

## A NEW SPECIES OF THE GENUS *Pseudocalotes* (SQUAMATA: AGAMIDAE) FROM VIETNAM

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Members of the genus *Pseudocalotes* of the Indochinese region were reviewed and a new species from Kon Tum province, Central Vietnam is described. The new species is similar in appearance to *P. brevipes* and *P. floweri* but it is distinguished from these species by the combination of the following characters: body scale shape, subdigital scale form, and coloration. Distribution patterns of the species *P. brevipes*, *microlepis*, *floweri*, and *poilani*, including all available new material of these species are discussed. An identification key to the species of the genus is provided.

**Keywords:** *Pseudocalotes zieglerei* sp. nov., *P. poilani*, taxonomy, first female record, distribution.

The agamid lizards of the genus *Pseudocalotes* are an enigmatic assemblage of Southeast Asian species. With the exception of *P. tympanistriga*, all species are extremely rare, with most of them known only from one or a few specimens. During the last five years the inventory of the herpetofauna of Vietnam has greatly increased, resulting in the description many of new species and an improved knowledge of the distribution of the known species (Ananjeva and Orlov, 2008a, 2008b; Ananjeva et al., 2007, 2008; Bain and Nguyen, 2004a, 2004b; Bain et al., 2007; Böhme et al., 2005; Darevsky et al., 2004; Das, 2004; David et al., 2007; Hallermann, 2004, 2005; Heidrich et al., 2007; Kuch et al., 2005; Matsui and Orlov, 2004; Nguyen et al., 2005; Orlov et al., 2004a, 2004b, 2005a, 2005b; Rösler et al., 2005; Stuart et al., 2005; Ziegler et al., 2003, 2005a, 2005b, 2006a, 2006c, 2007). Given their rarity, almost nothing is known about the ecology or natural history of *Pseudocalotes* lizards. Indeed, all we know is that most specimens were collected on trees or bushes in tropical mountain forests, generally at elevations above 1000 m. A review

of this genus with a description of new species of *Pseudocalotes* was given by Hallermann and Böhme (2000) and Hallermann and McGuire (2001).

A total of ten species are currently recognized: *Pseudocalotes brevipes*, *P. floweri*, *P. microlepis*, and *P. poilani* from mainland SE Asia; *P. dringi*, *P. flavigula*, and *P. larutensis* from West Malaysia; *P. tympanistriga* from Sumatra and Java; and *P. saravacensis* from Borneo; and the most recently described species, *P. khaonanensis*, from peninsular Thailand (Hallermann and McGuire, 2001; Chan-ard et al., 2008). Finally, the placement of *Pseudocalotes sumatrana* (sensu Hallermann and Böhme, 2000) is ambiguous. Manthey and Grossmann (1997) transferred this species from the former genus *Cophotis* to the new genus *Pseudocophotis* creating a monotypic genus until the recent description of the second species *Pseudocophotis kontumensis* in 2007 by Ananjeva et al. We herein accept the allocation of *P. sumatrana* into *Pseudocophotis* until further phylogenetic analyses of *Pseudocalotes* and *Pseudocophotis* are available. In Vietnam, specimens from northern areas are assigned to *P. brevipes*, specimens from central region are recognized as *P. microlepis*, and specimens from Kon Tum Province were previously known as *P. floweri* (Ziegler et al., 2006b; Bain et al., 2007). Based on the morphological comparison with all other species of *Pseudocalotes* we found that the allocation of the Kom Tum specimen to *P. floweri* is incorrect.

During recent field work, we made collected a remarkable collection of the genus *Pseudocalotes* from

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Fig. 1. Holotype (IEBR 330) of *Pseudocalotes ziegleri* sp. nov. in lateral view.

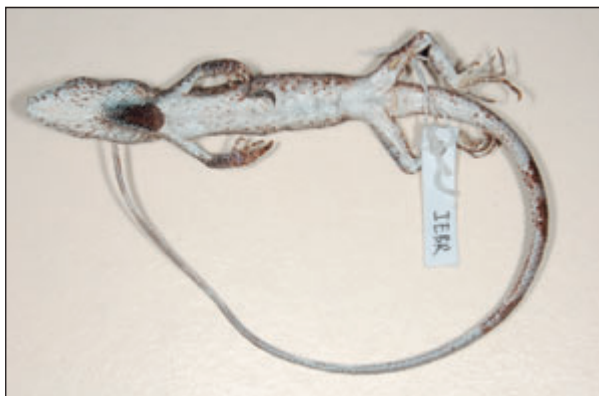


Fig. 2. Holotype (IEBR 330) of *Pseudocalotes ziegleri* sp. nov. in ventral view.



