

A new frog species of the genus *Cardioglossa* from the Tchabal Mbabo Mtns, Cameroon

(Anura: Arthroleptidae)

Eine neue Froschart der Gattung *Cardioglossa*
aus dem Tchabal Mbabo - Gebirge, Kamerun
(Anura: Arthroleptidae)

HANS-WERNER HERRMANN & PATRICIA A. HERRMANN
& ANDREAS SCHMITZ & WOLFGANG BÖHME

KURZFASSUNG

Zwölf Arten der arthroleptiden Froschgattung *Cardioglossa* sind aus Kamerun bekannt. Eine neue Art aus dem Tchabal Mbabo-Gebirge der Adamaoua-Provinz im Westen Kameruns wird beschrieben.

Die neue Art *Cardioglossa alsco* sp. n. wird als Vertreter der *Cardioglossa pulchra-venusta-trifasciata*-Gruppe betrachtet. Die Art ist ausschließlich von der Typuslokalität in Galeriewäldern in einer Höhe von 1700 bis 2100 m bekannt.

ABSTRACT

Twelve species of the arthroleptid frog genus *Cardioglossa* are recognized from Cameroon. A new species is described from the Tchabal Mbabo Mtns in the Adamaoua Province of Western Cameroon.

The new species *Cardioglossa alsco* sp. n. is considered to be a member of the *Cardioglossa pulchra-venusta-trifasciata* group. The species is known only from the type locality within gallery forests at an altitude of 1,700 to 2,100 m.

KEY WORDS

Amphibia: Anura: Arthroleptidae: *Cardioglossa alsco* sp. n., Tchabal Mbabo Mtns, Cameroon; new species

INTRODUCTION

The arthroleptid genus *Cardioglossa* comprises 16 species of small ranid-like frogs (< 40 mm) which have a strongly developed sexual dimorphism with males usually exhibiting a hypertrophied third finger. *Cardioglossa* species are typically distributed in tropical lowland and montane forests of Western and Central Africa (POYNTON 1999). Species' distribution extends into gallery forests of the savanna belt, others are found in montane habitats at altitudes of up to 2,700 m (AMIET 1972); some have restricted geographical and altitudinal ranges. Out of the sixteen species, twelve are recorded from Cameroon (LEBRETON 1999; FRÉTEY & BLANC 2000). Of these, only five species were recognized until SCHIØTZ (1963) described *pulchra* SCHIØTZ,

1963; subsequently, six additional species were described by AMIET (1972; 1981).

Based on material collected by three of us (H.-W. H., P. A. H., A. S.) in January 2000 we here describe a new species of *Cardioglossa* from the Tchabal Mbabo mountain range in Western Cameroon. The Tchabal Mbabo are unique in their physiogeography. They are a broad u-shaped mountain range on a west-east axis, open to the north with a rim altitude of 2,000 - 2,100 m. The southern slopes are slowly mounting grass savanna with patchy gallery forests along creeks. In contrast, the northern slopes drop precipitously from the rim to an altitude of approximately 1,300 m and are carpeted by large tracts of dense tropical cloud forest (BÖHME & SCHNEIDER 1987).

