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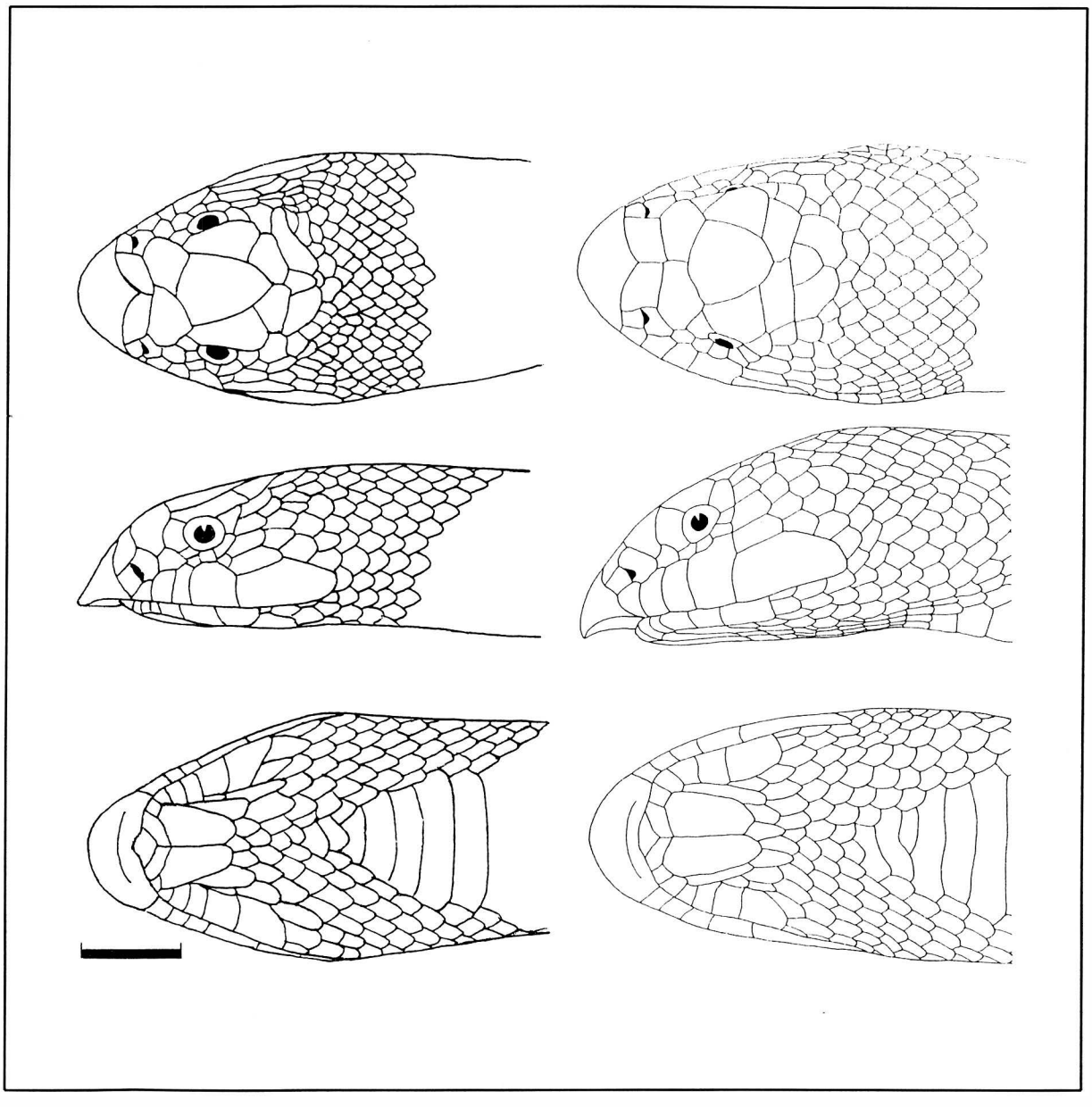

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A REVISION OF THE AFRICAN GENUS *SCAPHIOPHIS* PETERS (SERPENTES: COLUBRIDAE)

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Analysis of the geographical variation in the genus *Scaphiophis* suggests that *S. raffreyi* Bocourt should be reinstated as a full species, with *S. calciatti* Scortecci as a synonym. In *S. albopunctatus* Peters there are ring clines in counts of midbody scale rows and ventrals, the terminal populations in northern Zambia and southwestern Tanzania showing no overlap in these counts.

INTRODUCTION

Peters (1870) described the new genus and species *Scaphiophis albopunctatus* on the basis of a single juvenile specimen from Keta, Ghana, although Loveridge (1936; 1957) subsequently caused confusion by citing the type locality as "Kita, Guinea" (= Kita, Mali) and led Villiers (1962) to give the range as extending as far west as Mali.

Bocourt (1875) described *S. raffreyi*, based on a large adult specimen from Ethiopia, but Boulenger (1894) placed it in the synonymy of *S. albopunctatus*.

Scortecci (1928) described *S. calciatii* on the basis of a juvenile specimen from Eritrea, but Loveridge (1936) suggested that it was a synonym of *S. raffreyi*.

Parker (1949) considered the Eritrean-Ethiopian populations subspecifically distinct on the basis of their higher counts for midbody scale rows and ventrals. This taxonomic arrangement has subsequently been generally accepted.

About seven years ago, I was struck by the pronounced differences in the above scale counts between material from southern Zaire (Shaba Province) and northern Zambia on the one hand and specimens from the Rukwa Valley in southeastern Tanzania on the other, although they are only 200 km apart. I have subsequently collected data for most of the available material.

