

An assessment of vouchered records and field observations of the rare anguid, *Dopasia buettikoferi* (Lidth de Jeude, 1905) in Borneo

Daniel Jablonski¹, Martina Lawson¹, Andy J. Boyce², Christian Molls³, Indraneil Das⁴

¹ Department of Zoology, Comenius University in Bratislava, Ilkovičova 6, 842 15, Bratislava, Slovakia

² Conservation Ecology Center, Smithsonian Conservation Biology Institute, 1500 Remount Rd, Front Royal, VA 22630, USA

³ Institute for Environmental Research (Bio V), RWTH Aachen University, Worringer Weg 1, D-52074, Aachen, NRW, Germany

⁴ Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

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Corresponding author: Daniel Jablonski (daniel.jablonski@balcanica.cz)

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Abstract

We report recent observations, two new locality records and an updated overview of the distribution of *Dopasia buettikoferi* (Lidth de Jeude, 1905) from Borneo, as well as photographic documentation of this species showing colouration and patterns in living individuals and the holotype. This note represents the first complete compilation of distributional knowledge of this rarely-encountered member of the family Anguillidae.

Key Words

Anguillidae, legless lizards, Malaysia, Indonesia, coloration, diversity, rare species

Introduction

The genus *Dopasia* Gray, 1853 (formerly allocated to the genus *Ophisaurus*) is one of the least known amongst the herpetofauna of south-east Asia (Brygoo 1987; Lin et al. 2003; Nguyen et al. 2011; Lavin and Girman 2019). According to Uetz et al. (2019), the genus consists of seven species, distributed from northern India, through southeast Asia to Indonesia (Sumatra) and Malaysia (Borneo): *D. buettikoferi* (Lidth de Jeude, 1905), *D. gracilis* (Gray, 1845), *D. hainanensis* (Yang, 1984), *D. harti* (Boulenger, 1899), *D. ludovici* (Mocquard, 1905), *D. sokolovi* (Darevsky & Nguyen, 1983) and *D. wegneri* (Mertens, 1959). The majority of *Dopasia* species remain poorly studied (see main reviews of Brygoo 1987; Nguyen et al. 2011) and the most recent phylogeny of the genus does not contain all nominal species (Lavin and Girman 2019).

Dopasia buettikoferi (Lidth de Jeude, 1905), commonly known as the Bornean Glass lizard, is endemic to Borneo (Das 2004; Nguyen et al. 2011; Uetz et al. 2019). Due to its presumed rarity and occupancy of many inaccessible areas, it is rarely encountered. Together with *D. wegneri* from Sumatra, this species is amongst the most rarely seen members of the family. The original description was presented by Lidth de Jeude (1905), who described this species based on a single specimen obtained during the Dutch scientific expeditions to central Borneo (Fig. 1), organised by the “Maatschappij tot bevordering van het natuurkundig onderzoek der Nederlandsche Kolonien”, between 1893–94, 1896–97 and 1898–1900 (see Büttikofer 1897). The holotype (RMNH 4450; Fig. 1A–E) is deposited at the Naturalis Biodiversity Center (formerly, Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands. The type locality given in the original description is “Mount Liang Koeboeng” (= Bukit Liang