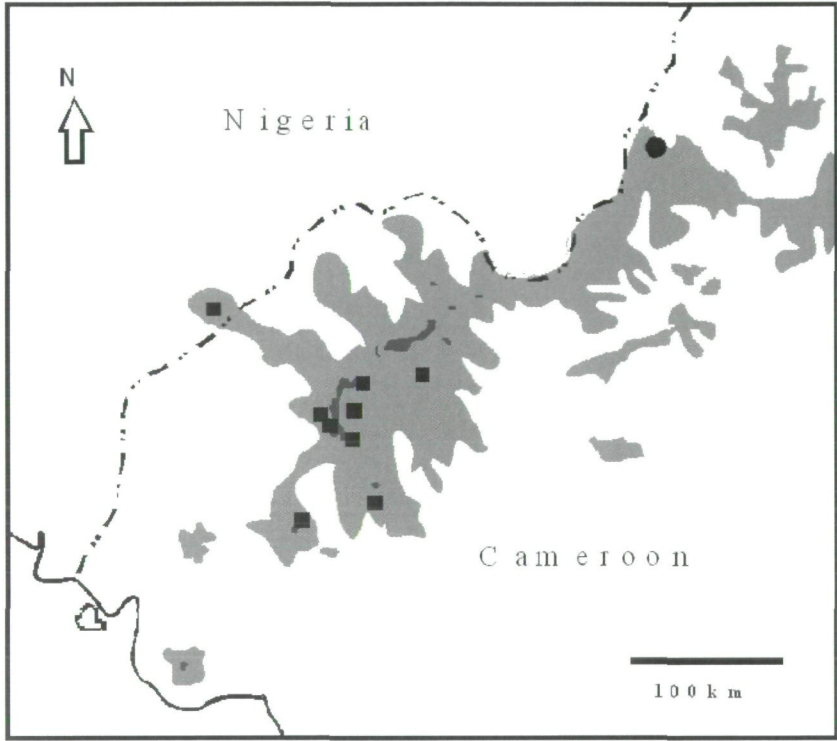


Fig. 1: Locality records for *Cardioglossa alsco* sp. n. (circle) and *C. pulchra* (squares, modified after AMIET 1972a).

Abb. 1: Fundorte von *Cardioglossa alsco* sp. n. (Punkt) und *C. pulchra* (Quadrate, verändert nach AMIET 1972a).

MATERIALS AND METHODS

A series of 73 specimens (ZFMK 75713 - 75725 and 77677 - 77736) were collected on 28 and 29 January 2000 along creeks in a gallery forest at an altitude of 2,100 m in the vicinity of the settlement Fungui in the Tchabal Mbabo Mnts, Adamaoua Province, Cameroon (fig. 1). All specimens were collected on the immediate southern side of the rim along creeks in gallery forest. Collection was during the dry season with no precipitation occurring; temperatures in the gallery forest ranged between 4 - 28 °C.

Vouchers were collected at night by hand-capture and preserved in 70% ethanol. Snout-vent length is abbreviated SVL; all measurements are in millimeters. Sex was

determined by examination of the third finger which is elongated in adult males. Comparisons of skin structures were made from photographs of live animals. Coloration was determined by photographs of live and freshly preserved specimens. Head width is the greatest width of the head; foot length is measured from the tarsal joint to the tip of the fourth toe. Further comparative material was examined in the Muséum d'histoire naturelle, Geneva (Appendix).

The following institutional abbreviations are used: MHNG = Muséum d'histoire naturelle, Geneva; UZM = Universitets Zoologiske Museum, Copenhagen; ZFMK = Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn.

RESULTS

Cardioglossa alsco sp. n.

H o l o t y p e: ZFMK 77678 (fig. 2), adult ♂, from 5 km E of Fungui (07° 14' N, 12° 03' E, 2,100 m), Tchabal Mbabo Mtns, Adamaoua Province, Cameroon, collected on 29 January 2000.

P a r a t y p e s: ZFMK 75714, 77677, 77687-77692, 77694, 77697 adult ♂♂, ZFMK 75713, 77679-77686, 77693, 77695-77696, 77698 adult ♀♀, all collected with the holotype.

D i a g n o s i s: A medium sized *Cardioglossa* (♂♂ to 30.0 mm, ♀♀ to 34.0 mm) with a granular dorsal integument and a blue ventral coloration. Within this group it bears closest likeness to *pulchra* SCHIÖTZ, 1963 but differs in the following characters: (1) tan dorsum with medial pattern consisting of three large confluent black blotches - cephalic, scapular, lumbar - which may be faded and conjoined to various degrees, (2) a finely granular textured dorsum (tubercles much less pronounced than in *pulchra*) in life [note: the holotype of *C. pulchra* (UZM R072173) in preservative has a smooth dorsum in contrast to live specimens which exhibit a very granular dorsum (see figure in AMIET 1972b)], (3) absence of spines on fingers in ♂♂, (4) ♂♂ relatively smaller [*C. alsco* (n = 11) 24.2 – 30.0 mm, \bar{x} = 26.1 mm; *pulchra* (n = 10) 27.0 – 33.2 mm, \bar{x} = 29.2 mm (data after SCHIÖTZ 1963 and AMIET 1972a)].