MATERIAL AND METHODS

Most of the available material was examined or data were obtained from the relevant institutions, the total sample consisted of 230 specimens. Preliminary analysis was based on the number of scale rows at midbody and ventral counts, but several other characters were investigated. Ventrals were counted using the Dowling (1951*b*) system and dorsal scale row reductions expressed using the Dowling (1951*a*) formula.

The following acronyms are used to indicate the institutions holding *Scaphiophis* material: AMNH = American Museum of Natural History, New York; BH = material examined by B. Hughes in West African Universities; BM = Natural History Museum, London; CM = Carnegie Museum, Pittsburgh; FSM = University of Florida, Gainesville; IFAN = Institut Fondamental d'Afrique Noire, Dakar; IRScNB = Institut Royal des Sciences Naturelles de Belgique, Brussels; MCZ = Museum of Comparative Zoology, Harvard; MNHN = Museum National d'Histoire Naturelle, Paris; MSNG = Museo Civico di Storia Naturale di Genova "Giacomo Doria"; NHMAA = Natural History Museum, Addis Ababa; NMK = National Museum of Kenya, Nairobi; NMZB = Natural History Museum of Zimbabwe, Bulawayo; PEM = Port Elizabeth Museum; RGMC = Musée royal de l'Afrique Centrale; TM = Transvaal Museum; UMMZ = University of Michigan, Ann Arbor; USNM = National Museum of Natural History, Washington, D.C.; VW = Van Wallach Collection; ZFMK = Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn; ZMB = Zoologisches Museum, Humboldt Universitat, Berlin.

RESULTS

CHARACTER ANALYSIS

1. *Midbody scale rows.* Table 1 shows the variation in five populations of *Scaphiophis*. *S. raffreyi* is readily distinguished from the *S. albopunctatus* population with the highest counts (south-east), the Coefficient of Difference being 1.43. The south-east and south-west populations are even better distinguished, with a CD of 2.73, but they are connected by a ring cline encircling the Zaire lowland forest block and the highlands bordering the western rift valley.

In the small sample of *S. raffreyi* there is sexual dimorphism in midbody scale counts, males having 25-27 rows and females 27-31.

In *S. albopunctatus* the mid-dorsal scales are about one and a half times as long as wide, whereas in *S. raffreyi* they are about three times as long as wide.

2. *Ventral counts.* Table 2 shows the variation in the five populations of *Scaphiophis*, with the sexes shown separately. In this case the population of *S.*

Population	*N*	Range	Mean	SD
ALBOPUNCTATUS:				
SOUTH-WEST: Gabon, Congo, Southern Zaire, Northern Zambia	102	19-21	20.72	0.72
NORTH-WEST: Ghana, Togo, Benin, Nigeria, Cameroun, Chad, Central African Republic	34	19-25	22.03	1.29
NORTH-EAST: Northern Zaire, Southern Sudan, Uganda	41	19-25	22.80	1.66
SOUTH-EAST: Kenya, Tanzania	43	23-25	24.65	0.72
RAFFREYI:				
Ethiopia, Eritrea, Eastern Sudan, Northeast Uganda	23	25-31	27.39	1.20

TABLE 1. Range of variation in counts of midbody scale rows in five populations of *Scaphiophis*. *N* = number of specimens

	Males				Females			
Population	*N*	Range	Mean	SD	*N*	Range	Mean	SD
ALBOPUNCTATUS:								
SOUTH-WEST	43	170-184	175.33	3.04	56	189-204	198.45	4.26
NORTH-WEST	18	174-191	182.83	5.69	17	192-216	203.35	6.64
NORTH-EAST	16	183-201	189.56	4.27	25	197-228	216.00	5.61
SOUTH-EAST	19	186-195	189.47	2.87	23	207-221	211.61	3.38
RAFFREYI	6	204-216	211.00	4.20	17	225-243	234.53	5.43

TABLE 2. Range of variation in ventral counts for five populations of *Scaphiophis* (as in Table 1).

	Males				Females			
Population	*N*	Range	Mean	S.D.	*N*	Range	Mean	SD
ALBOPUNCTATUS:								
SOUTH-WEST	45	58-72	66.93	2.60	56	52-62	56.91	2.70
NORTH-WEST	18	53-76	64.00	6.63	16	50-64	57.00	4.05
NORTH EAST	16	63-74	69.00	2.92	25	51-72	60.72	4.78
SOUTH-EAST	20	62-73	67.35	2.72	22	49-60	56.18	2.74
RAFFREYI:	6	72-79	76.00	2.53	13	55-68	63.77	3.65

TABLE 3. Range of variation in subcaudal counts for five populations of *Scaphiophis* (as in Table 1).

albopunctatus with the highest counts (north-east) is separated from *S. raffreyi* by a CD of 2.53 in males and 1.68 in females. The south-east and south-west populations are again readily distinguished by CD's of 2.39 in males and 1.72 in females. In this case the counts for the north-west population are intermediate and those for the north-east population are higher than those of the south-east.