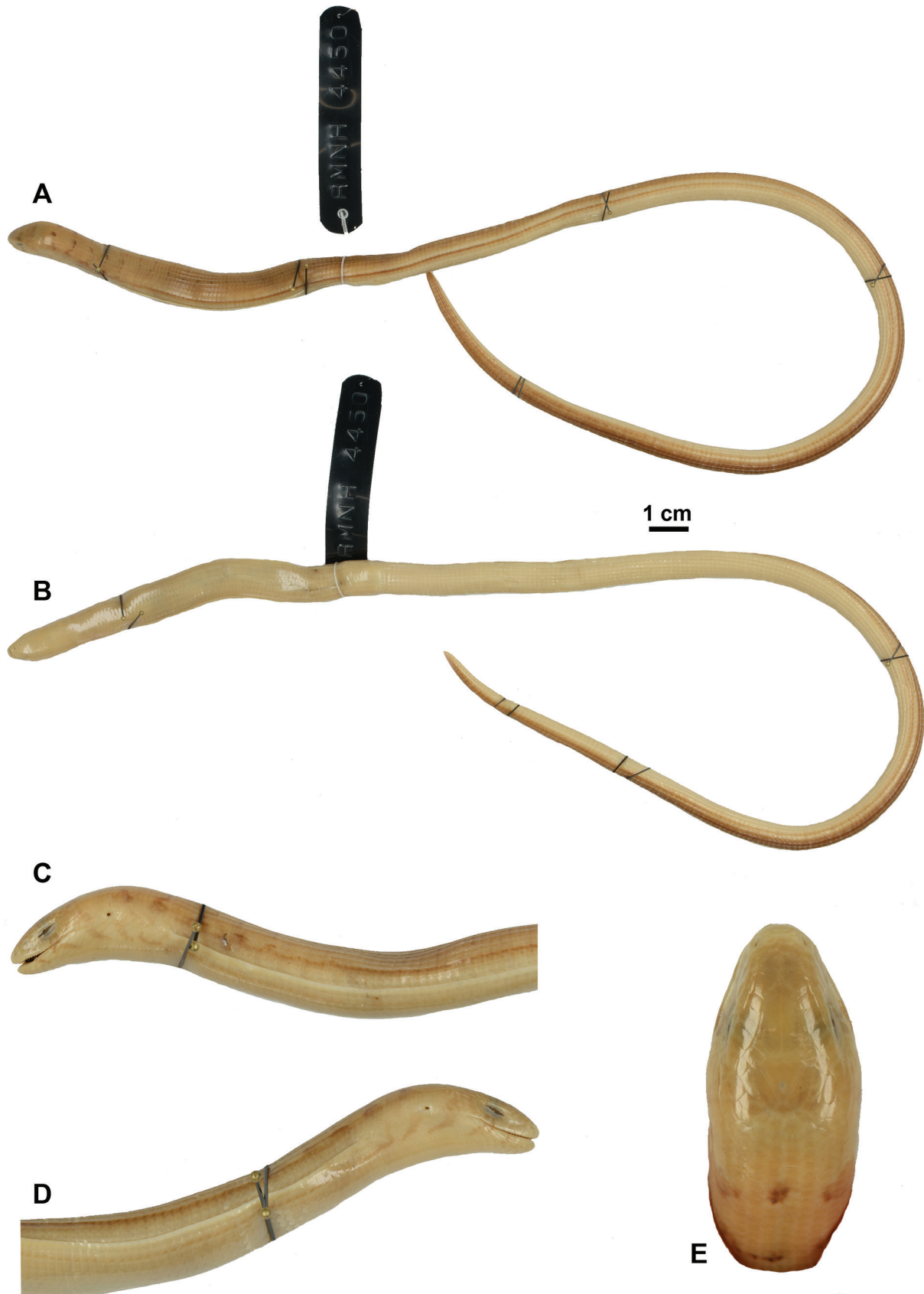


Figure 1. The holotype (RMNH 4450) of *Dopasia buettikoferi* (Lidth de Jeude, 1905) from the Naturalis Biodiversity Center, Leiden, The Netherlands: **A** – dorsal view, **B** – ventral view, **C**, **D** – lateral views, **E** – detail on the dorsal part of the head.