Fig. 3. Head of the holotype (IEBR 330) of *Pseudocalotes ziegleri* sp. nov. in lateral view.

Vietnam. Interestingly, together with the unique specimen collected in 2001 by Nguyen Quang Truong, Nikolai Orlov and his colleagues recently found a series of additional specimens of *Pseudocalotes* from Kon Tum Province, Central Vietnam, which was not assignable to any of the agamid species known from Vietnam nor to species reported from neighboring countries. Therefore, we herein describe it as a new species.

## MATERIAL AND METHODS

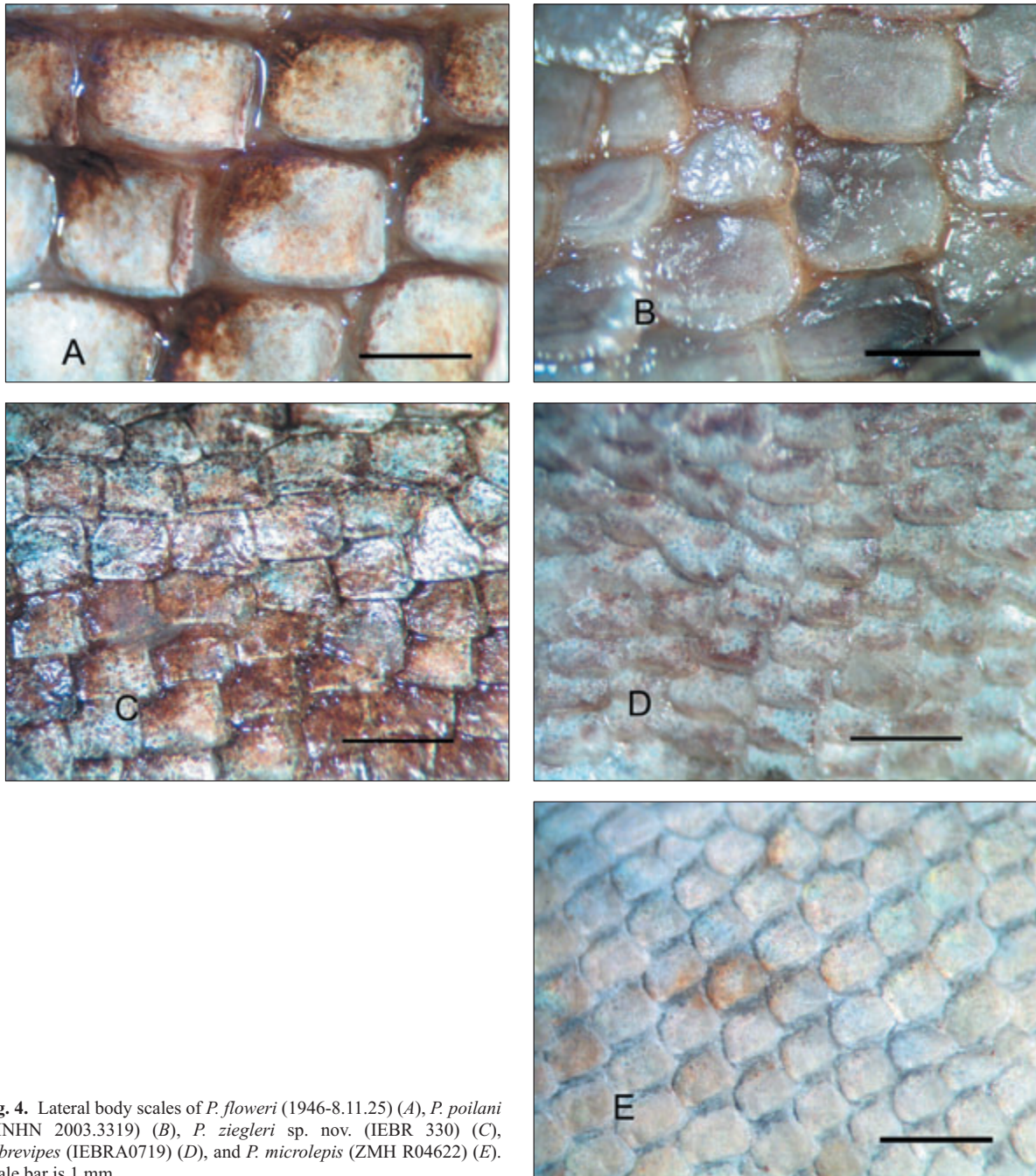
The following measurements were obtained for all specimens examined in this study: snout-vent length (SVL); tail length (TL); head length (HL, distance from tip of snout to occiput); head width (HW, in temporal region); number of supralabials (SL) and infralabials (IL);

