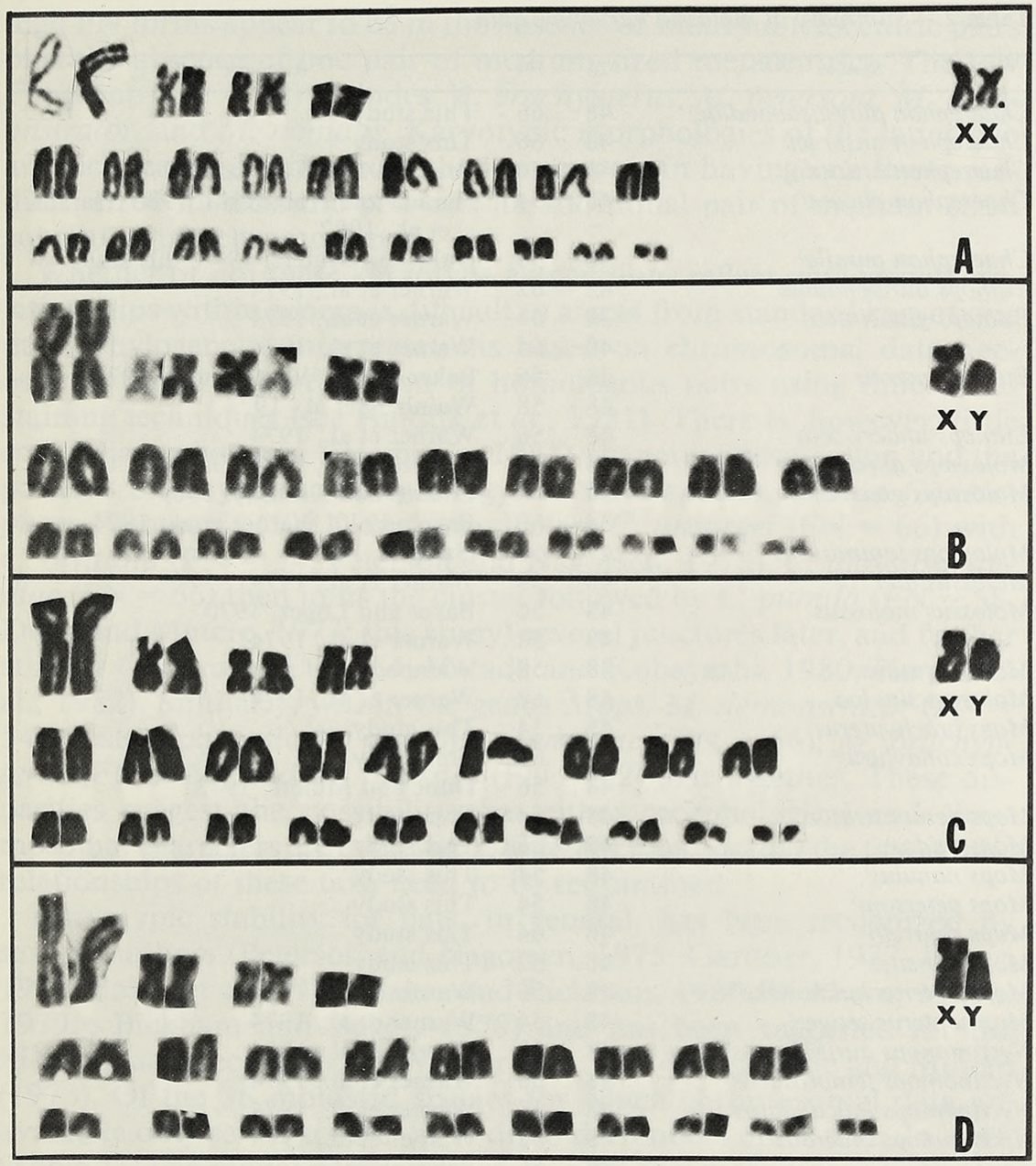

Fig. 3.—Representative karyotypes of A) *Mops brachypterus* from Cameroun, B) *Mops petersoni* from Cameroun, C) *Mops nanulus* from Cameroun, and D) *Mops demonstrator* from Cameroun.