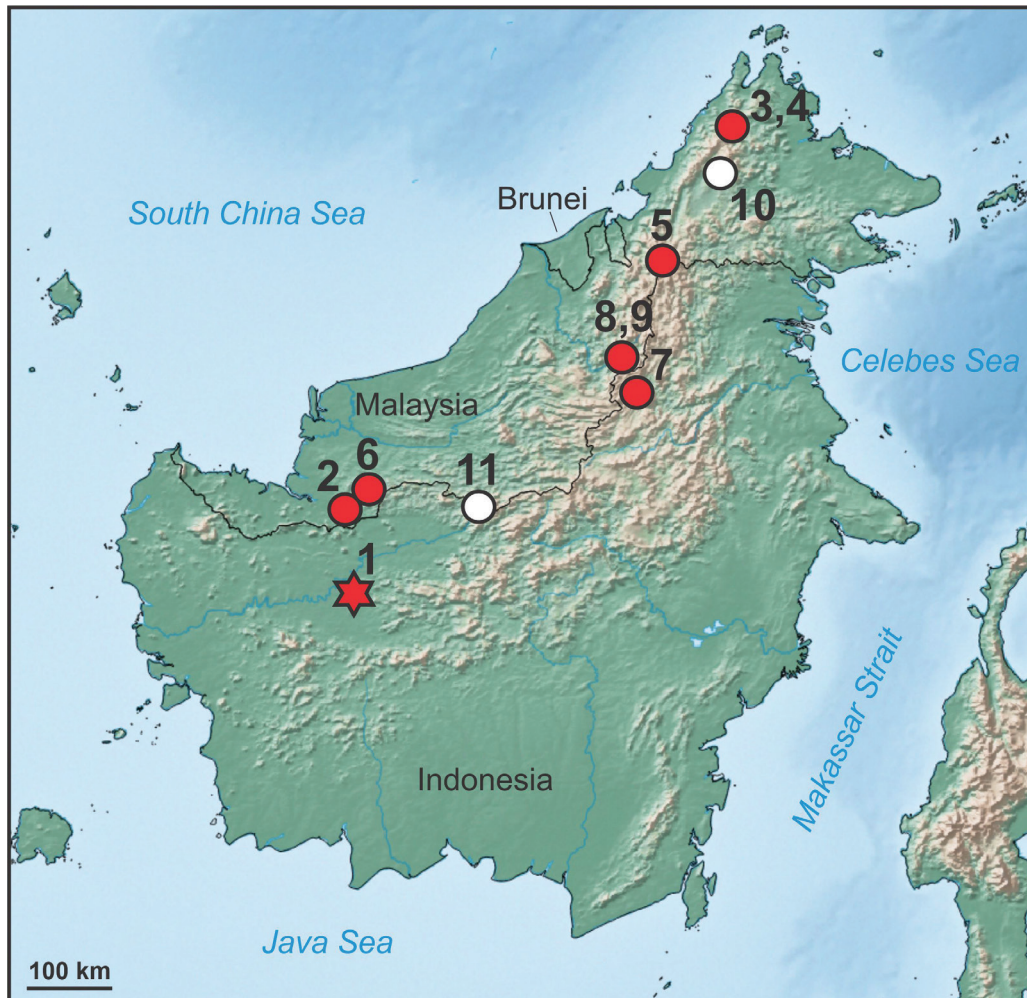


Figure 2. Distribution records of *Dopasia buettikoferi* from Borneo. Numbers correspond to those in Table 1. Red star – type locality of the species (holotype RMNH 4450); red circle – published localities; white circle – new locality record. The position in locality 7 is only approximate due to undefined locality presented by Mumpuni et al. (2003) from Taman Nasional Kayan Mentarang, Indonesia.

Kubung, on Sungai Kapuas, $\sim 0.216^{\circ}\text{N}$, 111.850°E , Kalimantan, Indonesia, Borneo; Fig. 2, loc. 1 in this paper). The species was named after Johann Büttikofer (1850–1927), a Swiss zoologist who participated in the expedition. The original description, however, lacked a figure illustrating the holotype and consisted of only a text description, as was the convention at the time. According to Lidth de Jeude (1905), the total length of the holotype is 50 cm with snout-vent length 12.5 cm. Amongst other characters, the author observed the distinct ear-opening that is no larger than the nostrils, dorsal scales in 16 longitudinal series with 12 of these keeled, four smooth and 105 transverse series where 10 longitudinal series were smooth. The author mentioned that the species was very similar to *D. gracilis* (at the time of description, one of three known species of the genus *Dopasia*), but differed in the number of longitudinal dorsal series and a longer tail. The colouration of the holotype was brown dorsally, with a darker lateral band that continued on to the

tail, separated from the dorsal part by a light-coloured demarcation line. On the anterior of the back are mentioned irregular transverse series of bluish, black-edged spots, not visible now on the voucher specimen (Fig. 1). Further description of colour and pattern are as follow: “lips and lower parts pale yellowish; a dark line below the eye is continuing on the lower labials and the gular region; a similar dark line below the corner of the mouth and one below the ear-opening; the continuation of these stripes is a dark line, running on either side of the belly on to the vent” (Lidth de Jeude 1905).