number of nuchal crest spines; number of scales around midbody (M); vertical diameter of orbit (E); horizontal diameter of tympanum (TY); number of scales (subdigital lamellae) under fourth finger (FI) and fourth toe (TOE); as well as the ratios of TL/SVL, HW/HL, and E/TY. Measurements were taken with dial calipers to a precision of 0.1 mm. Museum abbreviations follow Leviton et al. (1985).

## DESCRIPTION

### *Pseudocalotes ziegleri* sp. nov.

**Holotype.** IEBR 330, an adult male collected on 10 January 2001 by Nguyen Quang Truong, in Nuoc Ka forest, near Mang Canh, Kon Plong District, Kon Tum Province, Central Vietnam (14°41'57" N 108°12'5.7" E at an elevation of approximately 1200 m (Figs. 1 – 3).

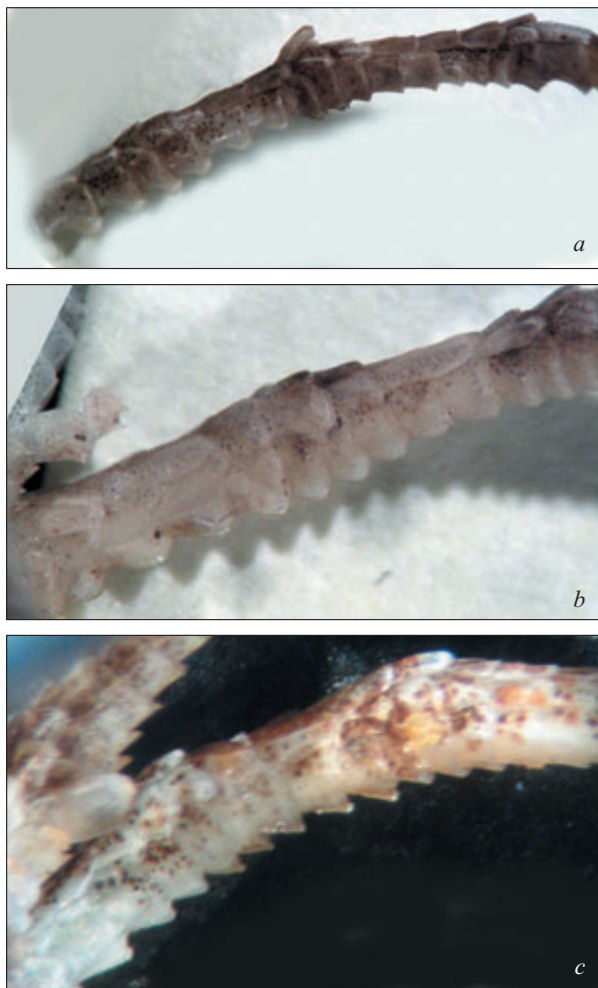


**Fig. 4.** Lateral body scales of *P. floweri* (1946-8.11.25) (A), *P. poilani* (MNHN 2003.3319) (B), *P. zieglerei* sp. nov. (IEBR 330) (C), *P. brevipes* (IEBRA0719) (D), and *P. microlepis* (ZMH R04622) (E). Scale bar is 1 mm.

