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## Two new chameleons (Sauria: Chamaeleonidae) from isolated Afromontane forests in Sudan and Ethiopia

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**Abstract.** Two new species of horned chameleon are described from isolated montane forests in eastern Africa. In one of the species, the male has a unique rostral cone unlike any other known chamaeleonid rostral appendage, and in the other, paired annulated rostral horns are present, a feature previously regarded as unique to a group of west African chameleons.

**Key words.** Reptilia, Chamaeleonidae, Sudan, Ethiopia, new species, taxonomy, zoogeography.

### Introduction

The forests of the Afromontane Archipelago serve as centres of endemism for plants and animals in Africa. It comes as no surprise that isolated and consequently little explored areas of montane forest should still produce new species of reptile.

In 1988 the chameleons in the spirit collection of the National Museum of Kenya (Nairobi) were examined. Amongst the specimens a single adult male chameleon was found that originated from the Imatong Mountains in southern Sudan. Its uniqueness was evident by its long non-annulated conical rostro-nasal projection. At the time it was hoped that further specimens of this form could be obtained to allow a more detailed analysis, but due to the civil unrest prevalent in that region, it seems unlikely that further specimens of this chameleon will be collected in the near future and therefore this species *Chamaeleo (Trioceros) conirostratum* n. sp. is described on the basis of this single adult male holotype.

Malcolm Largen (1995) described a new species of chameleon *Chamaeleo harenae* from the Harena Forest in Ethiopia on the basis of two specimens — an adult female and an unsexed juvenile LIV 1986.212.245. The latter specimen had been found dead, desiccated, severely damaged — presumably by a bird — and not in good condition. However it showed some significant differences from the adult specimen in having more heterogeneous scalation and was also noted to possess two tiny rostral tubercles. Largen felt that the observed differences were likely to be a consequence of its immaturity. Since males of a species may possess cranial ornamentation not exhibited by females, the possibility that the juvenile was a male and the adult specimen being a female, would allow that the two could still be conspecific. However on examining the photograph of the adult specimen, well developed hemipenal bulges are evident, suggesting that the hornless holotype is in fact an adult male. Since this would effectively negate the possibility that the juvenile was a horned female, the probability was high that the two specimens in fact represented two distinct taxa. During the course of 1996, a trip was made to the Harena Forest to test this hypothesis, that resulted in the collection of a good type series of a new

chameleon *Chamaeleo (Trioceros) balebicornutus* n. sp. and 4 additional adult specimens of *Ch. harennae* (one male and three females).

***Chamaeleo (Trioceros) balebicornutus* n. sp. (Fig. 1)**

**Diagnosis:** A small chameleon with markedly heterogeneous scalation. Each canthal ridge terminates in an annulated horn that is closely aligned to the opposite horn and projects forward over the upper lip. The horns are well developed in the males, and attenuated in females. The casque is flat and has a distinct shallow notch at the occiput. There are no obvious parietal or temporal crests. Gular crest is strong and the dorsal crest is limited to the anterior  $\frac{2}{3}$  of the keel. Ventral crest is represented by a line of white tubercles. The tail is smooth.

**Derivatio nominis:** The name derives from the fact that this is the only two-horned chameleon inhabiting the Bale Mountains.

**Holotype:** ZFMK 63049, adult male, collected 2nd October 1996 by Colin Tilbury and Stephen Spawls, Katcha clearing, altitude 2400 metres, Harenn Forest, Bale Mountains, central Ethiopia 06°42'N 39°44'E.

Paratypes ZFMK 63050-58 collected by Tilbury and Spawls, 21st September and 2nd October 1996 from roadside vegetation between 1700 m and 2100 m 06°37'N 39°44'E and LIV 1986.212.245 from 1980m 06°40'N 39°44'E collected by M. J. Largen on 7th August 1986.