groups. The high FN group (FN = 62–66) includes both species of *Chaerephon* and four of eight *Mops* species. Within this group, differences between the FN = 62–66 karyotypes apparently involve the absence of medium and small subtelocentric autosomes. Our examination of *Chaerephon pumila* (FN = 58) agrees with the karyotype of this species reported by Dulic and Mutere (1973), and forms an intermediate FN group. Again, differences between the intermediate and

Table 2.—*Summary of molossid karyotype data.*

Species	2n	FN	Reference
Chaerephon aloysiisabaudiae[1]	48	66	This study
Chaerephon ansorgei[1]	48	66	This study
Chaerephon bivittata[1]	48	54	Peterson and Nagorsen, 1975
Chaerephon plicata[1]	48	54	Harada and Kobayashi, 1980; Harada et al., 1982
Chaerephon pumila[1]	48	58	Dulic and Mutere, 1973; this study
Eumops auripendulus	42	62	Warner et al., 1974
Eumops glaucinus	38	64	Warner et al., 1974
	40	64	Warner et al., 1974
Eumops perotis	48	56	Baker, 1970; Warner et al., 1974
	48	58	Wainberg et al., 1974
Eumops underwoodi	48	56	Warner et al., 1974
Molossops abrasus	34	60	Warner et al., 1974; Gardner, 1977
Molossops greenhalli	34	—	Linares and Kiblisky, 1969
	34	60	Baker, 1970; Warner et al., 1974
Molossops temminckii	42	56	Gardner, 1977
Molossus ater	48	58	Warner et al., 1974
Molossus molossus	48	56	Baker and Lopez, 1970
	48	58	Warner et al., 1974
Molossus rufus	48	58	Wainberg et al., 1974
Molossus sinaloa	48	58	Warner et al., 1974
Mops brachypterus[1]	48	54	This study
Mops condylurus[1]	48	66	This study
	48	56	Dulic and Mutere, 1973
Mops demonstrator[1]	48	54	This study
Mops midas[1]	48	66	This study
Mops nanulus[1]	48	54	This study
Mops petersoni[1]	48	54	This study
Mops spurrelli[1]	48	64	This study
Mops thersites[1]	48	62	This study
Mormopterus kalinowskii[1]	48	56	Warner et al., 1974
Mormopterus setiger[1]	48	54	Warner et al., 1974
Nyctinomops aurispinosus[1]	48	58	Warner et al., 1974
Nyctinomops femorosacus[1]	48	58	Warner et al., 1974
Nyctinomops laticaudatus[1]	48	58	Warner et al., 1974
Nyctinomops macrotis[1]	48	58	Warner et al., 1974
	48	56	Baker, 1970
Otomops martiensseni	48	56	Dulic and Mutere, 1973
Promops centralis	48	58	Warner et al., 1974
Promops nasutus	40	54	Wainberg, 1966
Tadarida brasiliensis	48	—	Painter, 1925
	48	54	Kniazeff et al., 1967
	48	56	Warner et al., 1974; Baker et al., 1982
Tadarida fulminans	48	54	Peterson and Nagorsen, 1975

[1] Indicates species formerly recognized as *Tadarida*, see Freeman (1981).

high FN forms appear to be in the absence of small subtelocentric pairs plus the absence of one pair of medium-sized metacentrics. The low FN group (FN = 54) includes *M. brachypterus, M. petersoni, M. demonstrator,* and *M. nanulus.* Karyotypic morphologies of the latter two are identical and differ from the former pair in having one fewer medium-sized metacentric pair and an additional pair of medium-sized subtelocentric chromosomes.

Whether or not these karyotype associations reflect phylogenetic relationships within genera is difficult to assess from standard karyotypic data. Phylogenetic interpretations based on chromosomal data necessarily require identification of homologous pairs using differential staining techniques (see Haiduk et al., 1981). There is, however, little concordance between Freeman's (1981) phenetic classification and the patterns of karyotypic morphology for these species. Within *Chaerephon,* Freeman's (1981) analysis clusters *C. ansorgei* (FN = 66) with *C. bivittata* (FN = 54, Peterson and Nagorsen, 1975). *C. aloysiisabaudiae* (FN = 66) then joins the cluster followed by *C. pumila* (FN = 58, Dulic and Mutere, 1973; this study) several junctures later, and further still, by *C. plicata* (FN = 54, Harada and Kobayashi, 1980; Harada et al., 1982). Similarly, within the genus *Mops, M. demonstrator* (FN = 54) clusters phenetically with *M. condylurus* (FN = 66); *M. brachypterus* (FN = 54) and *M. thersites* (FN = 62) pair together. These disparities suggest the possibility that either morphological and chromosomal characters are evolving at different rates, or that the taxonomic relationships of these taxa need to be reexamined.

