The status of *Leptopelis barbouri* Ahl, 1929 and eleven other nomina of the current tree-frog genus *Leptopelis* (Arthroleptidae) described from East Africa, with a redescription of *Leptopelis grandiceps* Ahl, 1929

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Abstract

An investigation of name-bearing types and other relevant type specimens of twelve nominal *Leptopelis* taxa described from or distributed in the Eastern Arc Mountains in East Africa was carried out. Our aim was to clarify their status and where necessary revise respective nomina. We suggest several nomenclatural and taxonomic actions: 1) *Leptopelis barbouri* Ahl, 1929 is transferred to the synonymy of *Leptopelis flavomaculatus* (Günther, 1864) as a junior subjective synonym; 2) *Leptopelis grandiceps* Ahl, 1929 is resurrected from the synonymy of *Leptopelis uluguruensis* Barbour & Loveridge, 1928 to a valid species conforming to the tree frogs which have been known as ‘*L. barbouri*’ and a lectotype is designated; 3) *Leptopelis usambarae* Ahl, 1929 is transferred from the synonymy of *L. uluguruensis* Barbour & Loveridge, 1928 to the synonymy of *L. grandiceps* Ahl, 1929 as a subjective synonym; 4) a lectotype of *Leptopelis amaniensis* Ahl, 1929 (synonym of *L. uluguruensis*), *Hylambates johnstoni* Boulenger, 1897 (synonym of *L. flavomaculatus*) and *Leptopelis signifer* Ahl, 1929 (synonym of *L. vermiculatus*) is designated to stabilize identity of the nomina; and 5) the type locality of *Leptopelis martiensseni* Ahl, 1929 and *Leptopelis tanganus* Ahl, 1929 is corrected.

Key words: anurans, taxonomy, nomenclature, type material, revalidation, lectotype designation, Eastern Arc Mountains, Eastern Afromontane

Introduction

The arthroleptid genus *Leptopelis* Günther, 1859 currently comprises more than 50 species of mainly arboreal frogs inhabiting sub-Saharan Africa. Five species are known from forested areas along the Eastern Arc Mountains in southern Kenya and Tanzania and Southern Highlands in southern Tanzania, East Africa (Harper et al. 2010): *L. barbouri* Ahl, 1929, *L. flavomaculatus* (Günther, 1864), *L. parkeri* Barbour & Loveridge, 1928, *L. uluguruensis* Barbour & Loveridge, 1928 and *L. vermiculatus* (Boulenger, 1909). With an exception of *L. flavomaculatus*, which tolerates more open areas and dry low-elevation forests, the other four species are restricted to humid, predominantly montane forests (Channing & Howell 2006; Harper et al. 2010).

In 1929 Ahl published his work on African tree frogs of the genus *Leptopelis*. The work introduced twenty-one new nomina (singular nomen, sensu Dubois 2000; all were listed also in Ahl 1931), but seventeen have been moved into synonymy (as in Frost 2014). With one exception, *L. barbouri*, which is currently treated as a valid species, all nominal taxa described from the Eastern Arc Mountains (mainly Usambara Mountains) by Ahl have been synonymized. In the checklist of East African herpetofauna (Loveridge 1957), followed by the review of East African tree frogs (Schiøtz 1975), *L. amaniensis* Ahl, 1929, *L. grandiceps* Ahl, 1929, *L. tanganus* Ahl, 1929 and *L.
usambarae Ahl, 1929 were transferred into the synonymy of *L. uluguruensis*, *L. martiensseni* Ahl, 1929 into the synonymy of *L. parkeri*, and *L. signifer* Ahl, 1929 into the synonymy of *L. vermiculatus*. *L. tanganus* and *L. signifer* were firstly proposed as synonyms of the respective nomina by Loveridge (1933). However, the original ZMB types (Museum für Naturkunde Berlin, formerly Zoologisches Museum Berlin) were seemingly lost (Schiøtz 1975), and with an exception of *L. tanganus* and *L. signifer*, of which a paratype and a syntype were sent on exchange to MCZ (Museum of Comparative Zoology, Harvard University) where Loveridge was based, the synonymy was proposed only on the basis of a study of the original descriptions (Ahl 1929).

**FIGURE 1.** *Leptopelis flavomaculatus*: Name-bearing types of A–B) *Leptopelis barbouri* (lectotype, female, MCZ A-13561), C–D) *Hyperolius flavomaculatus* (holotype, juvenile, BMNH 1947.2.9.82) and E) *Hylambates johnstoni* (lectotype, subadult male?, BMNH 1947.2.10.4). Compare *L. barbouri* lectotype to the tree frogs having been commonly named with this nomen and notice the difference (Fig. 6; *L. grandiceps* now).

*Leptopelis barbouri* was described by Ahl (1929) based on the material collected by A. Loveridge on ‘Mt. Lutindi, Usambara Mtns.’ on 10. xii. 1926 and initially identified as *L. aubryi* (Duméril, 1856) as listed in Barbour & Loveridge (1928). The material consists of two adult females (MCZ A-13561–13562) and nine juveniles in early post-metamorphic stage (MCZ A-13563–13571). Although the material was not seen by Ahl (according to Loveridge 1933, 1957; Schiøtz 1975), he paradoxically provided a more detailed description of the material than that given by Barbour & Loveridge (1928) and differentiated it as a new species. Loveridge (1933, 1957) disagreed
with this decision and because he could not find any differences from Cameroonian *L. aubryi*, he transferred *L. barbouri* back to the synonymy of *L. aubryi*, where it remained till Schiøtz’s (1975) revision. Schiøtz (1975) re-examined the type material and revalidated *L. barbouri* as a species distinct from *L. aubryi* and designated a lectotype (adult female MCZ A-13561; Fig. 1A–B). He also mentioned that the juvenile types are only hardly identifiable as conspecifics. Beside the *L. barbouri* type material from the Usambara Mts., he compared it also with new material of six adult males from the Dabaga Forest (Udzungwa Mts.). Due to some morphological differences, mainly smaller tympanum, he mentioned that “the males from Dabaga are only doubtfully referred to this species” [L. barbouri]. However Schiøtz speculated about sexual dimorphism or population-level differentiation at the subspecific level, therefore he finally decided to treat all the specimens as conspecific under the name *L. barbouri*. Schiøtz (1975) also provided a colour photograph, drawing of a foot, and spectrogram of the reproductive call of the Dabaga frogs, which set the usage of *L. barbouri* for the tree frogs corresponding to the Schiøtz’s Dabaga material (e.g. Schiøtz 1999; Harper & Vonesh 2002; Channing & Howell 2006; Pickersgill 2007; Schiøtz et al. 2008; Harper et al. 2010).

This work aims to clarify the situation of type material of *L. barbouri* and the other nomina introduced by Ahl (1929) from the area of the Eastern Arc Mountains, as the ZMB type material was recently rediscovered. We further discuss species identities based on our own investigations of the type specimens and in comparison with the type specimens of other nominal species related to the Eastern Arc Mountains and Tanzanian Southern Highlands. Where necessary to stabilize a nomen, we designate a lectotype and apply nomenclatural changes accordingly.