Table 1: Morphometric variation in the holotype and paratypes of *Chamaeleo (Trioceros) balebicornutus* n. sp. — \* Measurements in millimetres. s/v = snout/vent length; c/snt = casque tip to snout length; i.o.d. = inter-orbital diameter; com/snt = commissure of mouth to snout distance; c/com = casque to commissure distance; g/cr = number of cones in the gular crest; d/cr = number of cones and pointed tubercles in the dorsal crest. — Mus No. = Museum accession number in the ZFMK Bonn, Germany. — MM = adult male, FF = adult female, jm = juvenile male, jf = juvenile female.

Mus No.	Sex	s/v*	Tail*	horn*	c/snt*	i.o.d.*	com/snt*	c/com*	g/cr	d/cr
Holotype 63049	MM	76	86	4.5	20.0	8.5	14.0	12.0	18	21
63050	MM	65	87	4.0	19.5	8.5	13	11.5	20	25
63051	MM	62	80	4.0	19	8.5	13	11.5	23	14(d)
63052	FF	70	83	1.0	21	8.5	12	13	12	25
63053	FF	59	71	1.0	18	8.0	13	11	15	23
63054	FF	70	80	1.0	19	8.5	13.5	12.5	10	19
63055	FF	75	84	1.5	19.5	8.0	14	12	20	22
63056	FF	72	83	2.0	20	8.0	13.5	12.5	11	30
63057	jm	37	48	1.0						
63058	jf	32	37							

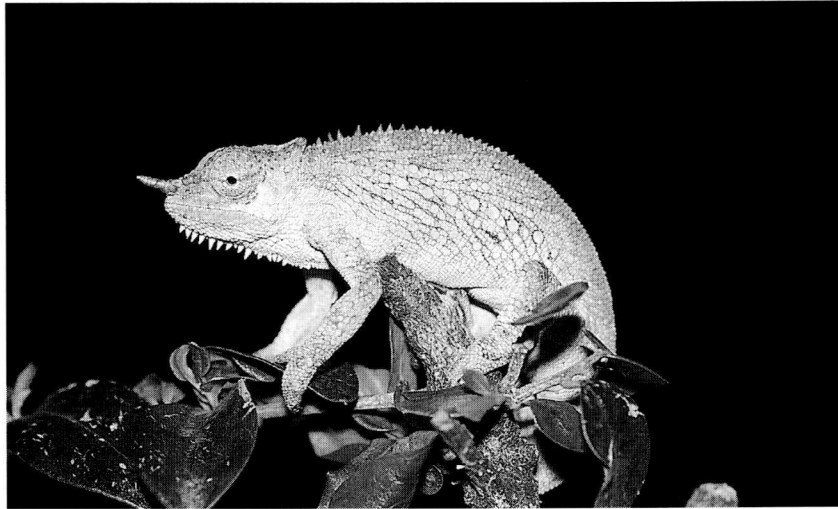


Fig. 1: Adult male of *Chamaeleo (Trioceros) balebicornutus* n. sp. from the Harena forest, Ethiopia.

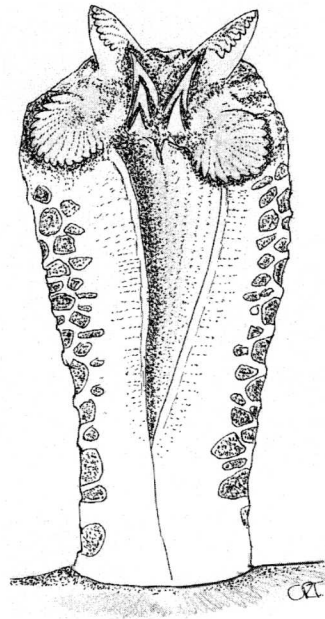


Fig. 2: Sulcal view of the hemipenis of the holotype of *Chamaeleo (Trioceros) balebicornutus* n. sp.