The second report of the species was presented over half a century later, by Inger (1958), who recorded it from the headwaters of Batang Lemanak, a tributary of the Lupar River, Second Division, Sarawak (1.233°N , 111.755°E ; Fig. 2, loc. 2) on a trail in primary forest at an approximate elevation of 305 m. The individual is presently uncatalogued in the collection of Sarawak Museum, Kuching. Inger (1958) also mentioned the first record of the

species from Bundu Tuhan (listed in the museum records as “Bundutuan”; ~5.993N, 116.533E; ~1200 m; Fig. 2, loc. 3), on Gunung (Mount) Kinabalu, voucher number MCZ (Museum of Comparative Zoology) 43493 and was collected by John A. Griswold, Jr. on 13 July 1937. There is also an unpublished voucher specimen collected from the area of the Bundu Tuhan View Trail, SPZM (Sabah Parks Zoological Museum) 04290. Manthey (1983) presented another record from Gunung Kinabalu (Fig. 2, loc. 4), but from an unspecified locality which was surprisingly low in elevation (between 300 to 600 m; the summit of Mt. Kinabalu is 4095 m). This species was reported to live a secretive lifestyle, feeding on the carrion of small mammals (Manthey 1983). This author also mentioned *D. buettikoferi* feeding on fish but this information is probably erroneous, as the author obtained it from unattributed literature (Manthey, in litt. to I. Das 2019). Finally, Chua and Kon (1996) and Chua (2004) recorded this species from south-western Sabah at Long Pasia, Sipitang District (Fig. 2, loc. 5).

Recent records of the species include the following locations: Ulu Engkari, Lanjak-Entimau Wildlife Sanctuary, Kuching Division, Sarawak (Hazebroek and Morshidi 2000, based on a Sarawak Forestry Department Museum uncatalogued specimen examined by us; Fig. 2, loc. 6); Taman Nasional Kayan Mentarang, Kalimantan, without specific geographical coordinates (Mumpuni et al. 2003; Fig. 2, loc. 7); and Sela'an Linau, Upper Baram, Miri Division, Sarawak (Asad et al. 2015; based on ZRC [IMG] 2.232; Fig. 2, loc. 8). Colour photographs of the species have appeared in Chua (2004), Chua and Kon (1996), Das (2004) and Das (2006). A colour painting, based on these photographs, appears in Das (2010).

Material and methods

In this study, we evaluated literature data (see above), museum collections (MCZ: Museum of Comparative Zoology; RMNH: Rijksmuseum van Natuurlijke Historie [today Naturalis Biodiversity Center]; SFDM: Forestry Research Centre Sarawak Museum; SMK: Sarawak Museum Kuching; SPZM: Sabah Parks Zoological Museum) and a citizen database (iNaturalists) with a combination of our own field research to present the current distribution of one of the most enigmatic reptile species in southeast Asia, *D. buettikoferi*. Historical data were obtained from the original description of the species (1905) up to 2015. Field research data come from the period between 2015 and 2019. Together with distribution, we recorded data on habitat, observed activity, basic morphology and colouration.

Results

In summary, a total of eight Bornean localities have been reported to date, two from Indonesia (Kalimantan) and six from Malaysia (three from Sarawak, three from Sabah; Table 1, Fig. 2). Here we report four recent observations from Borneo: three for Malaysia (one from Sabah, two from Sarawak) and one for Indonesia (Kalimantan), including a photographic documentation of this rare Bornean legless lizard. The records from Sabah (loc. 10) and Kalimantan (loc. 11) represent previously unreported localities, while the two records from Sarawak (loc. 6 and 9) have been mentioned in literature. Localities 8 and 9 represent different geographic coordinates within one area.

The first individual was found by Melynda Cheok near the summit of Gunung Sio, near Lio Mato, Sarawak, Bor-

Table 1. Chronologically ordered published and here presented records of *Dopasia buettikoferi* from Borneo.