### Material and Methods

Specimens examined are deposited at BMNH: Natural History Museum, London, UK; MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, USA; MHNG: Museum d’Histoire Naturelle, Geneva, Switzerland; MTSN: Trento Science Museum, Trento, Italy; ZMB: Museum für Naturkunde, Leibniz Institute for Research on Evolution and Biodiversity at the Humboldt University Berlin, Germany. There is a controversy on how to explain Ahl’s (1929) terminology used for specimens from type series. He used the following terms, in German: “Type” [= type], in plural “Typen” [= types], and “Cotype” [= cotype] or “Cotyphen” [= cotypes], respectively. The ‘cotype’ is a term not recognized by the fourth edition of the International Code of Zoological Nomenclature but had been formerly used to mean either syntype or paratype (ICZN 1999; glossary). Ahl (1929) combined the plural of both terms for different specimens even within the same description making interpretations confusing. We therefore follow an approach already used by Loveridge (1933) where “Type(n)” and “Cotyphen” are understood like holotype (syntypes) and paratypes (or ‘paratypes’ if in a series together with syntypes), respectively. If the label(s) on/in the jar were marked by a star (made probably by E. Ahl), we treated the specimen(s) in the jar like the “Type(n)” (holotype/syntypes in contemporary terminology) in accordance to the provenance and information in the original publication (Ahl 1929).

Specimens from type series of the following nomina described from or distributed in the Eastern Arc Mountains were examined (valid species according to the current taxonomy in bold; Frost 2014): *Leptopelis amaniensis* Ahl, 1929: ZMB 25315 (syntype), 23340 (‘paratype’); *Leptopelis barbouri* Ahl, 1929: MCZ A-13561 (lectotype), MCZ A-13562–3571 (paralectotypes); *Hyperolius flavomaculatus* Günther, 1864 (= *L. flavomaculatus*): BMNH 1947.2.9.82 (previously 64.1.9.49; holotype); *Leptopelis grandiceps* Ahl, 1929: ZMB 25307A–B (syntypes); *Hylambates johnstoni* Boulenger, 1897: BMNH 1947.2.10.4–1947.2.10.6 (previously 97.6.9.214), 1947.2.10.7 (previously 97.6.9.215) (syntypes); *Leptopelis martiensseni* Ahl, 1929: ZMB 25319 (holotype); *Leptopelis parkeri* Barbour & Loveridge, 1928: MCZ A-13597 (holotype); *Leptopelis signifer* Ahl, 1929: ZMB 11773A–B (syntypes), ZMB 11771A–C, 24089, 25305, 25313, 25317, 25318, 25320A–B, 25322, 25325, and 79082 – previously part of 25325 (‘paratypes’); *Leptopelis tanganus* Ahl, 1929: ZMB 25262 (holotype), ZMB 11367A–B, 11369A–B, 25316, 25321 (paratypes); *Leptopelis uluguruensis* Barbour & Loveridge, 1928: MCZ A-13586 (holotype), MCZ A-13587–13595, BMNH 1947.2.10.8, ZMB 38039, 38048, 46522 (paratypes); *Leptopelis usambaraee* Ahl, 1929: ZMB 25314 (holotype); *Hylambates vermiculatus* Boulenger, 1909 (= *L. vermiculatus*): BMNH 1947.2.20.11 (previously 1909.10.19.20) (holotype). See Fig. 2 for type localities.

We follow the International Code of Zoological Nomenclature (ICZN 1999), hereafter as the Code.
Results and discussion

**Leptopelis barbouri** Ahl, 1929


*Leptopelis barbouri* has a controversial taxonomic history, principally because the description by Ahl (1929) was carried out without having seen the type specimens (MCZ A-13561–13571). The type specimens were collected by A. Loveridge on Mt. Lutindi, East Usambara Mts. in 1926 and stored in MCZ, for details see Introduction. The collector of the type series repeatedly refused validity of *L. barbouri* and published that the material represents (Barbour & Loveridge 1928; Loveridge 1933, 1957) or probably represents (Barbour & Loveridge 1946) *L. aubryi* (Fig. 3), at that time believed to be a species widely distributed across Africa. Schiøtz (1975) was the first independent reviser who examined the type material and revalidated *L. barbouri* stating that “in size and coloration the Usambara material is very different from the West African *L. aubryi*”. Despite his reservations (“the males from Dabaga are only doubtfully referred to this species”), Schiøtz (1975) decided to join the MCZ Usambara female material (designated lectotype MCZ A-13561, Fig. 1A–B, and paralectotype 13562) with his new male material.
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from the Dabaga Forest in Udzungwa Mountains as conspecific under the name *L. barbouri*. However, he also stated that the juvenile paralectotypes (MCZ A-13563–13571) “may or may not belong to the same species”. He discussed the rather substantial morphological differences like possible sexual dimorphism or population-level, subspecific differentiation, and refrained from describing the specimens from Dabaga as a new species. Since the study by Schiøtz (1975), we are the second independent revisers who have investigated the original type material of *L. barbouri* (however, photographs of the lectotype are available in the online MCZ catalogue: http://mczbase.mcz.harvard.edu/guid/MCZ:Herp:A-13561, accessed 13 February 2014). Our finding was unexpected as both the lectotype and the female paralectotype were, at first glance, morphologically very different from what is today commonly named *L. barbouri* (cf. Dabaga specimens in Schiøtz 1975, 1999; further e.g. Harper & Vonesh 2002; Channing & Howell 2006; Schiøtz et al. 2008; Harper et al. 2010). At the time (Schiøtz 1975) no female specimens of ‘*L. barbouri*’ (conspecific to the Dabaga males) were known. In the meantime, however, many specimens of both males and females of ‘*L. barbouri*’ have been collected (most of the material is stored in MTSN and BMNH), and we can conclude that differences between the type material of *L. barbouri* (females) and the ‘*L. barbouri*’ males from Dabaga are not due to the sexual dimorphism (photographs of both sexes were published in Harper & Vonesh 2002). Based on our investigation of the *L. barbouri* type series, we conclude that all specimens represent *L. flavomaculatus* (see Figs. 1, 4). Although precise identification of the juveniles (MCZ A-13563–13571) is problematic, the two adult females including the lectotype (MCZ A-13561, 13562) clearly represent *L. flavomaculatus*. Comparison with the holotype of *L. flavomaculatus* (Fig. 1C–D) is not straightforward as the holotype is a juvenile specimen (see below) but common characters diagnostic for *L. flavomaculatus* are present (*L. barbouri* lectotype: SVL 52.3 mm, habitus stout, snout relatively short, slightly larger (1.05x) than the horizontal eye diameter, tympanum large 3/4 of the horizontal eye diameter, toes are only about half webbed, light line on the upper lip), similarly, when compared to the syntypes of *L. johnstoni*, a junior synonym of *L. flavomaculatus* (Loveridge 1953; see also below). Schiøtz’s (1975, 1999) ‘*L. barbouri*’ males from Dabaga and morphologically identical frogs under the name ‘*L. barbouri*’ from other publications (e.g. Harper & Vonesh 2002; Channing & Howell 2006; Pickersgill 2007; Schiøtz et al. 2008; Harper et al. 2010) turn out to be an unnamed