D e s c r i p t i o n o f h o l o t y p e: SVL 28.2 mm; head width 8.5 mm (30 % SVL); interorbital space much wider than eyelid; canthus rostralis rounded; nares closer to snout tip than eye; snout rounded in dorsal view and in profile; tympanum smaller than eye and of similar size in males and females; toes 3-5 of the left foot amputated for tissue samples; remaining toes with small, distinct discs, rudiment of web; a single small metatarsal tubercle, shorter than inner toe; tibiotarsal joint of the adpressed hind limb reaches the tympanum; hands large with elongated third finger; second and third fingers without spines; forearm length 7.5 mm (27 % SVL); tibia length 12.9 mm (46 % SVL), calf length 13.4 mm (48 % SVL); foot length 18.1 mm (64 % SVL).

Skin on anterior dorsum (fig. 2a) smooth with increasing granulation posteriorly and on the flanks; granulation consists of slightly pronounced tubercles; skin on venter, including gular region, smooth (fig. 2b).

Color in life (fig. 2), tan dorsum with remnants of three large dark consecutive blotches; these are faded to varying degrees with the cephalic blotch being a dark triangle with light stippling and the scapular and lumbar blotches being diffuse, consisting of shaded areas of varying intensity; broad black lateral band extends from the snout tip across the nares covering the lower two thirds of the eye and descends to the venter at mid-body; upper third of iris bronze; a black spot occurs at the inguinal area; flanks immaculate pink; arms and legs dorsally tan with thin broken black banding; venter blue; gular region with intense black speckling; body and limbs with slight black speckling. Color in ethanol is similar to color in life with the exception that the pink areas of the flanks are beige and formerly blue areas become grey.

D e s c r i p t i o n o f p a r a t y p e s: Body dimensions and proportions of the holotype, nine ♂ and twelve ♀ paratypes are given in table 1. Females are larger than males and lack the elongated third finger. Male paratypes have a smaller SVL than the holotype; all lack spines on elongated third finger. Paratypes similar to holotype in body proportions and coloration. Tympanum in ♂♂ and ♀♀ of similar size. On the dorsum the large medial blotches vary from a shadow of darker pigment to three dark blotches which merge to a broad undulating stripe; venter blue with varying degrees of black speckling.

D i s t r i b u t i o n a n d e c o l o g y: *Cardioglossa alsco* is known only from the type locality, the southern slopes of the Tchabal Mbabo Mtns. The frogs were found during the dry season at night while calling. Individuals were found under large stones around shallow pools which were adjacent to a creek in a gallery forest (fig. 3).

E t y m o l o g y: The specific name is a patronym for the American Linen Supply

Table 1: Body dimensions (mm) and means of *Cardioglossa alsco* sp. nov.. \bar{x} = mean, S = standard deviation. Males: ZFMK 75714, 77677-77678, 77687-77692, 77694, 77697, females: ZFMK 75713, 77679-77686, 77693, 77695, 77696, 77698.

Tab. 1: Körpermaße (mm) und Mittelwerte bei *Cardioglossa alsco* sp. nov.. \bar{x} = Mittelwert, S = Standardabweichung. Männchen: ZFMK 75714, 77677-77678, 77687-77692, 77694, 77697, Weibchen: ZFMK 75713, 77679-77686, 77693, 77695, 77696, 77698.

	Males / Männchen (n = 11)	Females / Weibchen (n = 13)
snout-vent length (SVL) / Kopf-Rumpflänge (KRL)	24.2 – 30.0 (\bar{x} =25.7, S=1.9)	25.2 – 34.0 (\bar{x} =27.8, S=2.2)
head width (HW) / Kopfbreite (KB)	7.6 – 9.3 (\bar{x} =8.2, S=0.5)	7.3 – 10.1 (\bar{x} =8.5, S=0.7)
(HW / SVL) / (KB / KRL)	0.30 – 0.35 (\bar{x} = 0.32, S=0.02)	0.28 – 0.34 (\bar{x} =0.31, S=0.02)
forearm length (FAL) / Unterarmlänge (UAL)	5.5 – 8.1 (\bar{x} =6.6, S=0.8)	5.6 – 7.5 (\bar{x} =6.7, S=0.6)
(FAL / SVL) / (UAL / KRL)	0.22 – 0.27 (\bar{x} =0.25, S=0.02)	0.20 – 0.27 (\bar{x} =0.24, S= 0.02)
thigh length (TL) / Oberschenkellänge (OSL)	9.6 – 12.9 (\bar{x} =11.3, S=0.9)	11.1 – 13.6 (\bar{x} =12.4, S=0.7)
(TL / SVL) / (OSL / KRL)	0.38 – 0.48 (\bar{x} =0.43, S=0.03)	0.39 – 0.48 (\bar{x} =0.45, S=0.02)
shank length (SL) / Unterschenkellänge (USL)	11.4 – 13.4 (\bar{x} =12.4, S=0.05)	11.9 – 14.1 (\bar{x} =13.2, S=0.7)
(SL / SVL) / (USL / KRL)	0.41 – 0.51 (\bar{x} = 0.48, S=0.03)	0.41 – 0.51 (\bar{x} =0.48, S=0.02)
foot length (FL) / Fußlänge (FL)	15.4 – 19.5 (\bar{x} =17.3, S=1.3)	17.7 – 22.2 (\bar{x} =19.1, S=1.2)
(FL / SVL) / (FL / KRL)	0.61 – 0.75 (\bar{x} =0.66, S=0.05)	0.61 – 0.74 (\bar{x} =0.69, S=0.03)