3. *Subcaudal counts. S. raffreyi* has higher average counts than *S. albopunctatus* in both sexes, but there is great overlap in the ranges. There is no significant geographical variation in *S. albopunctatus.*

4. *Scale row reduction formulae.* Three specimens of *S. albopunctatus* have the following formulae:

NMZB-UM 32859 female, Musosa, Zaire:

21 4+5(136) 19 (196)
4+5(138)

NMZB-UM 32858 female, Mweru Wantipa, Zambia:

23 5+6(12) 21 4+5(151) 19 (197)
5+6(13) 5+6(146)

NMZB 209 female, Kilifi, Kenya:

27 6+7(8) 25 -6(118) 23 5+6(166) 21 4+5(199)
6+7(8) -6(118) 5+6(176)

20 (212)

A specimen of *S. raffreyi* has the following formula:
NMZB 11789 female, Meki, Ethiopia:

29 6+7(15) 27 26 5+6 (142) 23
6+7(15) -2(122) 2+3 & 5+6(142)

4+5(211) 21 (229)
-5(211)

All the scale row reductions are lateral. The higher number of scale rows anteriorly in *S. raffreyi* and the eastern populations of *S. albopunctatus* is considered to be a derived character (Marx & Rabb, 1972).

5. *Number of loreals. S. raffreyi* usually has a single loreal (76.5%), rarely two (13%), very rarely 0, 3 or 4. *S. albopunctatus* has 1-3 loreals, two being most common.

6. *Colouration. S. albopunctatus* is light brown to grey-brown above, the juveniles with white stippling which disappears in the adult. Most adults have some irregularly scattered dark brown spots, more numerous posteriorly.

S. raffreyi is usually red-brown above, uniform or with a few dark spots posteriorly. Juveniles are pale blue-grey above, each scale black at the base and brown at the apex, giving a speckled effect.

7. *Skull and Dentition.* Bourgeois (1968) described and illustrated the skull of a *S. albopunctatus* from Zaire. She recorded the numbers of teeth as: maxillary 15, palatine 9, pterygoid 8, dentary 18.

Garth Underwood has reported on the skulls of two *S. albopunctatus*, BM 98.1.8.12 (female, Mgana, Kenya) and BM 94.2.10.4 (male, Ugogo, Tanzania, [broken, data in square brackets]), left/right: "The toothless stretch at each end of the maxilla is unusual: (blank equiv. 3 tooth places) 9 teeth (blank equiv. 5) [(3/2) 12/ 14 (3/3)].

The expanded maxillary process at the anterior end of the palatine bone is unique (both). It lacks a foramen for the maxillary branch of nerve V, a minor but not rare condition. Teeth: (blank equiv. 4) 9 [left broken/ (3) 10]. The choanal process is narrow and of full length. Palatine-pterygoid contact end to end.

Pterygoid 9 [8/10]. Dentary (blank 1) 17 [(1/1) 20/ 19]. Articular and splenial bones are without foramina (both). The shapes of these two bones are somewhat different in the Mgano and Ugogo specimens, but symmetrical within each.

The very large premaxilla separates the nasals (both); not seen elsewhere. The nasals have facets which articulate with the frontal; this is usual. The septomaxillae have unusually large facets for the frontal.

The sphenoid of the broken specimen has a broad sella turcica. The foramen for the left cerebral artery is much wider than the left; this is usual. The Vidian canals open anteriorly inside the sphenoid margin. Just above the anterior opening of the Vidian canal is a foramen which I believe is for the retractor branch of nerve V4, what Rieppel (1979) calls the constrictor internus dorsalis (CID) nerve. This arrangement is usual in colubrines. There is a canal for nerve VI passing on either side of the sella turcica to open over the anterior end of the Vidian canal. The posterior lateral parts of the sphenoid are greatly expanded, which obscures the features there. There appears to be a common tunnel for the cerebral artery and the palatine branch of nerve VII.

The stapes shows no signs of reduction in size; it does in some other burrowing snakes. In each the fenestra ovale lies between pro- and opisthotic. The foramina in the exoccipital bones are similar in *Scaphiophis* and *Spalerosophis*, but may be like this in many other snakes."

Scortecci (1928) reported fewer teeth on all bones in the type of *S. calciattii*, i.e. seven, five, three and twelve respectively. However, NMZB 11789, a *S. raffreyi* from Meki, seems to have had a similar number of teeth to *S. albopunctatus* (thirteen, seven, seven and sixteen respectively). The rounded toothless anterior tip of the dentary bone is very noticeable. In this genus the small teeth barely penetrate the thick pleated buccal membrane and the teeth are easily lost when the membrane is removed. As the tooth sockets are very shallow, apparently Scortecci (1928, pl. vii) did not count the empty sockets in the skull of the 370 mm juvenile type of *S. calciattii.* Scortecci also showed fused frontal bones in his illustration of the skull of *S. calciattii*; the frontals seem to be partially fused in NMZB 11789. As in *S.*

albopunctatus, the nasals are separated by a posterior extension of the premaxilla.

8. *Precaudal vertebra.* (Form of description follows Auffenberg, 1963): *S. raffreyi* (NMZB 11789) - middle precaudal vertebrae without well developed hypapophyses; centrum somewhat conical from below, without subcentral ridges. The haemal keel is flattened, but terminates in a prominent spatulate tip near the condyle. The paradiapophyses are provided with two well-developed articular facets, without a projected parapophysial process. The cotyle is round. The condyle is on a short neck, directed posteriorly. The neural canal is round from the front. The neural arch is moderately long, without epizygapophysial spines. The neural spine is slightly longer than high, overhanging both anteriorly and posteriorly. The zygosphene is shallowly hollowed crenate. The prezygapophses are oval to subtriangular. The accessory processes are moderately developed, directed laterally and blunted.