FIGURE 3. *Leptopelis aubryi*, female from northern Republic of the Congo. See the superficial resemblance to *L. flavomaculatus* (Figs. 1, 4), which caused earlier confusions. Type material of *L. barbouri* (= *L. flavomaculatus*) was repeatedly identified as *L. aubryi* (Barbour & Loveridge 1928, 1946; Loveridge 1933, 1957), a species from western Central Africa.
FIGURE 4. *Leptopelis flavomaculatus*, A) female and B) juvenile from the East Usambara Mountains. Compare with the lectotype of *L. barbouri* (Fig. 1A–B) and holotype of *L. flavomaculatus* (Fig. 1C–D), respectively.
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species. It could be argued that in accordance to the Article 75.6 of the Code (ICZN 1999; “Conservation of prevailing usage by a neotype”) a designation of a neotype would be appropriate to conserve the name in the prevailing usage. However, considering a relatively short time of the prevailing usage of the name *L. barbouri* for the frogs from mountains of Tanzania with a characteristic translucent green skin (since the work of Schiøtz, 1975), the controversial history of the nomen (see Loveridge 1933, 1957; Barbour & Loveridge 1946), and in light of further findings (see *Leptopelis grandiceps* Ahl, 1929), we prefer to follow the Article 23 and 61.3 of the Code and transfer *Leptopelis barbouri* Ahl, 1929 into the synonymy of *Leptopelis flavomaculatus* (Günther, 1864) as a subjective junior synonym.

**Name-bearing type:** MCZ A-13561, lectotype by designation of Schiøtz (1975).

**Type locality:** “Lutindi-Berg (Usambara-Gebirge)” [= Mount Lutindi (Usambara Mountains)], East Usambara, Tanzania, approx. 4.88°S 38.63°E.

**Proposed status:** Subjective junior synonym of *Leptopelis flavomaculatus* (Günther, 1864).

*Leptopelis flavomaculatus* (Günther, 1864)


The holotype of *L. flavomaculatus* (Fig. 1C–D) collected by J. Kirk & D. Livingstone was initially described as an “adult female” of *Hyperolius* (Günther 1864). However, Laurent (1948 “1947”) pointed out that the specimen is a juvenile *Leptopelis*, which was subsequently agreed on also by Loveridge (1953). In the first half of the 20th century, *L. flavomaculatus* was known as *Hylambates* (or *Leptopelis*) *johnstoni* (see below). We investigated the holotype, which is characterized by its juvenile, spotted colour pattern with typical light spots on heels and elbows. The external morphological characters (SVL 25.6 mm, habitus rather stout, snout short 9/10 of the horizontal eye diameter, tympanum 1/2 of the horizontal eye diameter, toes are only about half webbed, light line on the upper lip—see Table 1) correspond to how *L. flavomaculatus* is defined (cf. Schiøtz 1975, 1999; Harper & Vonesh 2002; Channing & Howell 2006; Harper et al. 2010; see also Fig. 4).

**Name-bearing type:** BMNH 1947.2.9.82 (previously 64.1.9.49), holotype by monotypy. **Type locality:** “Rovuma Bay” [= Ruvuma Bay], south-eastern coast of Tanzania, approx. 10.45°S 40.40°E.

**Confirmed status:** *Leptopelis flavomaculatus* (Günther, 1864).

*Leptopelis johnstoni* (Boulenger, 1897)


*Hylambates johnstoni* was described based on four subadult specimens, syntypes, collected by A. Whyte (and presented to BMNH by H. H. Johnston) from what is today Malawi (Boulenger 1897). Barbour & Loveridge (1928) used the name as a species of *Leptopelis* documenting it from the Uluguru Mts. in Tanzania [interestingly, they also reported other conspecific specimens from the Usambara Mts. under the name *L. aubryi*; see above the *L. barbouri* account]. Laurent (1948 “1947”) demonstrated that *Hyperolius flavomaculatus* Günther, 1864 is a juvenile *Leptopelis* and suggested it is probably conspecific with *L. johnstoni* with the *flavomaculatus* name having precedence. Loveridge (1953) confirmed this suggestion, and definitively synonymized the two names. He also doubted the Nyika Plateau as a place of origin of one type specimen and corrected the type locality to “Kondowe to Karonga, Nyasaland”, although he did not designate a lectotype. We investigated all four subadult syntypes (see Material and methods; SVL 37 – 40 mm, habitus relatively stout, snout short 9/10 of the horizontal eye diameter, tympanum 1/2 – 1/2 of the horizontal eye diameter, toes are only about half webbed, light line on the upper lip—see Table 1) and agree with the earlier statements of Laurent (1948 “1947”) and Loveridge (1953) that *Hylambates johnstoni* Boulenger, 1897 and *Hyperolius flavomaculatus* Günther, 1864 are conspecific within the genus.
Leptopelis Günther, 1859, although *H. flavomaculatus* is represented by a young individual (SVL 25.6 mm) superficially differing by a juvenile, spotted colouration (as noted already by Loveridge 1957). *Leptopelis flavomaculatus* is known from < 1600 m a.s.l. (Harper et al. 2010; own unpublished data) which indeed questions the probability of the Nyika Plateau (“6000–7000 ft.” stated on the original jar label of BMNH 1947.2.10.7; 1800–2100 m a.s.l.) as a valid type locality as already noted by Loveridge (1953). To stabilize the identity of the nomen and type locality we herein designate a lectotype: BMNH 1947.2.10.4, subadult specimen, probably male, SVL 39.0 mm, from “Kondowe to Karonga”, Malawi (Fig. 1E).

**Name-bearing type:** BMNH 1947.2.10.4 (previously part of 97.6.9.214), lectotype by present designation.

**Type locality:** Originally “Kondowe–Karonga, and one from the Nyika Plateau” (Boulenger 1897), corrected by Loveridge (1953) and fixed in the present study by lectotype designation to “Kondowe to Karonga”, Malawi.