Description of the holotype: A small chameleon with a total length (TL) of 162 mm. Casque flat. No parietal crest. The lateral crests terminate posteriorly in two large pointed tubercles on each side of the casque giving it a swept up appearance and causing the posterior edge of the casque to be shallowly notched in the midline. There is no temporal crest. The supra-orbital crest has a dentate appearance. The canthal ridges are smooth and each side terminates in an annulated horn which projects forward for 4 mm at an angle of  $10^\circ$  from the horizontal. The

two horns are tightly opposed to each other. The nare is sited midway between the anterior orbital rim and the tip of the snout, opens inferiorly and has no indication of a nasal bulge. Gular crest composed of 18 elongated white conical tubercles, largest anteriorly and becoming progressively smaller posteriorly. The gular area is incised by 4 shallow grooves that are most noticeable posteriorly and enclose a few islands of enlarged oval tubercles. Dorsal crest composed of 8 large cones, largest anteriorly and followed by a rapidly diminishing series of pointed tubercles to fade completely by about  $\frac{2}{3}$  of the way along the keel. There is no crest on the tail. The gular crest is followed posteriorly by a midline ventral row of white tubercles that extends a short way beyond the vent. Scallation heterogeneous with large flattened platelike tubercles 2–3 times the diameter of the surrounding tubercles, profusely scattered over the flanks forming several vague rows. Tail and belly covered with finer sub-homogeneous granules. Eyeball skin coated with fine homogeneous granules. The tail is longer than the snout/vent length, comprising 53 % of the TL.

**Hemipenis:** (Fig. 2). Club-shaped. Truncus is set with shallow simple calyces, the most prominent being on the proximal aspect of the asulcal side. The sulcal lips are almost smooth. The apex is adorned with 2 pairs of similarly sized rotulae with finely dentate free margins. The asulcal pair are orientated almost vertically while the sulcal pair are orientated horizontally towards the sulcal side. Between each of the sulcal and asulcal rotulae is a row of 2–3 large thornlike papillae curved toward the asulcal side.

**Colour in life:** Holotype — Background a light moss green. Flank tubercles divided into many vague rows by dark interstitial skin. A dark patch is present over the dorsal keel at the nape and pelvis and between these, two broad hourglass shaped dark blotches extend from the keel to the belly overlain by green tubercles. Top of head and temporal area pale off-white. Lower labials pale blue. Limbs blotched with dark brown, as is the tail. Belly off-white to green. Eyeballs with 8 radiating lines. Gular crest white. Anterior dorsal crest spines a rich brown chocolate colour.

**Female colour:** Background pale to bright green. Dorsal crest spines dark orange as are the lateral/supra-orbital crests and the tip of the snout. Gular crest white. No radiating lines on the eyeball. Belly crest indicated only by a faint white line.

**Variation:** (Table I) Little variation of any significance is seen amongst the chameleons. The gular crest varies between 18–23 cones and the number of cones and pointed tubercles in the dorsal crest varies between 14 to 25. Sexual dimorphism is seen in the development of the annulated horns which are much smaller in the female, and in the smaller average number and reduced prominence of the gular cones. The rostral projections are clearly seen in even the smallest specimens.

**Reproduction:** ZFMK 63056 was dissected and found to contain 16 eggs (6 in the left oviduct and 10 in the right). These averaged 8 mm x 6 mm in size.

**Habitat:** Broadleaved undifferentiated Afromontane rain forest between 1500 m – 2400 m. The Harena forest cloaks the southern slopes of the Bale Mountains. The tops of the tallest trees reach up to about 40–45 metres with the dominant species including *Aningeria adolfi-friedericii* and *Podocarpus latifolius* in the lower elevations and *Hagenia abyssinica* and *Schefflera abyssinica* at the higher reaches of

this chameleon's range. The chameleons are found in the lower shrub layer of the forest at perch heights varying between 1.5 metres and 5 metres above the ground. The holotype was collected at a height of approximately 5 metres in a tall specimen of *Hypericum revolutum* near a rivulet at the edge of a large grassy glade (Katcha clearing).

