



Confirmed Report of the Aniqiao Torrent Frog, *Amolops aniqiaoensis* (Anura: Ranidae), from India, with Additional Distributional Records for Two Other Indian Species of *Amolops*

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Abstract.—The torrent-dwelling frog genus *Amolops* is represented by 13 species in India, including type localities for 11 species. Based on recent field surveys and subsequent phylogenetic studies of specimens collected, we confirm the presence of *A. aniqiaoensis* Dong, Rao, and Lü 2005, which was described from Aniqiao, Xizang, China, in India. We also report a range extension of a recently described species, *A. adicola* Patel, Garg, Das, Stuart, and Biju 2021, with a further note on *A. indoburmanensis* Dever, Fuiten, Konu, and Wilkinson 2012.

Conservation and effective management for any amphibian taxon can be severely impeded by the lack of explicit information about its geographic distribution (S.N. Stuart et al. 2008), especially for range-restricted species with specialized habitat requirements. The torrent-dwelling frog genus *Amolops*, which is predominantly restricted to eastern and southeastern Asia and extending to the western Himalayas in India, has seen a burst of taxonomic descriptions that nearly doubled the total species count in the last decade (see Frost 2022). Of the 13 species of *Amolops* reported from India (Frost 2022), 11 species (*A. adicola* and *A. gerbillus* from Arunachal Pradesh; *A. assamensis* from Assam; *A. kohimaensis* and *A. nidorbellus* from Nagaland; *A. formosus* from Meghalaya; *A. chakrataensis* and *A. jaunsari* from Uttarakhand; and *A. himalayanus*, *A. monticola*, and *A. senchalensis* from West Bengal) were described based on type localities in the country (Günther 1876; Anderson 1871; Boulenger 1888; Annandale 1912; Chanda 1987; Ray 1992; Sengupta et al. 2008; Biju et al. 2010; Patel et al. 2021). Despite this rich diversity, our current knowledge of the distributional limits of these frogs in this region is relatively poor (Pawar et al. 2007).

In recent years, while studying the amphibian diversity of northeastern India (Fig. 1), we have collected representative torrent frogs in the genus *Amolops* that were subjected to molecular phylogenetic studies. This resulted in the confir-

mation of one new country record and a second distribution record of a recently described species.

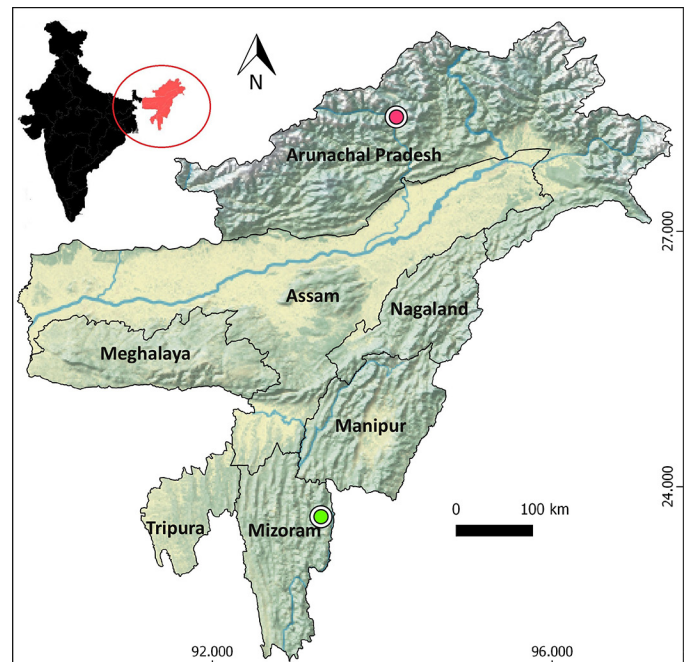


Fig. 1. Map of northeastern India. Siyum, Upper Subansiri District, Arunachal Pradesh, the site where we collected *Amolops adicola* and *A. aniqiaoensis* is marked by the red dot, and Murlen Village, Champhai District, Mizoram, where we collected *A. indoburmanensis* is marked by the green dot.