**Confirmed status:** Subjective junior synonym of *Leptopelis flavomaculatus* (Günther, 1864).

**TABLE 1.** Summary of basic comparative characteristics of *Leptopelis* from the Eastern Arc Mountains, East Africa.

<table>
<thead>
<tr>
<th></th>
<th><em>Leptopelis flavomaculatus</em></th>
<th><em>Leptopelis grandiceps</em></th>
<th><em>Leptopelis parkeri</em></th>
<th><em>Leptopelis uluguruensis</em></th>
<th><em>Leptopelis vermiculatus</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Habitus</strong></td>
<td>Rather stout</td>
<td>Slender</td>
<td>Slender</td>
<td>Broad and stout</td>
<td>Broad and stout</td>
</tr>
<tr>
<td><strong>Snout</strong></td>
<td>Truncated or rounded, high</td>
<td>Pointed, rather low</td>
<td>Rounded, rather low</td>
<td>Truncated, short and high</td>
<td>Truncated or rounded, high</td>
</tr>
<tr>
<td><strong>Tympanum</strong></td>
<td>Distinct, $1/2 - 3/4$ of the horizontal eye diameter</td>
<td>Small and indistinct, $3/4 - 1/2$ of the horizontal eye diameter</td>
<td>Small and indistinct, $3/4 - 1/2$ of the horizontal eye diameter</td>
<td>Small and indistinct, $3/4 - 1/2$ of the horizontal eye diameter</td>
<td>Distinct, $1/2 - 3/4$ of the horizontal eye diameter</td>
</tr>
<tr>
<td><strong>Toe webbing</strong></td>
<td>Half webbed</td>
<td>Half webbed</td>
<td>Well-developed</td>
<td>Half webbed</td>
<td>Well-developed</td>
</tr>
<tr>
<td><strong>Distinguishing colour characteristics</strong> (usually visible also on preserved specimens)</td>
<td>Light line on the upper lip</td>
<td>Light patches along the lower jaw on mentum</td>
<td>Darker sides of the face</td>
<td>Upper eyelids of darker colour, translucent-like (in preservation); often light irregular spots on dorsum (in live)</td>
<td>Light spot below the eye</td>
</tr>
</tbody>
</table>

**Leptopelis grandiceps** Ahl, 1929


This nomen was introduced by Ahl (1929) based on two specimens (“Typen”) collected by J. Vosseler in “Deutsch-Ost-Afrika (Amani)” [= German East Africa (Amani)], East Usambara Mts. (Fig. 5A–E). Historically, the name became a synonym of *L. uluguruensis* based on the list of Loveridge (1957) and followed by Schiotz (1975). However, neither of the authors examined the specimens and their synonymization was based only on the original description (Ahl 1929). The two syntypes were recently identified in ZMB as a male and female under the number ZMB 25307A–B, respectively [male SVL 30.9 mm, female SVL 39.9 mm, habitus slender, snout pointed about equal to the horizontal eye diameter (male) or 1.2x larger (female), tympanum small and indistinct $1/2$ of the horizontal eye diameter (male) or $3/4$ (female), toes are only about half webbed, on the mentum light patches along the lower jaw—see Table 1]. Both undoubtedly represent the same species of tree frog from the mountains of Tanzania with a characteristic translucent green skin, which were initially introduced by Schiotz (1975) based on the males from the Dabaga Forest in the Udzungwa Mountains under the name ‘*L. barbouri*’. However, Schiotz (1975) admitted his reservation in application of this name (*L. barbouri*) for the specimens from Dabaga. As argued above, *Leptopelis barbouri* Ahl, 1929 represents a subjective junior synonym of *Leptopelis flavomaculatus* (Günther, 1864). Subsequently, the nomen *Leptopelis grandiceps* Ahl, 1929 is available and applicable to the tree frogs from mountains of Tanzania with a characteristic translucent green skin which have been named ‘*L. barbouri*’ (e.g. Schiotz 1975, 1999; Harper & Vones 2002; Channing & Howell 2006; Pickersgill 2007; Schiotz et
To clarify the taxonomic status of the nomen, we herein designate the male specimen (ZMB 25307A) as the lectotype of *Leptopelis grandiceps* Ahl, 1929.

**Name-bearing type:** ZMB 25307A, lectotype by present designation.

**Type locality:** “Deutsch-Ost-Afrika (Amani)” [= German East Africa (Amani)], East Usambara Mountains, Tanzania, approx. 5.10°S 38.63°E.

**Proposed status:** *Leptopelis grandiceps* Ahl, 1929.

**FIGURE 5.** *Leptopelis grandiceps*: Type specimens of A–E) *L. grandiceps* [(lectotype, male, ZMB 25307A (A–C); paralectotype, female, ZMB 25307B (D–E)] and F) *L. usambarae* (holotype, female, ZMB 25314). Note the characteristic light patches along the lower jaw (C).
FIGURE 6. *Leptopelis grandiceps* (formerly ‘*L. barbouri*’) from the East Usambara Mountains in life, A) male and B) female. Compare with the type material (Fig. 5A–E) and lectotype of *L. barbouri* (Fig. 1A–B).
**Leptopelis usambarae** Ahl, 1929


This nomen was introduced based on a single specimen (Fig. 5F) collected by Küttner in “Usambara” (Ahl 1929) (Küttner himself provided as a locality for his collection “Hinterland von Tanga in Deutsch Ostafrika” [= hinterland of Tanga in German East Africa], collected between June and July 1895; ZMB herpetological catalogue). The name was transferred into the synonymy of *L. ulugurensis* by Loveridge (1957), followed by Schiøtz (1975), however neither of the authors had examined the holotype and their nomenclatural action was only based on the original description provided by Ahl (1929). The holotype was recently identified in ZMB as a female with the number ZMB 25314. The condition of the holotype is rather poor, flaccid, but still allows a clear identification (SVL 43.4 mm, habitus slender, snout slightly pointed about equal to the horizontal eye diameter, tympanum small and indistinct \( \frac{2}{5} \) of the horizontal eye diameter, toes are only about half webbed, on the mentum light patches along the lower jaw—see Table 1) showing the holotype to be identical at species-level to the lectotype (and allotype/paralectotype) of *Leptopelis grandiceps* Ahl, 1929. Both nomina were introduced simultaneously in the same study (Ahl 1929), and therefore, we acting as the First Reviser in accordance with Article 24.2 of the Code give precedence to the name *Leptopelis grandiceps* Ahl, 1929. Our decision is made on the basis of the better condition of the *L. grandiceps* lectotype, furthermore, males provide more diagnostic features, and for these specific specimens more specific locality information. As a result, we propose to transfer *Leptopelis usambarae* Ahl, 1929 to the synonymy of *Leptopelis grandiceps* Ahl, 1929 as a subjective synonym.

**Name-bearing type:** ZMB 25314, holotype by monotypy.

**Type locality:** “Usambara”, Tanzania. Probably East Usambara Mountains considering the current knowledge on the distribution of *L. grandiceps* (formerly ‘*L. barbouri*’), which is not known from the West Usambara Mountains (Harper et al. 2010; Loader et al. 2011; own unpublished data, Fig. 2).