This vertebra was compared with specimens from *Coluber constrictor* (NMZB 5438 - Florida), *C. (Haemorrhois) hippocrepis* (NMZB-UM 4578 - Morocco), *C. rogersi* (NMZB-UM 6871 - Egypt), *Meizodon semiornata* (NMZB 10161 - Mozambique) and *Spalerosophis diadema* (NMZB-UM 6865 - Egypt): it shows greatest similarity to the last of these. *S. diadema* differs in having a distinct haemal keel, the cotyle is horizontally oval, the zygosphene is crenate and the prezygapophyses are oval.

9. *Internal anatomy.* The jaw muscles are described and illustrated by Haas (1931). Garth Underwood has dissected a *S. albomaculatus* (BM 98.1.8.12) and a *S. raffreyi* (BM 1973.3257, female, Lake Chamo) and reports as follows (organ positions with reference to ventrals, *S. raffreyi* figures in parentheses): ventrals 207 (228), heart tip V38 (43), trachea to V39 (46), tip of liver V51 (58), systemic arches join at V39 (46). In each the entry of the trachea into the right lung is subterminal. There is a small left lung, not more than 1V long. The vascularisation of the lung fades out in the roof of the narrow trachea. The thyroid lies between four thymus bodies, two on each side. These features are primitive for higher snakes.

The above character analysis facilitates the compilation of the following key to the identification of the two taxa of *Scaphiophis*.

Midbody scale rows 19-25; ventrals 170-201 in males, 189-228 in females; dorsum grey-brown.....
S. albopunctatus Peters.

Midbody scale rows 27-31 (rarely 25); ventrals 204-216 in males, 225-243 in females; dorsum red-brown in adults.....*S. raffreyi* Bocourt.

SCAPHIOPHIS ALBOPUNCTATUS PETERS, GREY BEAKED SNAKE

Scaphiophis albopunctatus Peters, 1870: 645, pl. i, Fig 4 (Type locality: Keta, Ghana); Bocourt, 1875: art. 3; Mocquard, 1887: 77 (var. *nigropunctatus*); Boulenger, 1894: 254; Bocage, 1895: 102 & 1896: 83; Boulenger, 1896b: 641 & 1897: 279; Tornier, 1897: 71; Boulenger 1902: 446; Werner, 1907: 1873; Sternfeld, 1908: 243; Pellegrin, 1909: 204; Boulenger, 1911: 165, 1915*a*: 209, 1915*b*: 626 & 1915*c*: 649; Chabanaud, 1916: 372 & 1917: 11; Boulenger, 1919: 25 & 1920: 285; Schmidt, 1923: 90, pl. viii; Loveridge, 1928: 53; Haas, 1931: 396; Witte, 1933: 91; Loveridge, 1936: 255; Pitman, 1938: 122, pl. viii, Figs. 3 & 4, col. pl. H, Fig. 3; Vesey-FitzGerald, 1958: 46, pl. 16; Hughes & Barry, 1969: 1018; Cahill, 1971: 233; Vesey-FitzGerald, 1975: 14, pl. iii; Joger, 1982: 331; Hughes, 1983: 354.

Scaphiophis albopunctatus albopunctatus Witte, 1953: 208, Fig. 66; Loveridge, 1955: 46 & 1957: 264; Broadley & Pitman, 1960: 442; Robertson, Chapman & Chapman, 1962: 429; Witte, 1962: 100, Fig. 57; Doucet, 1963: 257; Villiers, 1963: 122, Fig. 161-162; Thys van den Audenaerde, 1965: 379; Witte, 1966: 75, pl. iv, Fig. 1; Bourgeois, 1968: 252, Fig. 109-111 (skull); Broadley, 1971: 81, pl. 9; Pitman, 1974: 113, pl. H, Fig. 3; Spawls, 1978: 5.

Description. Rostral very large, wedged between the internasals, which are usually shorter than the prefrontals; frontal large, longer than broad; parietals fragmented, usually an anterior pair, a lozenge-shaped interparietal and a group of 2 to 5 posterior parietals; nostril pierced between anterior and posterior nasals; loreals 1-3, usually 2, superposed; preoculars 1-2; suboculars 2-3; postoculars 2-3; anterior temporals 4-6, posterior temporals not differentiated; supralabials five, (very rarely six), fifth very long; infralabials 7-9, the first pair in contact behind the mental, the first 2-5 in contact with the single pair of large chin shields. The inside of the upper lip has a flange into which the lower jaw fits with valve-like precision.

Midbody scale rows 19-25, smooth with paired apical pits; ventrals 170-201 in males, 189-228 in females; anal divided; subcaudals 53-76 in males, 49-72 in females.

Size. Largest male (Loveridge, 1928 - Shinyanga District, Tanzania) 949 + 206 = 1155 mm; largest female (MNHN 1904-66 - Upper Nile Province, Sudan) 1302 + 210 = 1512 mm.

Colouration. Grey-brown above, white below. The juveniles are usually heavily speckled with white above, whereas adults usually have scattered large dark dorsal spots, which may be confluent.