**Paratypes.** Four specimens: ZISP 24716 (male), 24717 (female) (Fn 39738, 39739); and IEBR A.0833 (male), A.0834 (juv.) (Fn 39740, 39741) collected in May and June 2006 by Nikolai Orlov, Ho Thu Cuc, and Roman Nazarov, from Mang Canh, Kon Plong District, Kon Tum Province, Vietnam (14°41' N 108°19' E), altitude 1150 – 1250 m above sea level.

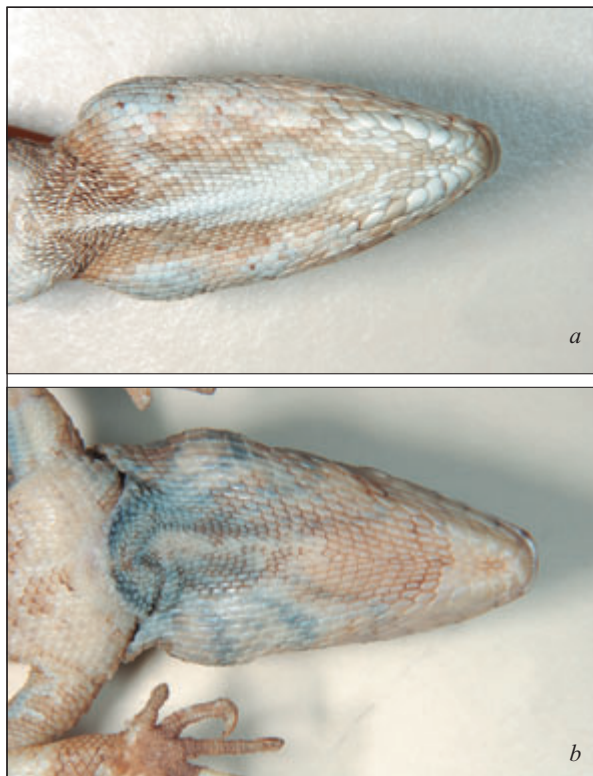
**Diagnosis.** *Pseudocalotes zieglerei* sp. nov. differs from *Pseudocalotes brevipes* and *P. microlepis* in having fewer scales around midbody 57–64 (mean 60.2,  $n = 5$ ) vs. 69 – 78 (mean 72.4,  $n = 17$ ) in *P. brevipes* and 65 – 72 (mean 69.7,  $n = 6$ ) in *P. microlepis*. The new species is similar to *P. brevipes* in having the same character of subdigital lamellae on third toe, however, it further dif-





**Fig. 5.** Subdigital scales under third toe of *P. floweri* (BMNH 1946-8.11.25) (a), *P. poilani* (MNHN 2003.3319) (b), and *P. ziegleri* sp. nov. (IEBR 330) (c).

fers from the latter by lacking white spots on the elbows, by having lateral scales rhomboidal and smooth (vs. triangular and feebly keeled in *P. brevipes*), and a relatively larger tympanum (ratio of orbit/tympanum 1.84 vs. 2.23 in *P. brevipes*) (Fig. 4). Whereas *P. microlepis* has a homogenous body scalation with nearly cycloid lateral body scales, with only the posterior point of the scale overlapping (Fig. 4). The new species somewhat resembles *P. poilani* in midbody scales rows (56–60 rows, mean 58.3,  $n = 3$ ) and *P. floweri* (51–61 rows, mean 55.7,  $n = 4$ ). However, it can be distinguished from *P. floweri* and *P. poilani* by having the leading edges of subdigital scales under third-toe triangular and pointed (vs. with blade-like lateral extensions in both latter species) (Fig. 5). *P. poilani* differs from both



**Fig. 6.** Gular region of *P. floweri* (1946-8.11.25) (a) and *P. poilani* (FMNH 258704) (b).

*P. ziegleri* sp. nov. and *P. floweri* by having a transverse gular fold in all males, females and juveniles and a heart-like black marking in males (vs. longitudinal gular fold or no fold in congeners, Fig. 6). *P. ziegleri* sp. nov. is distinguishable from *P. flavigula* by having more scales around midbody (57–64 vs. 38–40). The new species differs from *Pseudocalotes dringi*, *P. khaonensis*, *P. saravacensis*, and *P. tympanistriga* in having the leading edges of the subdigital scales under of third toe modified to a triangular and pointed condition (vs. unmodified in remaining species). *P. ziegleri* sp. nov. differs from *P. larutensis* by having five or more scales on canthus rostralis between nasal and first supraorbital (vs. four in *P. larutensis*).