Company (ALSCO) who's German branch supported the authors' excursion to the Tchabal Mbabo area during which the species was discovered.

R e m a r k s: Together with the holotype and the paratypes we collected one further adult ♂ (ZFMK 75715) and 48 juvenile and subadult specimens of *Cardioglossa alsco*

(ZFMK 75716-75725, 77699-77736). These specimens resemble the type specimens in all morphological aspects relative to their developmental stages. The variation of the dorsal pattern as described for the paratypes corresponds to the variation of this character in juvenile and subadult specimens.

DISCUSSION

AMIET (1972a) describes five new species of *Cardioglossa* whereby he finds measurements and proportions to be of low diagnostic value, whereas pattern and coloration are viewed as valuable diagnostic characters. Skin texture was also found to be of interest in determining species. With reference to these points, namely the dorsal pattern and degree of granulation of the posterior dorsal and lateral integument, *Cardioglossa alsco* sp. nov. differs markedly from the morphologically related *C. pulchra*. Relative to the dorsal pattern *C. pulchra* represents one extreme within the genus, with the three dorsal blotches fused to a broad black stripe extending over the entire dorsum, and *C. venusta* AMIET, 1972 representing the other extreme with the three dorsal blotches reduced to dispersed speckling. Within species dorsal pattern remains relatively consistent with the exception of *C.*

oreas AMIET, 1972, in which the variation of the dorsal pattern is comparable to that found in the entire genus. However, a high degree in dorsal pattern variation is also found in *C. alsco*, seemingly second only to *C. oreas*.

The hypertrophied third finger of male *Cardioglossa*, also found in species of *Arthroleptis* and *Schoutedenella*, may serve a function in reproduction. Whether the presence or lacking of spines on the third and sometimes second fingers within *Cardioglossa* has a functional significance cannot be interpreted. The only other species lacking spines is *C. oreas* (AMIET 1981), however it also lacks an elongated third finger.

All 73 specimens of *C. alsco* were found within a small area suggesting a high concentration of animals. Our attention was drawn to the frogs by their calls. This is



Fig. 2a: Adult male *Cardioglossa alsco* sp. n. (ZFMK 77678).
Abb. 2a: Adultes Männchen von *Cardioglossa alsco* sp. n. (ZFMK 77678).

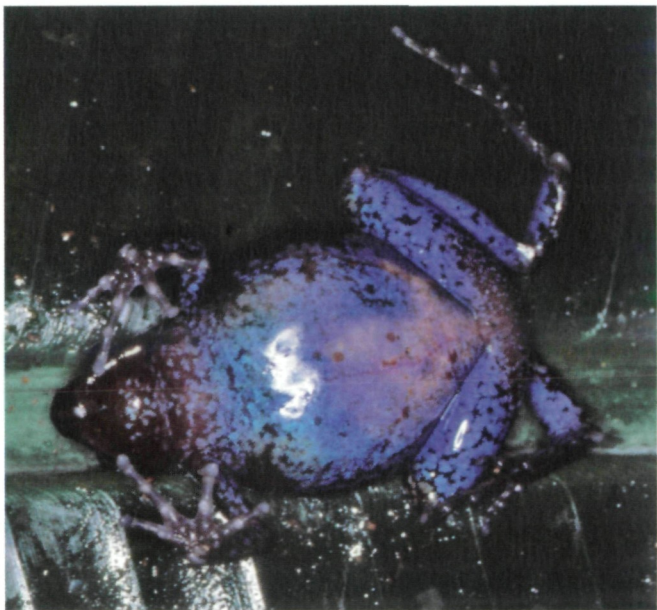


Fig. 2b: Adult male *Cardioglossa alsco* sp. n. (ZFMK 77678), ventral view.
Abb. 2b: Adultes Männchen von *Cardioglossa alsco* sp. n. (ZFMK 77678), Ventralansicht.