Behaviour. There is little information available on this fossorial species. Vesey-FitzGerald (1958: 47) has described its threat display: "The snake will grimace by expanding the lips, opening its mouth, and extruding the tongue. The inside of the mouth and the tongue itself are deep blue. Against this dark

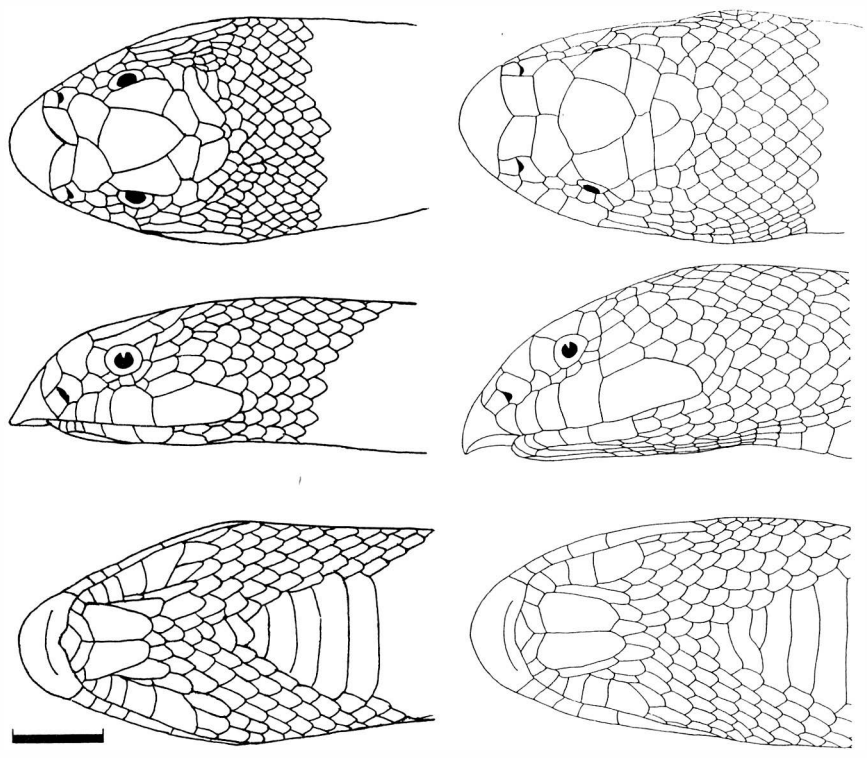

FIG. 1. Dorsal, lateral and ventral views of the head of (left) *Scaphiophis albopunctatus*(NMZB-UM 32858 - Mweru Mantipa, Zambia) and (right) *Scaphiophis raffreyi* (Type: MNHN 4331 - Debre Tabor, Ethiopia). Scale bar = 1cm.

background the hawk-like beak is seen to full advantage. After this preliminary warning, the snake may strike with such violence that its whole body nearly leaps off the ground, and in fact if the teasing is continued, a sort of wild dance is enacted, which one can easily imagine might have a most terrifying effect on a possible enemy." Two stages in the display are illustrated (Vesey-FitzGerald, 1958, pl. 16 & 1975, pl. iii)

Cahill (1971) has described the efficient way in which this snake kills mice in an artificial burrow by crushing them against the tunnel wall with its muscular body. The prey is never taken into the jaws until it is dead.

Diet. In the Rukwa valley Robertson *et al.* (1962) found four newborn rats in a 384 mm snake and an adult rat in a 774 mm snake (snake measurements from field note book in NMZB).

Habitat. Robertson *et al.* (1962) collected 27 of their 32 specimens in the open mixed woodland fringing the Rukwa flood-plain grasslands in southwestern Tanzania. Most of the recorded locailities in Kenya and Tanzania seem to be in dry savanna, varying from miombo woodland to *Acacia-Commiphora* deciduous bushland and thicket (White, 1983). However, the habitats on the Kenya coast are much more moist and a Gede specimen was found crawling on the forest floor.

In northern Zambia and southeastern Zaire (Shaba Province) this snake inhabits moist Zambezian miombo woodland, then it seems to occur in the Guineo-Congolian mosaic of lowland rain forest and secondary grassland (? cultivation) which encircles the main Congo lowland forest block and extends west to Ghana. In the environs of Kinshasa it occurs equally in savanna and forest (Thys van den Audenaerde, 1965). In Nigeria and Benin *S. albopunctatus* also occurs in Sudanian woodland with abundant *Isoberlinia.*

Distribution. (Fig. 2). Northern Zambia and southern Zaire, northwest through Congo, Gabon, Cameroun, Nigeria, Benin and Togo to Ghana, east through Chad, Central African Republic, northern Zaire and southern Sudan to Uganda. Southern Kenya, western Tanzania and extreme eastern Zaire at Uvira on the northwest shore of Lake Tanganyika (so presumably present in southern Burundi).

Recorded localities. GHANA: Keta (Peters, 1870) ZMB 6945 (type). TOGO: Agou RGMC 73-14-R-16; Ezime, Atakpame USNM 223899-901; Tohoun IFAN 50-4-34. BENIN: No locality MNHN 1904-117; Agouagou (Chabanaud, 1917) MNHN 1916-156, 157, 200; Ajuda (Bocage, 1895, 1896); Parakou USNM 199603; Segbana USNM 199602. NIGERIA: No locality BM 1940.2.1.8; BH C30A2; Bauchi AMNH 96112; Ibi BM 1916.11.6.9; Ilorin BM 1916.11.6.10; Jos BM 1966.352; Kankiya RGMC 28342, 28348;