| Locality number | Country | State: locality | WGA coordinates (N, E) | Altitude (m) | Catalogue numbers/institution | Reference |
|-----------------|-----------|---|----------------------------|--------------|---|---------------------------------------|
| 1 | Indonesia | Kalimantan: Mount Liang Koeboeng = Bukit Liang Kubung – type locality | ~0.217, 111.850 | ~600 | RMNH 4450 | Lidth de Jeude 1905 |
| 2 | Malaysia | Sarawak: Batang Lemanak, Lupar River | 1.233, 111.755 | 305 | Sarawak Museum Kuching, uncatalogued | Inger 1958 |
| 3 | Malaysia | Sabah: Bundu Tuhan, Gunung Kinabalu | ~5.993, 116.533 | ~1200 | MCZ 43493; SPZM 04290 | Inger 1958; unpublished |
| 4 | Malaysia | Sabah: Gunung Kinabalu | – | ~300–600 | – | Manthey 1983 |
| 5 | Malaysia | Sabah: Long Pasia | ~4.404, 115.728 | ~1000 | – | Chua and Kon 1996; Chua 2004 |
| 6 | Malaysia | Sarawak: Lanjak–Entimau Wildlife Sanctuary, Ulu Engkari; S Segerak Research Station | 1.413, 112.020 | 300–700 | Forestry Research Centre Sarawak Museum, uncatalogued | Hazebroek and Kashim 2000; This study |
| 7 | Indonesia | Kalimantan: Taman Nasional Kayan Mentarang | ~2.00–04.30, 114.80–116.30 | – | – | Mumpuni et al. 2003 |
| 8 | Malaysia | Sarawak: Sela'an Linau (Lio Mato) | ~3.172, 115.221 | ~230 | – | Asad et al. 2015 |
| 9 | Malaysia | Sarawak: Lio Mato, Gunung Sio | 3.133, 115.243 | 1268 | – | This study |
| 10 | Malaysia | Sabah: Gunung Trusmadi | 5.443, 116.451 | 1185 | – | This study |
| 11 | Indonesia | Kalimantan: Lanjak Deras, Batang Lupar | 1.267, 113.410 | 1121 | – | This study |



Figure 3. *Dopasia buettikoferi* from Borneo. **A–C:** individual from Gunung Sio, Sarawak. (Fig. 2 loc. 9). **D–E:** individual from Gunung Trusmadi, Sabah (Fig. 2, loc. 10). **F–H:** individual from Segerak Research Station, Sarawak (Fig. 2, loc. 6) and its microhabitat.

neo (3.133N, 115.243E, 1268 m elev.; Fig. 2, loc. 9). This record is close to that of Asad et al. (2015), but represents the highest elevational record known thus far for the species (Table 1). The individual was found on 16 October 2015 at 15:37 hours and had been killed by local people (Fig. 3A–C). The specimen possessed a different phenotype compared to other known specimens of *D. buettikoferi* and more closely resembled *D. gracilis* or *D. harti* from mainland Southeast Asia (Brygoo 1987). Although the specimen was not collected, from the photographs it is evident that the head is elongated and the colouration of the dorsum and ventre are distinctly different. The ventral colouration is uniformly yellow from the chin to the tip of the tail while the top of the head and back are dull brown and the tail is reddish–brown. On top of the back are a number of blue dots scattered from the neck to the tail. The individual was an adult, estimated to be 40 cm in length (Fig. 3A–C).

The second individual (Fig. 3D, E) was seen and photographed by CM on Gunung (mountain) Trusmadi, Sa-

bah, Malaysia, Borneo (5.443N, 116.451E, 1185 m elev.; Fig. 2, loc. 10). This record represents a new locality for the species in Borneo. Gunung Trusmadi is the second highest mountain in Sabah as well as Malaysia, with a summit elevation of 2,642 m and is located within the Trusmadi Forest Reserve. The individual was found on 1 April 2018 at 12:20 hours, in leaf litter behind a building of the Jungle Girl Camp site. Length was not measured but was estimated to be approximately 30–45 cm. The dorsum was hazel brown and flanks were pale brown with two dark, continuous lateral stripes on each side of the body starting from the neck to the tail. A few black stripes were visible on the dorsal and lateral surfaces of the head, extending for a few centimetres before disappearing. The first marking was present in the subocular area. Another stripe was under the nostril continuing to the jawline. There were also prominent spots leading to the dark lateral stripe. Chin, throat and ventre show a lighter colouration that fades away along with the black markings when

the thick lateral band appeared. The iris appeared pale yellow with a round black pupil.