**Proposed status:** Subjective synonym of *Leptopelis grandiceps* Ahl, 1929.

**Leptopelis parkeri** Barbour & Loveridge, 1928


This species was described based on a single female (Fig. 7A,C) collected by A. Loveridge in the Uluguru Mts. in 1926 in the Tanganyika Territory, the mainland part of modern-day Tanzania (Barbour & Loveridge 1928). Barbour & Loveridge (1928) also reported other conspecific specimens from the Uluguru Mts. under the name *L. rufus* Reichenow, 1874 (Schiøtz 1975). Although the condition of the holotype is rather poor, flattened and flaccid, the morphological characters (SVL 42.2 mm, habitus slender, snout relatively long but rounded, \( \frac{9}{10} \) of the horizontal eye diameter, tympanum small and indistinct \( \frac{1}{3} \) of the horizontal eye diameter, toes with a well-developed webbing, darker sides of the face—see Table 1) conform to what is traditionally considered to be *L. parkeri* (cf. Schiøtz 1975, 1999; Harper & Vonesh 2002; Channing & Howell 2006; Howell et al. 2008a; Harper et al. 2010).

**Name-bearing type:** MCZ A-13597, holotype by original designation.

**Type locality:** “Vituri, Uluguru Mountains, Tanganyika Territory [= Tanzania]”, approx. 6.84°S 37.75°E.

**Confirmed status:** *Leptopelis parkeri* Barbour & Loveridge, 1928.

**Leptopelis martiensseni** Ahl, 1929

This nomen was based on a single specimen, male (Fig. 7B,D), collected by G. Martienssen from “Deutsch-Ost-Afrika” [= German East Africa] (Ahl 1929). German East Africa was a colony in East Africa, which included the currently known countries of Tanzania, Burundi and Rwanda. Ahl (1929) suggested as a possible place of origin “Tanga? oder [= or] Amani?”. The name Tanga as a locality could either be the actual town on the northern coast of Tanzania, or the region as a whole. Amani is a location found within the region of Tanga and is about 50 km west of the town of Tanga. Amani was formerly a Biological-Agricultural Experiment Station during the colonial period and a site of numerous early biological collections in the region (Schabel 2006). Amani is part of the larger area of the East Usambara Mountains, located about 50 km west of Tanga. Today, Amani is a designated nature reserve.

According to our investigations of the holotype, general external morphology (SVL 39.1 mm, habitus slender, snout relatively long but rounded, \( \frac{9}{10} \) of the horizontal eye diameter, tympanum small and indistinct \( \frac{2}{5} \) of the horizontal eye diameter, toes with a well-developed webbing, darker sides of the face) corresponds to the morphology of the \( L. \) parkeri holotype (see above). Loveridge (1957) followed by Schiøtz (1975) moved this name into the synonymy of \( L. \) parkeri based on the information from the original description (Ahl 1929). We tentatively agree with this decision before a more detailed investigation of geographic variation of \( L. \) parkeri is conducted. Ecologically, \( L. \) parkeri is a strictly forest species, predominantly known from montane areas and not inhabiting disturbed habitats outside forest (Schiøtz 1975, 1999; Harper & Vonesh 2002; Channing & Howell 2006; Howell et al. 2008a; Harper et al. 2010). Based on the habitat preference of this species and current knowledge of the
distribution of *L. parkeri*, Amani, which is a forested nature reserve at elevation of ca. 900 m a.s.l., seems to be a more likely place of origin than Tanga (town). However, the region of Tanga comprises the many currently fragmented forests found across the East Usambara Mts. According to Martienssen’s correspondence with the ‘Zoologisches Museum Berlin’ (Martienssen 1896–1902), there is evidence that during the time he was collecting amphibians for ZMB in the East Usambara Mts. – and apparently not in Amani. According to his letters it is very clear that all amphibians he sent to Berlin were collected at “Magrotto” or “Plantation Schöller” between December 1896 and June 1899 – no other amphibians were subsequently sent to ZMB from Martienssen. In a letter, dated 22 February 1897, Martienssen described the location of Magrotto as follows: “Magrotto is located ca. 800 m elevation behind the Rituloe [river?], one and a half hour North of Magila. It is the headwater of the Mkulumusi.” Today’s Magrotto is a plantation estate in the southern part of the Mlinga Mountain, East Usambara Mts., where Magoroto Forest (forest reserve) is situated (Cunneyworth & Stubblefield 1996). The (coffee) Plantation “Schöller” or “Schoeller” was founded in 1894 as part of the “Westdeutsche Handels- und Plantagengesellschaft” and located east of the Mlinga Mountain in the Bondei County very near to the railway station “Ngomeni” ca. 25 km SW of Tanga Town (Fitzner 1901). This location places it outside of the area of the foothills of the East Usambara Mts., and is therefore an unlikely collecting locality for *L. parkeri* – a species restricted to forested higher elevations in the East Usambaras. We therefore propose Magrotto or Magoroto Forest, respectively, as the most likely type locality. In accordance to these findings and forest ecology of *L. parkeri*, we suggest a correction of type locality, in agreement with the Recommendation 76A of the Code (ICZN 1999), as below.

**Name-bearing type:** ZMB 25319, holotype by monotypy.

**Type locality:** Originally “Deutsch-Ost-Afrika (Tanga? oder Amani?)” [= German East Africa (Tanga? or Amani?)], corrected to Magoroto, East Usambara Mountains, Tanzania, approx. 5.12°S 38.75°E in the present study.

**Confirmed status:** Subjective junior synonym of *Leptopelis parkeri* Barbour & Loveridge, 1928.

### Leptopelis uluguruensis Barbour & Loveridge, 1928


*Leptopelis uluguruensis* was described on the basis of the holotype MCZ A-13586, an adult male from “Nyang” (Fig. 8A–B) and twenty-one paratypes from “Vituri near Nyange”, collected by A. Loveridge in October 1926, both localities in northern Uluguru Mts. (Barbour & Loveridge 1928). Some of the original MCZ paratypes were exchanged to other museums worldwide. We investigated the holotype and thirteen paratypes, including those stored in BMNH and ZMB (MCZ A-13587–13595; BMNH 1947.2.10.8; ZMB 38039, 38048, 46522). All specimens are consistent in morphology (males SVL 32 – 43 mm, females SVL 51 – 54 mm, holotype an adult male SVL 41.7 mm, habitus broad and stout, short snout $\frac{3}{4}$ (males) – $\frac{4}{5}$ (females) of the horizontal eye diameter, indistinct tympanum $\frac{1}{3} – \frac{2}{5}$ of the horizontal eye diameter, upper eyelids of darker colour, translucent-like, toes are only about half webbed—see Table 1) and correspond to what is today named *L. uluguruensis* (cf. Schiøtz 1975, 1999; Harper & Vonosh 2002; Channing & Howell 2006; Howell et al. 2008b; Harper et al. 2010).