Karyotypic stability for bats, in general, has been recognized by several authors (Peterson and Nagorsen, 1975; Gardner, 1977; Baker, 1978; Baker et al., 1982; Baker and Bickham, 1980; Bickham, 1979*a,* 1979*b*; Bickham and Baker, 1979) and has been suggested for the Molossidae, specifically, by Warner et al. (1974) and Dulic and Mutere (1973). Of the 36 molossid species for which chromosomal data are available only seven species have diploid numbers other than 2n = 48 (Table 1). The modal occurrence of 2n = 48 chromosomes in both Old and New World genera plus the similarity between this number and the proposed primitive diploid number for the Vespertilionidae (Baker, 1970) led Warner et al. (1974) to propose 2n = 48 as primitive for the Molossidae. Our documentation of the 2n = 48 karyotype in 11 Old World molossid species further supports this diploid value as primitive for the family.

SPECIMENS EXAMINED

Chaerephon aloysiisabaudiae.—CAMEROUN: 16 km S, 2 km E Yaounde (3°43′N, 11°32′E), (1♂ CM 58678).

Chaerephon ansorgei.—CAMEROUN: 25 km S, 13 km E Garoua, (9°05′N, 13°30′E), (1♂ CM 58679).

Chaerephon pumila.—CAMEROUN: 24 km S, 13 km E Garoua (9°05′N, 13°30′E), (1♂ CM 58724); SOMALIA: Libsoma Farm 6 km S, 17 km W Afgoi (2°05′N, 44°58′E), (3♂♂ CM 85438, 85439–85440; 2♀♀ CM 85441–85442); SOMALIA: Bulo Burti (3°51′N, 45°34′E), (4♂♂ CM 85455–85456, CM 85459–85460; 4♀♀ CM 85457–85458, 85461–85462).

Mops brachypterus.—CAMEROUN: 25 km S, 3 km E Yaounde (3°38′N, 11°33′E), (1♀ CM 58687).

Mops condylurus.—SOMALIA: Libsoma Farm, 6 km S, 17 km W Afgoi (2°05′N, 44°58′E), (4♂♂ CM 85423, 85408–85409, 85424; 5♀♀ CM 85410–85411, 85412, 85425–85426).

Mops demonstrator.—CAMEROUN: 2 km W Ngaoundere (7°20′N, 13°34′E), (1♂ CM 58681).

Mops midas.—SOMALIA: Libsoma Farm, 6 km S, 17 km W Afgoi (2°05′N, 44°58′E), (3♂♂ CM 85429, 85436, 85428; 3♀♀ CM 85427, 85430).

Mops nanulus.—CAMEROUN: 25 km S, 13 km E Garoua (9°05′N, 13°30′E), (1♂ CM 58694); CAMEROUN: 24 km S, 13 km E Garoua (9°05′N, 13°30′E), (1♂ CM 58692; 2♀♀ CM 58693, CM 58695).

Mops petersoni.—CAMEROUN: 25 km S, 3 km E Yaounde (3°38′N, 11°33′E), (1♂ CM 58688; 1♀ CM 58691).

Mops spurrelli.—CAMEROUN: 30 km N, 40 km E Obala (4°22′N, 11°58′E), (1♂ CM 58730); CAMEROUN: 25 km S, 3 km E Yaounde (3°38′N, 11°33′E), (2♂♂ CM 58731, CM 58786).

Mops thersites.—CAMEROUN: 30 km N, 40 km E Obala (4°22′N, 11°58′E), (1♂ CM 58737); CAMEROUN: 25 km S, 3 km E Yaounde (3°38′N, 11°33′E), (2♀♀ CM 58743, CM 58745); CAMEROUN: 7 km S, 8 km W Yaounde (3°48′N, 11°27′E), (2♂♂ CM 58739, CM 58741; 2♀♀ CM 58740, CM 58742).

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