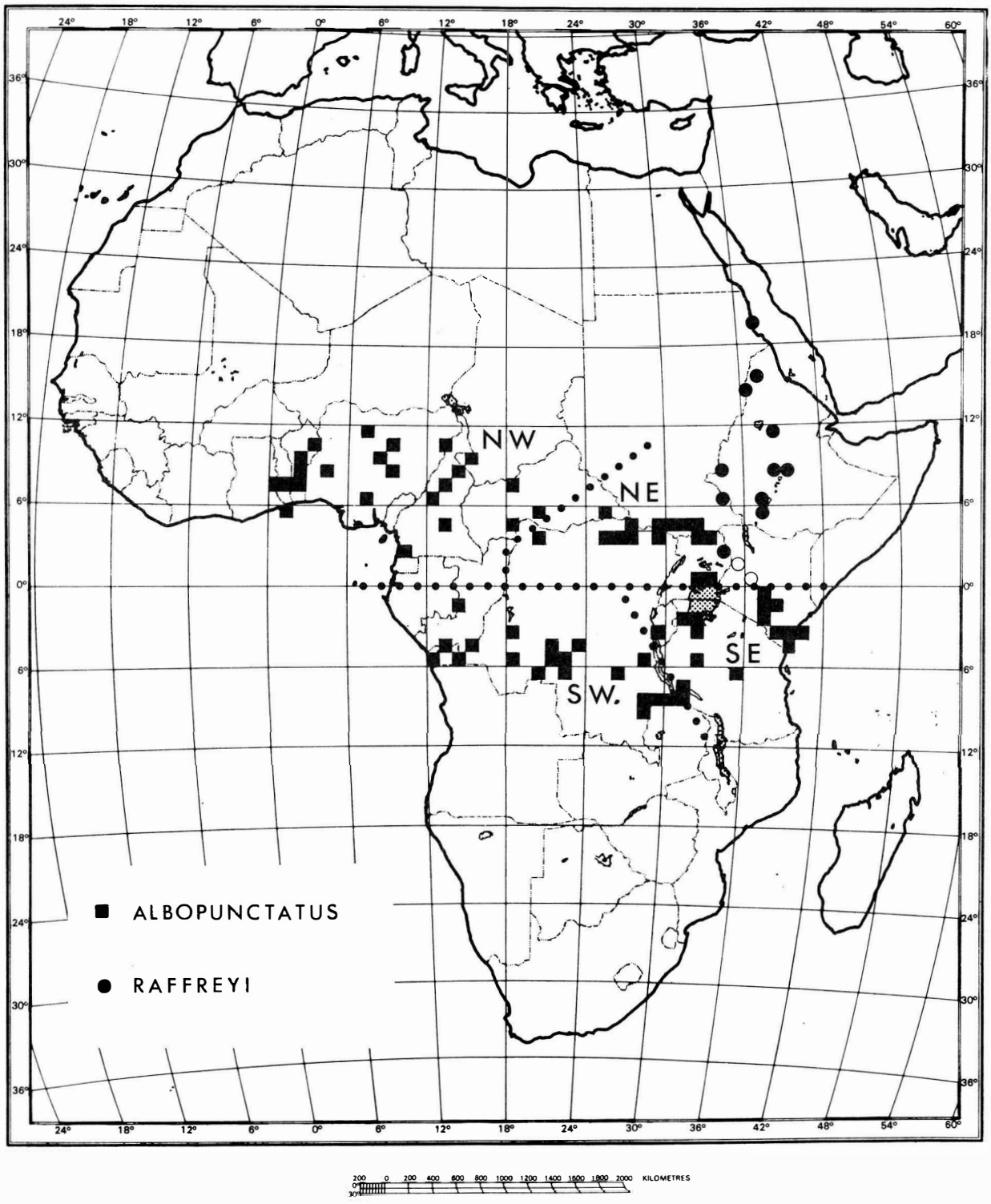

FIG. 2. Distribution of two species of *Scaphiophis*. Open symbols indicate unverified literature records. The dotted lines separate the four populations of *S. albopunctatus* for which data for midbody scale rows and ventrals are presented separately.