**Description of holotype.** An adult male, SVL 68.5 mm, TL 148 mm, HL 19.3 mm, HW 10.5 mm, forelimb length 22.9 mm, hind limb length 37.8 mm, fourth toe of addressed limb reaches axilla (for further measurements see Table 1). Distance from anterior corner of orbit to nostril longer than horizontal diameter of orbit. Upper head scales in supraorbital and parietal region strongly keeled. Rostral three times wider than

**TABLE 1.** Scale Counts, Morphometric Measurements (in mm), and Proportions of the Type Series of *P. zieglerei* sp. nov.

Character	IEBR 330	ZISP 24716	ZISP 24717	IEBR A.0833	IEBR A.0834
	Male (holotype)	Male (paratype)	Female (paratype)	Female (paratype)	Subadult male (paratype)
SVL	68.5	71.0	73.1	78.2	58.1
TL	148.0	126.7	155.3	167.8	119.2
HL	19.3	21.7	21.7	22.8	17.0
HW	10.5	9.8	10.8	11.0	7.8
TY	2.55	2.65	2.3	2.9	1.9
E	4.52	4.85	4.68	5.4	3.2
M	57	60	60	64	60
SL left/right	8/11	8/9	9/10	7/8	7/8
IL left/right	8/7	8/9	9/9	8/8	8/9
Large post-mentals right/left	4/5	6/6	6/6	7/7	6/6
Scales on canthus rostralis	5	6	6	7	6
Nuchal crest spines	7	7	7	6	7
P index E/TY	1.77	1.83	2.03	1.86	1.68

**Note.** For abbreviations see *Material and Methods*.

high, bordered posteriorly by two labials and seven post-rostrals (five on upper and one on each lateral side). Lateral postrostrals separating the first supralabial nearly completely from rostral. Scales in frontal area keeled; keels unordered, parallel or oblique to body axis, a series of enlarged scales (5 + 3 + 3) forming an inverse Y-shaped figure. Two series of slightly enlarged semicircular scale on inner border of supraocular region, separated from each other by two scale rows. Five scales between anteriormost semicircular scale and nostril.

Tympanum exposed, horizontal diameter (2.6 mm) a little more than half as large as orbit (4.5 mm). Scales covering temporal region unequal in size, smaller scales intermixed with enlarged, weakly keeled scales. Posterior parietal, occipital, and upper postorbital region covered by slightly enlarged and elevated keeled scales.

Supralabials 8/11 (seventh and eighth fused, posteriormost two on the right side small); infralabials 8/7; gular scales keeled, small, pointing medially and posteriorly; mental triangular in shape, wider than long (relation: 2:1.5) followed by two rows of four or five enlarged scales (left/right): first pair in contact each other measially, bordered by mental anteriorly and first infralabials laterally; second to fourth pairs separated from labials by one row of small scales laterally; fifth pair separated from labials by two rows. Second pair separated from each other by two scales, third pair by four scales, and fourth pair by five scales. No gular pouch or antehumeral fold.

Nuchal crest composed of seven erect compressed scales, triangular in shape, pointed, largest 2.6 mm in length; nuchal crest spines separated from one another

by a small scale; one much smaller spine anterior to crest. A low dorsal crest formed by a keeled and slightly erect middorsal scale row, dorsal crest scales oriented posteriorly. 57 scales around midbody. Four to five rows of feebly keeled, slightly imbricate, rectangular dorsal scales; and smooth rhomboidal lateral scales arranged in transversely or slightly posteroventrally oriented rows. Ventral scales strongly keeled, forming 18 – 20 rows.

Limbs slender, covered with strongly keeled scales. Scales under toes I(8), II(15), IV(24), V(18) are bicarinate; third toe with 20 subdigital lamellae; leading edge of subdigital scales of third toe enlarged, triangular (Fig. 5). Tail compressed, slightly swollen at base, covered with strongly keeled scales.