Notes: The Bale mountains form an important centre of endemism in Ethiopia. In addition to *Ch. (T.) balebicornutus* n. sp., two other species of chameleon are known from these mountains. The recently described *Ch. harennae* occurs chiefly in the upper reaches of the Harennna forest between 2400 metres and the upper forest line at about 3300 metres. Here it extends into the giant heathers and ericaceous shrubs. The two species are sympatric in the zone around 2400 metres where they both share the same type locality (Katcha clearing). *Ch. (T.) balebicornutus* n. sp. differs chiefly from *Ch. harennae* in the presence of paired rostral horns in both sexes, a more heterogeneous scalation and in the complete absence of a parietal crest. The tail is also smooth. The third species *Chamaeleo (T.) affinis* was not found in the Harennna forest but rather on the northern slopes of the mountains at elevations up to at least 2700 metres. This species has a much finer scalation with no trace of a rostral projection, and either no gular crest or a pair of low gular ridges.

Taxonomic affinities: The arrangement of the rostral horns in *Ch. (T.) balebicornutus* n. sp. is unusual in that all other species with paired annulated horns are strictly west African forms. This, coupled with the absent parietal and temporal crests (also characteristics of the west African *Ch. cristatus* group (Klaver & Böhme 1992) suggests a west African splinter radiation. This is not however borne out by the affinities of the other herpetofauna of the Ethiopian highlands, which show nothing in common with either the west or central African forests, and are largely unique with a high rate of endemism. In Tanzania, *Ch. (T.) deremensis* shares some features with *balebicornutus* n. sp. in that it also lacks a parietal and temporal crest, but has no gular crest and 3 annulated horns.

*Chamaeleo (Trioceros) conirostratum* n. sp. (Fig. 3)

Diagnosis: The adult male chameleon is recognised by a unique rostral process comprising of an elongated non-annulated cone 3 mm in length which appears to be attached to a pliable base. The tail is slightly shorter than the snout/vent length. The general habitus, shape of the casque and structure of the parietal crest ally this taxon to the *Ch. bitaeniatus* (sensu lato) group.

Derivatio nominis: The name *conirostratum* derives from the unique shape and position of the rostral process.

Holotype: NMK L/1949, an adult male collected by Parker and Stubbs in 1982 from Lomoriti, at 3500 feet a.s.l., south west Imatong Mountains, southern Sudan 03°54'N 32°43'E.

Description: A small chameleon with a total length of 130 mm. Casque narrowly elevated and peaked posteriorly. Parietal crest distinct, forks anteriorly with a few small tubercles continuing in a midline row between the orbits. The temporal crests

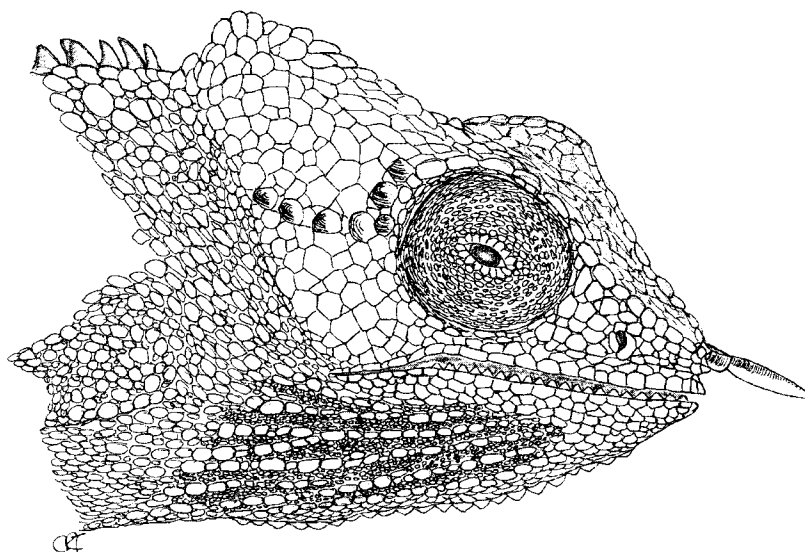


Fig. 3: Detail of the head of the adult male holotype of *Chamaeleo (Trioceros) conirostratum* n. sp. from Lomoriti, Imatong mountains, southern Sudan.