Nsukka (Cahill, 1971); Zaria BM 1975.608. CAMEROON: Duma ZMB 20708; 30 km E of Kribi MCZ 44242; Mokolo Mts MNHN 1962.12; Tcholliré (Joger, 1982) ZFMK 20216-7; Tibati IFAN 51-5-12; Touboro MNHN 1962.11; Wakwa, Ngaoundére MNHN 1972, 139-140. CHAD: Maillao MNHN 1978.1831; Mayo-Kebbi MNHN 1965.42. CENTRAL AFRICAN REPUBLIC: Bambari MNHN 1991.346; NW of Damara MNHN 1991.374; Gribingui river MNHN 1921.17. GABON: Diélé (Mocquard, 1887) MNHN 1886.221. CONGO: Brazzaville MNHN 1965.14, 1966.726, 1987.1643. ZAIRE: Api RGMC 1022; Avakubi (Boulenger, 1919); Bagbele (Witte, 1966) CM 69270; RGMC 30734-45; Banana (Witte, 1933) RGMC 2479; Bas Congo RGMC 10717, 10726; Bulape AMNH 104101; USNM 167085-9; Dika (Witte, 1933) RGMC 3537; Faradje (Schmidt, 1923) AMNH 12151; Gangala na Bodio RGMC 20164; Kabalo (Witte, 1933) RGMC 4243; Kafumba UMMZ 172970; Kalina RGMC 14679, Kananga (Lulubourg) MCZ 42948; RGMC 2810, 12019, 74-13-R-74; Karawa Mission USNM 236653; Kasai BM 97.1.30.7; Kilwa RGMC 11653; Kina RGMC 9367-8; Kinshasa (Leopoldville) PEM 3355; RGMC 1275, 11577, 14580, 14588-9, 14935, 27204, 27215, 27270-81; VW 1167, 1240; Kinsuka VW (x3); Kisangani (Stanleyville) (Boulenger, 1919); Kwango (Boulenger, 1897) RGMC 38; Lubondaie Tshimbu RGMC 21076; Luebo RGMC 2757; Lusambo RGMC 16533; Makaw River, Kasai RGMC 21121; Mauda (Witte, 1933) RGMC 3352; Mbanza Ngungu (Thysville) RGMC 10741; Misumba RGMC 15589; Musosa (Witte, 1933) NMZB-UM 32859; TM 38157; Niangara (Schmidt, 1923) AMNH 12146-7, 12149; RGMC 3235; Niemba-Lukaga Confluence RGMC 1988, 1994; Nyunzu RGMC 9791; Poko (Boulenger, 1919) RGMC 1758; Pweto BM 1901.2.12.97; RGMC 256; Tanganika district RGMC 433; Tshanga RGMC 14826; Tshikaji, Kasai RGMC 74-13-R-11, 35-6, 45, 71, 77 & 120; Tshikapa (Witte, 1933) RGMC 2412; Uvira MNHN 1950.72; Zemio (Boulenger, 1894) BM 84.5.2.15. SUDAN: Juba ZFMK 29568; Kagelu ZFMK 26069; Lerwa MCZ 53394; Nimule MCZ 53395; Torit (Loveridge 1955) MCZ 53396-9; Upper Nile MNHN 1904-66. UGANDA. Budini (Pitman, 1975) NMZB 182; Busoga NMK 491; Bussu (Boulenger, 1911; Pitman, 1975) BM 1911.7.8.10-11, UMMZ 61227; Eastern Province BM 1931.10.1.1; Kaliro AMNH 63773. KENYA (Spawls, 1978): Gede NMK 2563, 2804, 3193, 3195 (2); Ithumba BM 1966.64; Kiboko Range Station NMK 2951(2), 3003; Kibwezi (Sternfeld, 1908) ZMB 22476(2); Kilifi BM 1955.1.12.12-13; NMZB 209; Kwale BM 1966.63; Malindi NMK 1410-1; Mazinga Hill, Voi NMK 1568; Mgana BM 98.1.8.12; Ngomeni, Kitui NMK 1568; O1 Doinyo Sabuk NMK 1575; Voi AMNH 61635; NMK 1422, 1505; Sakoke Forest (Loveridge, 1936) MCZ 39953-4. TANZANIA: Dodoma (Loveridge, 1928) MCZ 23068; USNM 72469; Kafukola (Robertson *et al*, 1962) MCZ 54581; NMZB 664-5; TM 25304, 25586; Kapenta, Kapombo & Kinambo (Robertson *et al*., 1962); Kipangate (Robertson *et al*., 1962) MCZ 54079; Kizumbi, Shinyanga (Loveridge, 1928) MCZ 23069; Lake Rukwa MCZ 53115, 54078, 54080; NMZB 1756; ZMB 16111; Machaka MCZ 54579-80; Malombe (Robertson *et al*., 1962); Milepa NMZB 666; Mwanza ZMB 16820; Nkulukulu Mbuga (Robertson *et al*., 1962); Tabora (Tornier, 1897) ZMB 10377; Tumba NMZB 668; Ugogo (Boulenger, 1896) BM 94.2.10.4; Utundu, S.W. Nyanza (Tornier, 1897) ZMB 13275; Zimba ZMB 23473. ZAMBIA (Broadley, 1971): Buleya IRScNB 5055; Chansa, Masanka Flats PEM 1435/65; Mbala (Broadley & Pitman, 1960) CM 59030; IRScNB 4223, 4224(8), 4230(2), 4233(2), 5056(3), 8745; Mukupa Katundula (Broadley & Pitman, 1960) IRScNB 8743(3); Mweru-Wantipa IRScNB 4229, 4231(4); NMZB-UM 32858.

SCAPHIOPHIS RAFFREYI BOCOURT, ETHIOPIAN BEAKEDSNAKE

Scaphiophis raffreyi Bocourt, 1875: art. 3 (Debre Tabor, Ethiopia); Loveridge, 1936: 256.

Scaphiophis albopunctatus (not Peters) Fischer, 1885: 100, pl. iii, Fig. 6; Boulenger, 1896*a*: 553; Emmrich, 1985*a*: 68 & frontispiece; 1985b: 40, pl. 8.

Scaphiophis calciattii Scortecci, 1928: 300, Fig. 5, pl. vii, Figs. 2-5. (Cunana Region, Eritrea); 1930: 201.

Scaphiophis albopunctatus raffreyi Parker, 1949: 62; Emmrich, 1985*a*: 68.

Description. Head scalation similar to *S. albopunctatus*, except that a single loreal is usual and infralabials average a little more numerous, i.e. 8-11. Midbody scale rows 27 in males (25 in one from Khor Okwat), 27-31 in females, smooth with weakly developed paired apical pits; ventrals 204-216 in males, 225-243 in females; anal divided; subcaudals 72-79 in males, 55-68 in females.

Size. Largest male (NHMAA606 - Gambela, Ethiopia) 1050 + 270 = 1320 mm; largest female (BM 1973.3258 - Arba Minch, Ethiopia) 1220 + 260 = 1480 mm.

Colouration. Red-brown above, usually uniform, but with some dark spots posteriorly in the type specimen, ventrum white. Juveniles pale blue-grey above, speckled darker (Emmrich, 1985*a*: frontispiece).

Behaviour. Emmrich (pers. comm.) caught a 110 cm adult at Meki in May 1982 and noted that in captivity it killed mice by clumsily pressing them against the ground with its body. Only about one in ten attempts to pin down prey was successful. It detected prey by scent rather than vision.

Habitat. Ionides (in Pitman, 1974) dug a 1423 mm female *Scaphiophis* from an abandoned termitarium at Baringo in northwestern Kenya. Emmrich (pers. comm.) recorded a juvenile caught at Meki during ploughing.