Methods

We collected, preserved, and deposited five frogs (*Amolops* spp.) in the museum of the North Eastern Regional Centre, Zoological Survey of India, Shillong (ZSIS) (V/A/NERC/ZSI/1497, 1565A–B, 1707–8) (Table 1). Prior to fixation, we extracted and preserved liver tissues in 90% ethanol for molecular studies. We conducted genomic DNA extraction and polymerase chain reaction following the protocol of B. Saikia et al. (2021) and used the primers 16sar-L (5'CGCCTGTTTATCAAAAACAT3') and 16sbr-H (5'CCGGTCTGAACTCAGATCACGT3') of Palumbi et al. (2002) to amplify the 697 bp fragment of the mitochondrial 16S rRNA gene from genomic DNA extracts of the four amphibian samples. We outsourced Sanger sequencing. Using SeqTrace (Stucky 2012), we filtered and end-trimmed low-quality base calls from trace files of 16S rRNA gene sequence fragments, and checked the resultant sequence for corrections in MEGA XI software (Tamura et al. 2021). In addition, we downloaded 197 sequences of *Amolops* spp. available in GenBank and aligned them manually in MEGA XI using the MUSCLE algorithm (Edgar 2004). Sequence names (Appendix 1) follow Jiang et al. (2021) and Patel et al. (2021). We performed maximum-likelihood phylogenetic estimation in RAxML 2.0.0 (Stamatakis et al. 2007; Silvestro and Michalak 2012) under GTR+GAMMA+I model with 1,000 thorough bootstrap replicates. Outgroups followed Wu et al. (2020) and the final consensus tree was visualized by Fig Tree v1.4.0.

Results

The phylogenetic analysis revealed that our *Amolops indoburmanensis* sample (MN519705) from Murlen, Mizoram, India, and those reported in previous studies were genetically similar (Fig. 2). Also, our *A. aniqiaoensis* samples (MT636754 and MT636755) from Siyum, Arunachal Pradesh, India, were clustered with *A. aniqiaoensis* from earlier studies. Finally, our *A. adicola* sample (OK138593) from Siyum was genetically identical with the *A. adicola* sample reported by Patel et al. (2021).

Amolops adicola Patel, Garg, Das, Stuart, and Biju 2021 (Fig. 3A).—Bikramjit Sinha collected two adult female Adi Cascade Frogs (*A. adicola*) (V/A/NERC/ZSI/1707, SVL 65.8 mm; V/A/NERC/ZSI/1708, SVL 67.7 mm) about 3 km from Siyum towards Taliha, Upper Subansiri District, Arunachal Pradesh, India (28.337°N, 94.031°E; elev. 563 m asl), on 24 September 2018. These frogs were collected after twilight from the bank of a fast-flowing second-order hill stream with large boulders (Fig. 3D) locally known as Row Stream. Mixed streamside vegetation is dominated by wild banana trees (*Musa* sp.), which are quite common in the area.

Bodies robust; heads almost as long as wide; snouts rounded and longer than diameter of the eyes; nostrils

slightly closer to the snouts than to the eyes; interorbital distance almost equal to the length of the upper eyelids, but less than internarial distance; tongues large and cordate shaped; vomerine teeth present; tympana distinct and round, separated from the eyes by a distance equal to the diameter of the tympana; fingers free, tips ending in discs bearing circummarginal grooves; subarticular tubercles prominent; relative finger lengths I<II<IV<III; tibiae longer than femura and more than half of SVL; toes fully webbed and ending in discs with circummarginal grooves; inner metatarsal tubercles elongated, outers absent; tibiotarsal articulations reaching beyond the snout; dorsolateral folds present; skin smooth. The preserved specimens are grayish-brown dorsally, creamy white ventrally; sides of heads are darker but additional markings are not evident in the preserved specimens.

Our specimens generally agreed with the original description of the species (Patel et al. 2021), although the heads of our specimens were almost as long as wide, whereas Patel et al. (2021) described *A. adicola* as having a head longer than wide.

This report from the Upper Subansiri District of Arunachal Pradesh is only the second report of this species and it extends the range of the species about 85 km southwest from the type locality near Mossing in Upper Siang District of Arunachal Pradesh and the maximum elevational distribution from 515 m (Patel et al. 2021) to 563 m.

***Amolops aniqiaoensis* Dong, Rao, and Lü 2005** (Fig. 3B).—Bikramjit Sinha also collected two adult male Aniqiao Torrent Frogs (*A. aniqiaoensis*) (V/A/NERC/ZSI/1565A, SVL 49.5 mm; V/A/NERC/ZSI/1565B, SVL 51.4 mm) at the same locality as the female *A. adicola* mentioned above (Fig. 3D).

Bodies slender; heads as wide as long; snouts blunt; nostrils nearer the eyes than to the snouts; tongues bifid; a pair of vomerine teeth present between the choanae; interorbital distance greater than the length of the upper eyelids; tympana distinct and round, separated from the eyes by a distance equal to the diameter of the tympana; fingers free, tips ending in discs bearing circummarginal grooves; subarticular tubercles prominent; prepollices enlarged; relative finger lengths I<II<IV<III; tibiae longer than femura and more than half of SVL; toes fully webbed, ending in discs with circummarginal grooves; inner metatarsal tubercles elongated, outers absent; tibiotarsal articulations reaching beyond the snout; dorsolateral folds present; posterior regions (including the hindlimbs) with numerous scattered spinules characteristic of this species; venter smooth. Dorsa with small scattered dark markings; venters creamy white with a few darker spots; limbs with irregular markings (not banded). Both males have a pair of gular pouches at the posterior end of the mandibles.