**Coloration in alcohol.** Upper side of body more or less uniform grayish brown, intermixed with small dark brown dots and with three interrupted indistinct lighter bands extending on dorsum to the sides of the body. Region below eye whitish with some dark radiate stripes from eye to upper lip. Upper side of head dark brown between eyes and in parietal region. Gular with a dark brown patch, region between mental and gular whitish with few small brown dots. Venter whitish intermixed with small brown dots, lower surface of legs and tail whitish upper surface of legs with brown dots; manus and pes with brown dots on above surface and whitish on below side. Tail light brownish gray with six brown bands on upper side.

**Variation in paratypes.** For measurements and scale counts see Table 1. Scales around midbody 57 – 64 (mean 60.2,  $n = 5$ ), infralabials 7 – 11, supralabials 7 – 9. Postmentals in contact only in the holotype (see

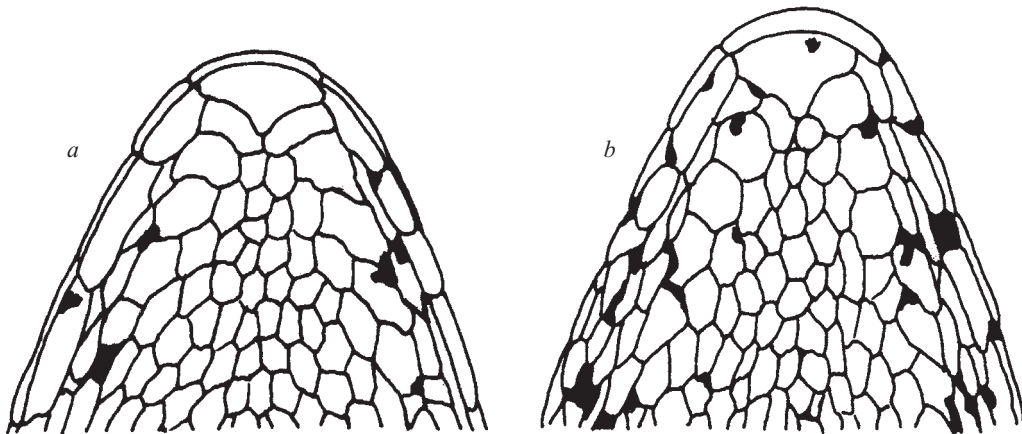


Fig. 7. Postmental region of *Pseudocalotes zieglerei* sp. nov. (IEBR 330) (a) and *P. brevipes* (IEBR A.0712) (b).



Fig. 8. *Pseudocalotes zieglerei* sp. nov. (ZISP. 24716, paratype) in life.

Fig. 7a), but separated from each other by a small scale in all paratypes, as well as in other species of *Pseudocalotes* (see Fig. 7b). There are major variations in coloration (see below and Fig. 8)

**Coloration in life.** Coloration is variable from grayish brown to yellowish rusty or yellowish green. Brown dorsal stripes are often running from nape to tail or with triangular brownish marks along the dor-





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## KEY TO THE SPECIES OF THE GENUS *Pseudocalotes*

- 1a. Scales under third toe modified: keels on the leading edge enlarged, keels on the trailing edge reduced (Fig. 5) . . . 2  
 1b. Scales under third toe bicarinate. . . . . 7
- 2a. Gular region with transverse fold (in males, females, juveniles) and a black heart-shaped marking in males; 56 – 60 scales around midbody . . . . . *poilani*  
 2b. Gular region without transverse fold, sometimes a small gular sac present; 50 – 80 scales around midbody. . . . . 3
- 3a. Light spots on elbows and knees present; lateral body scales keeled, imbricate, triangular (Fig. 4d); males with heterogeneous body scutellation; sometimes a fold in front of shoulder present; 69 – 80 scales around midbody . . . . . *brevipes*  
 3b. Light spots at elbows and knees absent. . . . . 4
- 4a. Four or less scales on canthus rostralis between nasal and supraorbital; 50 – 53 scales around midbody; triangular subdigital lamellae under third toe . . . . . *larutensis*  
 4b. Five or more scales on canthus rostralis between nasal and supraorbital . . . . . 5
- 5a. 65 – 72 scales around midbody; lateral body scales rounded, weekly imbricate (Fig. 4e) . . . . . *microlepis*  
 5b. 51 – 64 scales around midbody; lateral body scales smooth, rhomboidal imbricate . . . . . 6
- 6a. 57 – 64 scales around midbody; subdigital scales on third toe with enlarged, triangular leading edge (Fig. 5c) . . . . . *ziegleri* sp. nov.  
 6b. 51 – 61 scales around midbody; subdigital scales on third toe blade-like. . . . . *floweri*
- 7a. Two compressed flexible scales in temporal region (Sarawak, Borneo) . . . . . *saravacensis*  
 7b. No compressed flexible scales in temporal region . . . 8
- 8a. A denticulate crest present in both males and females; head scales strongly keeled; 46 – 64 scales around midbody (Java and Sumatra) . . . . . *tympanistriga*  
 8b. Denticulate dorsal crest absent or a very low crest formed by the middorsal scale row of keeled scales sometimes present; head scales keeled or smooth scales intermixed with keeled scales . . . . . 9
- 9a. Less than 46 scales around midbody (Malay Peninsula) . . . . . *flavigula*  
 9b. 48 – 76 scales around midbody . . . . . 10
- 10a. 48 – 51 scales around midbody (Malay Peninsula) . . . . . *dringi*  
 10b. 72 – 76 scales around midbody (Peninsular Thailand) . . . . . *khaonanensis*