Most records of *S. raffreyi* are from the Ethiopian rift valley: deciduous mixed savanna woodlands (1300-1400 m) in the south (Lake Chamo and Arba Minch) and *Chrysopogon/Dactyloctenium* grasslands (1300-1760 m) further north (Meki, Nazaret, Ouardji and Welenchiti). From western Ethiopia there is a series from Gambela (515 m in *Hyparrhenia* grassland) and one from Tulu Walel (formerly broadleaf forest, but now intensively cultivated). Two of the earliest records are from altitudes of 2500 m, the type from Debre Tabor (broadleaf forest) and a specimen from Rappe (coniferous forest), habitats not substantiated by recent material. The Eritrean records are from *Sorghum* grasslands at approx. 1000 m. (Data on natural vegetation from the National Atlas of Ethiopia, 1988).

The northernmost record is from Khor Okwat on the Red Sea in Sahel semi-desert grass/shrubland. The southernmost specimen examined is from Moroto in the Karamoja District of northeastern Uganda in the Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket (White, 1983). *Scaphiophis* records from this habitat in northwestern Kenya (Baringo and Kerio Valley) are provisionally assigned to *S. raffreyi*, pending the collection of voucher specimens.

Distribution. (Fig. 2) Eastern Sudan, Eritrea, Ethiopia from the rift valley westwards, northeastern Uganda and probably northwestern Kenya as far south as Baringo.

Recorded localities. SUDAN: Boma National Park Base Camp NMK 0/2889; "Kor Ofat, Egypt" = Khor Okwat MNHN 1909.159; Nubia (Fischer, 1885). ERITREA: Barentu (Scortecci, 1930) MSNG 40756 (2); Cunana Region (Scortecci, 1928). ETHIOPIA: Arba Minch BM 1973.3258; Debre Tabor (Bocourt, 1875) MNHN 4331 (type); Gambela (Emmrich, 1985*a*) NHMAA 606, 708, 877-8; West of Lake Chamo BM 1973.3257; Meki (Emmrich, 1985) NMZB 11787-9; Ouardji MNHN 1905-197; Rappe (Boulenger, 1896); Tulu Walel ZFMK 16812; Welenchiti BM 1916.6.24.8-9. UGANDA: No locality BM 1909.10.30.31; Moroto NMK 0/1028. KENYA. Baringo (Ionides, pers. comm. to Pitman, 1974); Kerio Valley (Spawls 1978).

DISCUSSION

The relationships of *Scaphiophis* are uncertain. Bogert (1940) placed it in his monotypic Group XI, one of the groups distinguished by vertebral hypapophyses absent posteriorly, sulcus spermaticus not forked and no grooved maxillary teeth.

Taub (1967) investigated labial glands in the Colubridae and noted that *Scaphiophis* shared with *Arizona, Eirenis* and some *Elaphe* ".. a primarily mucous supralabial gland with occasional serous cells interspersed among the mucous lobules. The numerous lobules open into the oral cavity via several ducts." The last three above-mentioned genera were assigned to the Tribe Colubrini by Dowling & Duellman (1978), although they included *Scaphiophis* in the Tribe Pseudaspidini of the Subfamily Lycodontinae. McDowell (1975) considered *Scaphiophis* to be closely rellated to *Argyrogena fasciolata* (Shaw), which in turn he considered to be a specialised relative of *Coluber ravergieri* and *Spalerosophis diadema*, both of which have a Duvernoy's gland. Branch (pers. comm., 1978) examined the everted hemipenis of a Nigerian *Scaphiophis* (BM 1975.608) and also noted its resemblance to the hemipenis of *Argyrogena fasciolata* (Shaw), described by Wilson (1967).

It seemed that *Scaphiophis* should be assigned to the Tribe Colubrini, so a spine was prepared from a *Scaphiophis raffreyi* (NMZB 11789) and a precaudal vertebra closely resembles that of *Spalerosophis diadema*, illustrated by Schatti (1986), although the haemal keel is weakly developed. This affinity was confirmed by comparison with vertebrae from five colubrine species.

Skulls were prepared of both *Scaphiophis* species. The striking feature of the interior of the mouth is the heavily pleated blackish buccal membrane, through which the small teeth barely penetrate. This resembles the interior of the mouth of *Dasypeltis*, described and illustrated by Gans (1952). There is a pronounced flange on the inside of the upper lip into which the countersunk lower jaw fits tightly. A less well developed pleated buccal membrane was noted during the preparation of a skull of *Spalerosophis diadema*.

The skull of *S. raffreyi* (NMZB 11789) resembles that of *S. albopunctatus* illustrated by Bourgeois (1968) in most respects, but the nasals are larger and in good contact with the frontals (which are partially fused), separated by a posterior prolongation of the premaxilla. Many teeth were lost during preparation of the skull and determination of the number of teeth is difficult due to the shallowness and irregular spacing of the tooth sockets.

Minton (1966) recorded behaviour in Pakistan *Spalerosophis atriceps* reminiscent of that used by *Scaphiophis* to kill mice. "[Captive specimens] feed well on mice, young rats and sparrows. The prey tends to be small in proportion to the size of the snake. Usually the snakes press struggling animals against the floor or wall of the cage with a coil; occasionally they employ true constriction".

Underwood (1967) thought that there were probably no fossorial Colubrids, but *Scaphiophis* seems to be the exception, which may have arisen from an isolated southern population of ancestral *Spalerosophis* stock.

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