**Name-bearing type:** MCZ A-13586, holotype by original designation.

**Type locality:** “Nyang, Uluguru Mountains, Tanganyika Territory [= Tanzania]”, approx. 6.87°S 37.76°E.

**Confirmed status:** *Leptopelis uluguruensis* Barbour & Loveridge, 1928.

### Leptopelis amaniensis Ahl, 1929


This nominal species contains in the type series three specimens from “Amani”, two of them collected by J.
Vosseler (“Typen” = syntypes) and the third one by Awerinzew (“Cotype” = ‘paratype’; Ahl 1929). Two specimens were found in ZMB, one Vosseler’s syntype (ZMB 25315) and the Awerinzew’s (ZMB 23340) specimen (‘paratype’), both originally identified as *Hylambates aubryi* forma *rufus* (Reichenow, 1874), which was a common identification before the work of Ahl (1929) (or as *Hylambates rufus*, e.g. Nieden 1915). The syntype is in better condition and larger than the ‘paratype’, which is obviously a subadult specimen. Both specimens display typical characters of *L. uluguruensis*, an older available nomen, and morphologically correspond to the *L. uluguruensis* holotype, see above (syntype: female SVL 38.1 mm, habitus broad and stout, short snout 4/5 of the horizontal eye diameter, indistinct tympanum 2/5 of the horizontal eye diameter, upper eyelids of darker colour, translucent-like, toes are only about half webbed—see Table 1). As the second syntype is currently seemingly lost, and therefore its identity remains unsure, and because there are cases of misidentification in type series of some other nomina introduced by Ahl (1929), see below, the name should be fixed by a lectotype designation. Therefore, we designate ZMB 25315, female from “Amani (Deutsch-Ost-Afrika)”, SVL 38.1 mm, leg. J. Vosseler, the lectotype of *Leptopelis amaniensis* Ahl, 1929 (Fig. 8C), and move this nomen into the synonymy of *Leptopelis uluguruensis* Barbour & Loveridge, 1928. This is in accordance to the previously published opinion of Loveridge (1957) and Schiøtz (1975), however, in their case not based on specimen investigation. Amani is today a forested nature reserve in the East Usambara Mts.

**FIGURE 8.** *Leptopelis uluguruensis*: Name-bearing types of A–B) *L. uluguruensis* (holotype, male, MCZ A-13586), C) *L. amaniensis* (lectotype, female, ZMB 25315) and D) *L. tanganus* (holotype, female, ZMB 25262).
Name-bearing type: ZMB 25315, lectotype by present designation.

Type locality: “Amani (Deutsch-Ost-Afrika)” [= Amani (German East Africa)], East Usambara Mountains, Tanzania, approx. 5.10°S 38.63°E.

Confirmed status: Subjective junior synonym of *Leptopelis uluguruensis* Barbour & Loveridge, 1928.

*Leptopelis tanganus* Ahl, 1929


This is another new nomen introduced by Ahl (1929). In this case, Ahl exceptionally designated a holotype (“Type”) in the type series, which was identified under the number ZMB 25262, collected by G. Martienssen in “Tanga” (Fig. 8D). Other type specimens, paratypes (“Cotypen”) have the following provenance: another Martienssen’s specimen from “Tanga”, ZMB 25321; “Bulae bei [= near] Tanga”, collected by Eismann, ZMB 11367A–B, 11369A–B, MCZ A-17529 (on exchange from ZMB; not examined); “Amani”, collected by J. Vosseler, ZMB 25316. The holotype and all six paratypes examined are consistent in external morphological characters and correspond to the morphology of *L. uluguruensis*, an older available nomen [rather small, males SVL 31.4/33.5 mm, females SVL 45.4–50.7 mm, holotype an adult female SVL 50.2 mm, habitus broad and stout, short snout up to equal of the horizontal eye diameter, indistinct tympanum $1/4–1/3$ of the horizontal eye diameter, upper eyelids of darker colour, translucent-like in preservation, toes are only about half webbed—see Table 1].

Synonymy with *L. uluguruensis* had already been proposed by Loveridge (1933) based on the specimen gained on exchange from ZMB, i.e. a paratype from Bula near Tanga. This was repeated in Barbour & Loveridge (1946) and Loveridge (1957), and followed also by Schiøtz (1975). Having seen the holotype, we agree with the previous decision and continue to keep *L. tanganus* in the synonymy of *L. uluguruensis* as the morphological characters of both holotypes are substantially similar (even taking account of sexual dimorphism; see above). If we consider historical circumstances known about the holotype collector, G. Martienssen, and ecological requirements of *L. uluguruensis* (forest species predominantly known from submontane and montane areas > 600 m a.s.l. not tolerating habitats outside forest; Schiøtz 1975, 1999; Harper & Vonesh 2002; Channing & Howell 2006; Howell et al. 2008b; Harper et al. 2010; own unpublished data), the type locality “Tanga” should be corrected as in the case of *L. martiensseni* (see above). Therefore, in accordance to the Recommendation 76A of the Code (ICZN 1999), we suggest a correction of type locality as below.

Name-bearing type: ZMB 25262, holotype designated by Ahl (1929) and identified in the present study.

Type locality: Originally “Tanga”, Tanzania, corrected to Magoroto, East Usambara Mountains, Tanzania, approx. 5.12°S 38.75°E in the present study.

Confirmed status: Subjective junior synonym of *Leptopelis uluguruensis* Barbour & Loveridge, 1928.

*Leptopelis vermiculatus* (Boulenger, 1909)


The nomen *Hylambates vermiculatus* was introduced based on a single specimen (Fig. 9A–B) collected by P. Krefft in “Amani”, East Usambara Mts. (Boulenger 1909). Barbour & Loveridge (1928) were the first to combine the name with the genus *Leptopelis*. The holotype BMNH 1947.2.20.11 (previously 1909.10.19.20) is a young (probably subadult) male of SVL 33.0 mm, in the colour phase 1 (sensu Schiøtz 1975) with a fine black vermiculation on the dorsum. The current condition of the holotype is rather poor (flattened and flaccid), nevertheless, the external morphological characters (snout short $3/4$ of the horizontal eye diameter, tympanum about $1/2$ of the horizontal eye diameter, toes with a well-developed webbing, light spot below the eye—see Table 1) allow us to state that the holotype is in good agreement with the frogs which are traditionally named *L. vermiculatus* (cf. Schiøtz 1975, 1999; Harper & Vonesh 2002; Channing & Howell 2006; Howell et al. 2008c; Harper et al. 2010).
Name-bearing type: BMNH 1947.2.20.11 (previously 1909.10.19.20), holotype by monotypy.
Type locality: “Amani”, East Usambara Mountains, Tanzania, approx. 5.10°S 38.63°E.