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## APPENDIX

### Material examined

#### *Pseudocalotes brevipes*

**Vietnam:** Tonkin or Tongking [now northern Vietnam]: MNNH 1907.164 (lectotype), NMW 11412, SMF 9960, SMF 9961, ZMB 29664, MCZ 33519; Man-Son Mts. [now Mau Son

Mountain in Lang Son Province], 3000 – 4000 ft.: BMNH 1946-8.11.22, BMNH 1946-8.11.23); Ba Vi Mountain [now in Hanoi]: MNHN 1948.49; Vinh Phuc Province: Tam Dao Mountains: ZFMK 59202, 723249, MNHN 1948.48; Ha Tinh Province: Huong Son District: Rao An Forest (18°22' N

105°13' E, altitude 400 m a.s.l.): IEBR A.0712; Bac Kan Province: Cho Don District: Xuan Lac Commune (22°19' N 105°27' E, altitude ca. 300 – 400 m a.s.l.): IEBR A.0716; Bac Giang Province: Luc Nam District: Yen Tu Mountain (21°12' N, 106°39' E; altitude ca. 350 – 450 m a.s.l.): IEBR A.0718 – 0720.

***Pseudocalotes floweri***

**Cambodia:** Bockor: Elephant Mts.: BMNH 1932-8.1.2; Koh Kong Province: Cardamons Mountain: FMNH 270127. **Thailand:** FMNH 114514; Chantabun [Chantaburi]: BMNH 1946-8.11.25 (lectotype).

***Pseudocalotes microlepis***

**Vietnam:** South Annam: Camley, Langbian Plateau [now Cam Ly in Lam Dong Province] (BMNH 1921-4.1.118); Da Nang: Ba Na Nature Reserve: ZFMK 83905. **Myanmar:** Tenneserim: Pla-Poo, Mooleyit [now Mount Muleyit]: ZMH R04622, MNHN 1888.85. **LAOS:** Phong Saly: FMNH 14499.

**Thailand:** Doi Nang Ka [now Mt. Nang Kao – Phu Khoa Pram] (09°20' N 98°31' E): USNM 84744.

***Pseudocalotes poilani***

**Laos:** Champasak Province: Pakxong District: between Pak Song [Muang Pakxon] and Pak Sé [or Pakxé]: MNHN 1948.00.50 (holotype); Boloven Plateau [Phouphiang Bolavén]: MNHN 2003.3319; Dong Hua Sao National Biodiversity Conservation Area, near Ban Nongluang (15°04'07" N 106°12'03" E, altitude 1100 m a.s.l.): FMNH 258704 and (15°03'55" N 106°13'03" E, altitude 1200 m a.s.l.): FMNH 258710.

***Pseudocalotes zieglerei* sp. nov.**

**Vietnam:** Kon Tum Province: Kon Plong District: Mang Canh Commune (14°41' N 108°19' E, altitude 1100 – 1250 m a.s.l.): IEBR 330 (holotype), ZISP 24716 – 24717, IEBR A.0833 – 0834 (paratypes).