The third individual (Fig. 3F, G) was documented by AJB approximately 700 m in elevation on a narrow ridge-top trail east of Segerak Research Station, Lanjak Entimau Wildlife Sanctuary, Lubok Antu, Sarawak, Malaysia, Borneo (1.413N, 112.020E; 700 m elev.; Fig. 2, loc. 6). It was moving through the leaf litter in hill dipterocarp forest (Fig. 3H), at approximately 22:15 hours on 7 March 2019. The animal was photographed and subsequently released. This locality was previously mentioned by Hazebroek and Morshidi (2000: 292). The individual was approximately 20 cm in length from snout-tip to the tail. The colouration on the frontal region and the anterior part of the body was brick red and most prominent on the neck region. The colour continued up to about one fifth the length of the individual and then slowly faded to light brown for the rest of the body. The ventre was light green to yellow. It appears that a dark-coloured subocular stripe, together with two other stripe on the head bordered by light coloured margins, were visible mostly on the dorsal and lateral sides of the head, continuing for a few centimetres and then disappearing. The lateral flanks of the body are lighter than the dorsum and there are two dark continuous lateral stripes extending from the neck to the tip of the tail. The eyes appear to have pale yellow irises and round black pupils. The circular ear-opening was visible.

In addition, we found another individual that was recorded on the online Citizen Science project, iNaturalist, that we confirm as belonging to this species (<https://www.inaturalist.org/observations/28593612>). The individual was photographed on 24 June 2019 in Kalimantan, Lanjak Deras, Batang Lupar, Indonesia, Borneo (1.267N, 113.410E, 1121 m elev.) and represents a new locality of the species (Fig. 2, loc. 11). Unfortunately, we do not have any other information except the images under the iNaturalist link. The individual was russet brown, with two dark lateral stripes that were bordered above by a narrow, lighter stripe. This particular feature is the most prominent in this russet brown individual due to the contrast of colours and clearly demarcates the colouration of the dorsum and flanks. Markings on the dorsum were similar to that of the specimens from Gunung Trusmadi and Lanjak Entimau (Fig. 3D–G), except for more prominent markings on the head of this specimen i.e. one stripe on the snout, one subocular strip beneath the eyes and a band across the nape. The lateral bands extended further down along the lower side of the head dividing into three to five upward rising markings, with one coinciding with the eyes. The iris was golden yellow and the pupils round and black.

Discussion

The apparent rarity of *D. buettikoferi* is reflected by the scarcity of recorded specimens and its scattered distribution across western and northern Borneo. As Borneo is a

large and herpetologically under-explored island, however, more records may be expected in the future. Based on our findings in this review, the species is probably not restricted to montane or sub-montane localities (the current range is approximately from 230 to 1300 m, Table 1), as is common for other members of the genus (Nabhitabhata 1987).

The large variation in the colouration and patterning of this species is noteworthy, especially in the case of the specimen from Gunung Sio (Fig. 3A–C). This specimen is completely different compared with all other specimens including the holotype (Fig. 1). All individuals observed in this study, except the Gunung Sio specimen, are characterised by dark-coloured subocular stripes together with other stripes on the head bordered by light-coloured margins. This pattern is also observed on the holotype, suggesting it is one of the main characters that can allow the recognition of the species. The individual from Gunung Sio, however, lacks this pattern. We are missing detailed evaluation of the specimen but the photo presented here clearly shows significant blue (dorsal) and yellow colouration (ventral) that are otherwise unknown for *D. buettikoferi*. This variation may (less likely) reflect individual variability, sexual dimorphism or variation related to developmental stage, but the latter is unlikely, as all observed specimens, including the holotype, were of adult stage. Therefore, in view of current knowledge, we can hypothesise that there may be cryptic diversity within Bornean *Dopasia* that could be resolved by an integrative approach including molecular and morphological data. Since *D. buettikoferi* is the only known species of the genus for Borneo and is considered an endemic to the island, we highlight the record from Gunung Sio to make future workers aware of the need for additional data, including voucher specimens and tissue samples for molecular research.

The knowledge on *Dopasia* lizards remains unappreciated as, at least, the current molecular phylogeny of the genus suggests (Lavin and Girman 2019). Therefore, further studies on the systematics, morphology and natural history of this genus are needed to better understand their evolutionary history, phenotypic variation, habitat associations and general ecology.

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Autor(en)/Author(s): Jablonski Daniel, Lawson Martina, Boyce Andy J., Molls Christian, Das Indraneil

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