*Leptopelis signifer* Ahl, 1929


This nominal taxon has showed up as another controversial taxon from the nomina introduced by Ahl (1929) considering the composition of the type series. The type series contains 18 specimens, and three of them collected by O. Neumann in “Derema” were marked as “Typen” [= syntypes; ZMB 11773], while the others as “Cotypen” [= ‘paratypes’] (Ahl 1929; also sensu Loveridge 1933). One syntype from the Neumann’s series from Derema was sent on exchange to MCZ (A-17530) and allowed Loveridge (1933) to designate *L. signifer* as a junior synonym of *L. vermiculatus*. This opinion was repeated in Barbour & Loveridge (1946), Loveridge (1957) and followed by Schiøtz (1975) but Laurent (1972) considered *L. signifer* a junior synonym of *L. christyi* (Boulenger, 1912) [species from forests of today’s eastern Dem. Rep. Congo, Uganda, north-western Tanzania, and presumably Rwanda and Burundi; Frost 2014]. Having examined two syntypes and 14 ‘paratypes’ in ZMB (one ‘paratype’ from “Nguru” remains lost), the result was surprising as these specimens represent at least four species. According to our measures, eight of them are *L. vermiculatus*, including both syntypes [syntypes: males in the colour phase 2 (sensu Schiøtz 1975) with an irregular darker triangle on the back with an apex pointing forward, SVL 51.2/50.1 mm, snout short 4/3 of the horizontal eye diameter, tympanum about 3/1 of the horizontal eye diameter, toes with a well-developed webbing, light spot below the eye—see Table 1]: ZMB 11773A–B from “Derema”, East Usambara Mts., leg. O. Neumann (syntypes), ZMB 25305, 25313 from “Usambara”, probably East Usambaras, leg. Küttnner, and ZMB 25318, 25320A–B from “Tanga” and ZMB 25263 from “Deutsch-Ost-Afrika”, all leg. G. Martienssen, thus probably from Magoroto, East Usambaras (see above for *L. martiensseni* and *L. tanganus*); four *L. flavomaculatus* (SVL = 40–65 mm, habitus relatively stout, snout rather short about equal to the horizontal eye diameter, tympanum relatively large 1/2–1/3 of the horizontal eye diameter, toes are only about half webbed, light line on the upper lip—see Table 1): ZMB 11771A–C from “Magile und [= and] Usegua”, Tanzania, leg. O. Neumann; and ZMB 25317 from “Amani”, East Usambaras, leg. J. Vosseler; three *L. uluguruensis* (SVL 47–48 mm, habitus broad and stout, short snout 1/3 of the horizontal eye diameter, indistinct tympanum 1/1 of the horizontal eye diameter, upper eyelids of darker colour, translucent-like, toes are only about half webbed—see Table 1): ZMB 24089 from “Nguru” Mountains, leg. Rohrbeck, and ZMB 25235 and 79082 from “Deutsch-Ost-Afrika”, leg. G. Martienssen, thus probably from Magoroto, East Usambaras Mts.; and one specimen is *L. christyi* (female SVL 52 mm, a darker triangle on the back with an apex pointing forward, snout slightly larger than the horizontal eye diameter, large tympanum 1/1 of the horizontal eye diameter, irregular darker spots along the body sides): ZMB 25322 from “Urwald zwischen Beni und Mboga [= forest between Beni and Mboga]”, Irumu, Democratic Republic of the Congo, leg. Schubotz. In addition, the third syntype from Derema (MCZ A-17530) seems to be *L. vermiculatus* (probably a male in the colour phase 2 sensu Schiøtz 1975) according to the photographs from the MCZ online catalogue (http://mczbase.mcz.harvard.edu/guid/MCZ:Herp:A-17530, accessed 13 February 2014), in accordance with the earlier identification by Loveridge (1933) and Barbour & Loveridge (1946). To clarify the taxonomic status of *Leptopelis signifer* Ahl, 1929, we herein designate the male specimen ZMB 11773A, SVL 51.2 mm, as the lectotype (Fig. 9C–D). As a result, we continue to treat *L. signifer* as a synonym of *L. vermiculatus* following Loveridge (1933, 1957), Barbour & Loveridge (1946) and Schiøtz (1975). The type locality “Derema” is a forested site in the East Usambara Mts., only about 5 km from Amani (type locality of *L. vermiculatus*).

Name-bearing type: ZMB 11773A, lectotype by present designation.
Type locality: “Derema”, East Usambara Mountains, Tanzania, approx. 5.05°S 38.66°E.
Confirmed status: Subjective junior synonym of *Leptopelis vermiculatus* (Boulenger, 1909).

For a historical overview of the taxonomic opinions on the nominal taxa described by Ahl (1929) from the Eastern Arc Mountains in East Africa see Table 2.
**TABLE 2.** Historical overview of the taxonomic opinions on the nominal taxa described by Ahl (1929) from the Eastern Arc Mountains, East Africa. The main nominal taxa in focus, *Leptopelis barbouri* Ahl, 1929 and *Leptopelis grandiceps* Ahl, 1929 in bold.

<table>
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<tr>
<th>Ahl (1929) spp. nov.</th>
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</table>

*Synonymy firstly proposed by Loveridge (1933)*

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**Redescription of *Leptopelis grandiceps* Ahl, 1929**

[Pending genetic analyses the redescription is based on the material from the East Usambara Mountains only.]

**Large Headed Forest Treefrog**

**Figs. 5, 6**


**Diagnosis.** A small (males) to medium-sized (females) and slender arboreal *Leptopelis* characterized by (1) colouration (in life): translucent green smooth skin, sometimes with tiny light dots or more rarely larger spots, light patches along the lower jaw on the mentum, throat and marginal parts of ventral side bluish (intense blue colouration in males); (2) indistinct but present skin fringes along posterior margin of limbs; (3) size SVL 30–33 mm in males, 39–45 mm in females; (4) snout sharply pointed in dorsal and lateral view, protruding beyond the margin of lip, nostrils prominent and protruding in profile; (5) head wider than long; (6) large protruding eyes whitish with red-orange circle variegation and blackish vermiculation, edged with black; (7) tympanum small and barely visible, \(1/3\)–\(1/5\) of the horizontal eye diameter; (8) manual and pedal digits with large discs, pedal digits only about half webbed: I 1-1\(\frac{1}{4}\) – 1\(\frac{1}{4}\) II \(\frac{3}{2}\)–\(\frac{3}{4}\) – 2 III \(\frac{1}{2}\)–\(\frac{3}{4}\) – 2 IV 1\(\frac{1}{4}\)–\(\frac{3}{4}\) – \(\frac{1}{4}\)–\(\frac{3}{4}\) – 1\(\frac{1}{4}\)–\(\frac{3}{4}\) – 1\(\frac{1}{4}\)–\(\frac{3}{4}\) – 1\(\frac{1}{4}\)–\(\frac{3}{4}\) – 2 IV 1-1\(\frac{1}{2}\) – 1\(\frac{1}{2}\) – \(\frac{3}{4}\)–\(\frac{3}{4}\) – 2 IV 1\(\frac{1}{2}\)–\(\frac{3}{4}\) – \(\frac{1}{2}\)–\(\frac{3}{4}\) in males and I 1 – \(\frac{1}{4}\)–\(\frac{1}{2}\) II \(\frac{3}{4}\)–\(\frac{3}{4}\) – \(\frac{3}{4}\)–\(\frac{3}{4}\) – \(\frac{3}{4}\)–\(\frac{3}{4}\) – \(\frac{3}{4}\)–\(\frac{3}{4}\) – \(\frac{3}{4}\)–\(\frac{3}{4}\) – \(\frac{3}{4}\)–\(\frac{3}{4}\) – \(\frac{3}{4}\)–\(\frac{3}{4}\) in females; (9) inner metatarsal tubercle small, ovoid, not very prominent, the basis about half the length of the first pedal digit; (10) subarticular tubercles slightly prominent.
### TAXONOMY OF TANZANIAN LEPTOPELIS