Fig. 3: Gallery forest habitat of *Cardioglossa alsco* sp. n. on the immediate southern side of the Tchabal Mbabo Mtns' rim.

Abb. 3: Galeriewaldhabitat von *Cardioglossa alsco* sp. n. unmittelbar südlich des Gipfelkamms des Tchabal Mbabo-Gebirges.

similar to SCHIÖTZ's (1963) discovery of the type specimens of *C. pulchra* on 5 January, 1959 in a comparable habitat on the Obudu Plateau in neighboring Nigeria. His specimens were also found calling during the dry season. The calling activity of our specimens together with their presence under stones, where *Cardioglossa* species are known to deposit eggs (AMIET 1972b), suggests a breeding aggregation, although no amplexus nor clutches were observed. Additionally, this high concentration could be assisted by the reduced available moist refugia due to the dry climatic period.

According to a species distribution map published in AMIET (1972a) *C. pulchra* is shown as an isolated point in the Tchabal Mbabo. The dorsal patterns of eight specimens (illustrations provided by J.-L. AMIET) collected by J.-L. AMIET (collection J.-L. AMIET no. 72.844-7, 65, 67, 69-70) from Mayo Kelele (1,675 m) and Hama Aoudi

(approx. 2,100 m) in May 1970 and December 1972 complied with dorsal patterns in our specimen series, thus presumably these represent further specimens of *C. alsco*. The nearest *C. alsco* and *C. pulchra* populations are separated by a distance of approximately 230 km (fig. 1). Both species are montane with *C. alsco* found at altitudes of around 1,700 to 2,100 m and *C. pulchra* found at the lower altitudes of 1,200 to 1,700 m (with the exception of one specimen found at 1,900 m) (AMIET 1972a). Although mountains of comparable height are located within the distribution gap, neither species has been reported.

AMIET (1981) tentatively identifies four distinct phylogenetic lineages within the genus *Cardioglossa*. Based on being a montane species with a granulate integument and a blue ventral color we assign *C. alsco* to the *C. pulchra-venusta-trifasciata* group sensu AMIET (1981).

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Appendix

Specimens examined / Undersuchte Exemplare

Cardioglossa also sp. nov.: ZFMK 77677-77736, 75713-75725: 5 km E of Fungui, Tchabal Mbabo Mtns, Cameroon, 2,100 m; *Cardioglossa oreas*: MHNG 1253.87: Bamboutos Mtns, Cameroon, 2,600 m; *Cardioglossa pulchra*: MHNG 1521.58: Nsoug, Mt Manengouba, Cameroon, UZM R072173: Obudu Plateau, Nigeria, approx. 1,600 m; *Cardioglossa trifas-*

ciata: MHNG 1253.88: Nsoug, Mt Manengouba, Cameroon, 1,750 – 1,800 m; *Cardioglossa venusta*: MHNG 1253.89: Fotabong, Cameroon, 950 – 1,000 m, ZFMK 67544-45: Nyasoso, Mt Kupe, Cameroon, ZFMK 69194: Nguengue, Mt Nlonako, Cameroon, ZFMK 69713: Edib, Bakossi Mtns, Cameroon.

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AUTHORS: Hans-Werner HERRMANN, Center for Reproduction of Endangered Species (C.R.E.S.), Zoological Society of San Diego, P. O. Box 120551, San Diego, CA 92112-0551, U.S.A., <hwherrmann@sandiegozoo.org> and P.O. Box 3055, Messa, Yaounde, Cameroon; Patricia A. HERRMANN, P. O. Box 3055, Messa, Yaounde, Cameroon; Andreas SCHMITZ, Department of Herpetology & Ichthyology, Museum of Natural History, C. P. 6434, 1211 Genève 6, Switzerland; Wolfgang BÖHME, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, 53113 Bonn, Germany

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