are distinct, comprising 4 enlarged tubercles on each side. The canthal ridges are edged in enlarged, but smooth oval scales (5 on the left and 6 on the right). The canthal ridges merge anteriorly to end in the base of an elongated non-annulated thin cone projecting 3 mm off the front of the upper lip. The base of the cone appears to be pliable (In the preserved specimen this appendage is bent downwards and to the left side over the tip of the snout — possibly an artefactual state caused at the time of preservation). There are no traces of any pre-orbital projections. The nares open facing directly posteriorly, from a nasal bulge located  $\frac{3}{8}$  of the distance from the anterior orbital rim to the tip of the snout. The gular crest is composed of a continuous series of 24 low cones between the mentum and the angle of the jaw, and continues posteriorly as an even lower series of enlarged midline belly tubercles to the vent. The skin on the sides of the throat are incised by shallow grooves (6 on the left and 5 on the right).

The dorsal crest begins at the nape with 3 isolated small cones and is then followed by somewhat triangular laterally flattened tubercles that enlarge successively in groups of 2 to 3 along the dorsal ridge. The crest fades completely by the sacrum and then continues as a low series of angulated tubercles to again fade by the mid tail. Background scalation heterogeneous but not particularly coarse. A single row of slightly enlarged tubercles extends from the shoulder region over the upper third of the flank towards the pelvis. Belly covered with finer almost homogeneous flattened tubercles. The skin of the circular eyeball is covered in roughly homogeneous granules with a few slightly enlarged rounded tubercles seen scattered near the eye opening. The hemipenes are not extruded.

Dimensions: Snout/vent length 67 mm, Tail length 63 mm, Casque tip/snout 21 mm, Casque tip/commissure 13 mm, Commissure/snout 14 mm, Rostral process 3 mm.

Notes: The female of this species is currently undescribed.

Taxonomic affinities: *Ch. (Trioceros) conirostratum* is closely allied to the other chameleons of the “*Ch. bitaeniatus* group” (Rand 1963) as evidenced by the overall similarity to *Ch. (T.) bitaeniatus* Fischer, 1884 in body proportion and the shape and structure of its head and body crests. The unusual structure of its rostral process does not exclude it from the subgenus *Trioceros* where annulated horns are regarded as a synapomorphous character. The structure of its rostral projection does not strictly qualify as a horn and its position and orientation in the living chameleon awaits clarification. Other species of chameleon that are known to occur in the Imatong Mountains include *Ch. (Trioceros) bitaeniatus*, *Ch. (T.) kinetensis* Schmidt, 1943 and *Ch. (T.) ellioti* Günther, 1895 (Böhme & Klaver 1980). None of these species possess horns or rostral projections. *Ch. (Trioceros) marsabitensis* Tilbury, 1991 from the Marsabit volcano to the south east of the Imatongs, possesses a short single annulated rostral horn, and *Ch. (Trioceros) hoehnelii* Steindachner, 1891 differs in that its rostral projection is more of a clump of tubercles than a horn.

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#### Zusammenfassung

Es werden zwei neue Arten gehörnter Chamäleons aus isolierten Bergwäldern Ostafrikas beschrieben. Bei einer Art besitzt das Männchen einen markanten rostralen Zapfen, der keinem der von Chamäleons bekannten Anhänge ähnlich ist. Die andere Art zeichnet sich durch paarige geringelte Rostralhörner aus, ein Merkmal, welches bisher als charakteristisch für eine Gruppe westafrikanischer Chamäleons angesehen wurde.

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