**TABLE 3.** Morphometric characteristics (in mm) and webbing formulae (number of webbing-free phalanges) of the name-bearing types of *Leptopelis* nominal taxa described from or distributed in the Eastern Arc Mountains, East Africa (in *L. grandiceps* both type specimens). Ordered according to the new taxonomy proposed in this study (*fla* = *L. flavomaculatus*, *gra* = *L. grandiceps*, *par* = *L. parkeri*, *ulu* = *L. uluguruensis*, *ver* = *L. vermiculatus*). The main nominal taxa in focus, *Leptopelis barbouri* Ahl, 1929 and *L. barbouri* Ahl, 1929 in bold. Morphological abbreviations: SVL, snout-vent length; tip of snout to mid of vent; SUL, snout-urostyle length: tip of snout to posterior margin of urostyle; FmL, femur length: middle of vent to external margin of knee joint, when thighs and shins in perpendicular position to body axis; TbL, tibia length: external margin of knee joint to external margin of heel articulation; TrL, tarsus length: external margin of heel articulation to proximal edge of inner metatarsal tubercle; IMTL, inner metatarsal tubercle length: length of base of tubercle; TIL, first toe length: distal edge of inner metatarsal tubercle to tip of first pedal digit; T4L, fourth toe length: see T1L; WL, webbing length: distal margin of inner metatarsal tubercle to margin of webbing in the middle between third and fourth pedal digit; FoL, forearm length: proximal edge of palmar region to external margin of elbow; DDA, disc diameter of third finger; HLt, horizontal eye diameter; EN, eye-nostril distance: anterior corner of eye to proximal edge of nostril (parallel to body axis); TD, horizontal tympanum diameter; ET, shortest eye-tympanum distance; TL, shortest tympanum-upper lip distance; I–V, pedal digits I–V (i—internal edge, e—external edge).

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Description of lectotype (male; differences of the female allotype in parenthesis, if applicable). Body slender SVL 30.9 mm (condition of female poorer, dehydrated with skeleton prominent, SVL 39.9 mm); large head, 1/3 of SVL, 1.2x wider than long; snout sharply pointed in both dorsal and lateral view; nostrils directed laterally, only partly visible from dorsal view (visible in female); canthus rostralis flat, prominent nostrils in profile; loreal region flat; eye large with horizontal eye diameter 1.5x the distance from nostril to anterior corner of eye (1.4x in female), edged with black; pupil vertical; iris with blackish vermiculation (pupil and iris condition not so clearly visible in female); tympanum indistinct, small, oval, 1.5x higher than wide, horizontal diameter 1/3 of the horizontal eye diameter (1/5 in female), tympanic annulus absent (slightly visible in female); skin of all dorsal surfaces smooth, only very finely granular; skin on ventral surfaces also only finely granular, more on thighs; pectoral glands absent; skin fringes along posterior margin of limbs, forming a small flap on elbows (less visible in female, probably due to poor condition of the specimen); hind limbs relatively long with tibia slightly larger than femur (equal in female), and slightly larger than the half SVL; foot webbing formula I 1 – 1 4/5 II 3/4 – 2 III 3/4 – 2 IV 1 3/4 – 2 V (I 1 – 1 4/5 II 3/4 – 2 III 3/4 – 2 IV 1 3/4 – 2 V in female); relative length of pedal digits I < II < III < V < IV; inner metatarsal tubercle small, rather flat, roundish (more prominent and elongated in female); outer metatarsal tubercle indistinct; hands slightly webbed, all fingers with lateral fringes; relative length of manual digits: I < II < IV < III; palmar and plantar surfaces tubercular; subarticular tubercles under all digits well developed, round, single; all digits end into round discs, each about 1.5x wider than width of distal phalange (smaller in female due to worse condition of the specimen). For measurements see Table 3.

In alcohol, dorsal and lateral surfaces yellowish with thighs and shanks darker, orange; eye-lids, knees, heels, and feet lighter than surrounding surfaces; miniature light dots sparsely scattered on dorsal surface (in female light marbling visible only on posterior surface of limbs); eye strongly edged by black (less clear in female); tympanum of the same colour as surrounding areas; flanks yellowish like dorsum; most ventral surfaces also of similar yellowish-orange colour like dorsum but with distinct light patches on the mentum along the lower jaw (probably with glandular function), similarly light marbling on the posterior surfaces of limbs (more conspicuous in female); belly is partly translucent allowing observation of inner organs with brightly light peritoneum.

Comparison. For comparisons to other species distributed in the Eastern Arc Mountains see Tables 1 & 3.

Distribution and ecology. The species is known from along the Eastern Arc Mountains and Southern Highlands in Tanzania where it inhabits humid forested areas along watercourses, predominantly montane forests (see ‘L. barbouri’ in Schiøtz et al. 2008; Harper et al. 2010). Based on our unpublished data, tree frogs corresponding to the former name ‘L. barbouri’ have been recorded from the following mountain blocks: East Usambara, Nguu, Nguru, Ukaguru, Uluguru (including montane and lowland elevation forests), Rubeho, Udzungwa (all Eastern Arc Mountains), and Mt. Rungwe and Livingstone Mts. in Southern Highlands (Fig. 2). It ranges from 170 m a.s.l. (East Usambara) to 2020 m a.s.l. (Nguru). However, in respect to our preliminary results (e.g. Menegon et al. 2008; Müller et al. 2013), and pending genetic analyses, we recommend to restrict the name L. grandiceps to the population from the East Usambara Mts., while the other populations of former ‘L. barbouri’ we tentatively name L. cf. grandiceps. The recorded altitudinal range in the East Usambara Mts. is 170 – 960 m a.s.l. The tadpole of the Ukaguru population of L. cf. grandiceps was described by Channing et al. (2012) and a spectrogram of advertisement call from Dabaga (Udzungwa Mts.) population of L. cf. grandiceps was published by Schiøtz (1975, 1999). However, the tadpole and advertisement call of L. grandiceps sensu stricto (East Usambara Mts.) is currently unknown.

Acknowledgements

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References


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http://dx.doi.org/10.1080/00222930908692705


http://dx.doi.org/10.1080/00222934708654636


http://dx.doi.org/10.1111/j.1096-3642.1897.tb03122.x