This report from Upper Subansiri District of Arunachal Pradesh, the first confirmed report of this species from India and the first record other than the type locality at Aniqiao,

Table 1. Morphometric data (as in Dinesh et al. 2022) of the specimens of torrent frogs (*Amolops* spp.) used in this study. Abbreviations: SVL = snout-to-vent length; HW = head width at the angle of the jaws; HL = head length (rear of the mandible to tip of the snout); IN = internarial distance; NE = nostril-to-eye distance; NS = distance from nostril to tip of snout; MN = distance from the rear of the mandible to the center of the nostril; MFE = distance from the rear of the mandible to the anterior-most orbital border; MBE = distance from the rear of the mandible to the posterior-most orbital border; SL = snout length (tip of the snout to the anterior-most orbital border); EL = eye length (the horizontal distance between the bony orbital borders of the eye); IUE = inter upper-eyelid width (shortest distance between the upper eyelids); UEW = maximum upper-eyelid width; IFE = distance between anterior corners of the eyes; IBE = distance between the posterior corners of the eyes; TYD = tympanum diameter; TE = tympanum to posterior corner of eye distance; FLL = forelimb length (elbow to the base of the outer palmar tubercle); HAL = hand length (base of the outer palmar tubercle to the tip of the third finger); FL1 = first finger length (tip of finger to proximal palmar tubercle); FL2 = second finger length (tip of finger to proximal palmar tubercle); TFL = third-finger length (tip of finger to proximal palmar tubercle); AGL = axilla to groin distance; WBS = body width behind the shoulders; WFG = body width anterior to the groin; ShL/FL = thigh length; TiL = tibia length; Tal = tarsus length; FOL = foot length (base of the inner metatarsal tubercle to the tip of the fourth toe); FTL = fourth toe length (base of proximal subarticular tubercle to the toe tip); ITL = inner toe length; IMT = length of the inner metatarsal tubercle.

Character	Species (<i>Amolops</i> sp.) and Registration Number (V/A/NERC)				
	<i>A. adicola</i> ZSI/1707	<i>A. adicola</i> ZSI/1708	<i>A. aniqiaoensis</i> ZSI/1565A	<i>A. aniqiaoensis</i> ZSI/1565B	<i>A. indoburmanensis</i> ZSI/1497
SEX	F	F	M	M	F
SVL	65.8	67.7	49.5	51.4	94.7
HW	21.3	22.0	16.1	17.0	33.1
HL	20.9	21.8	16.1	17.0	29.7
IN	6.8	7.5	5.6	6.1	11.1
NE	4.2	4.6	3.3	3.3	6.7
NS	4.1	4.4	3.8	4.0	6.1
MN	17.5	17.6	12.6	13.3	24.4
MFE	12.6	12.9	9.7	10.6	17.5
MBE	6.9	7.3	5.1	5.8	9.9
SL	8.6	9.7	7.5	7.7	13.4
EL	7.4	7.6	6.3	6.3	11.7
IUE	5.7	5.7	4.4	5.0	8.2
UEW	5.5	5.6	4.4	5.0	8.8
IFE	11.7	12.1	9.2	9.7	17.9
IBE	17.3	17.5	13.8	14.9	26.5
TYD	3.0	3.1	2.7	2.7	3.1
TE	3.0	3.1	2.3	2.2	4.6
FLL	16.1	16.1	13.3	13.3	18.9
HAL	21.5	21.5	17.1	17.2	26.7
FL1	13.1	13.2	11.0	11.1	15.5
FL2	15.4	15.6	12.1	12.0	17.0
TFL	21.5	21.5	17.1	17.2	25.6
AGL	32.4	32.4	22.2	22.3	39.9
WBS	22.2	25.2	14.8	14.8	33.7
WFG	13.0	13.0	9.1	9.2	18.4
ShL/FL	40.3	40.3	30.6	30.7	52.3
TiL	45.7	46.5	33.9	33.9	56.1
Tal	21.9	22.1	16.2	16.3	25.1
FOL	39.6	39.6	29.9	30.2	48.6
FTL	22.9	22.7	17.9	18.0	26.1
ITL	10.2	10.9	7.8	7.7	12.3
IMT	3.5	3.5	2.5	2.6	6.8



Fig. 2. Maximum-likelihood tree for species of *Amolops* based on 560 bp of mt 16s rRNA.

China, extends the range of the species about 155 km aerial distance to the southwest and the lower elevational distribution from 1,066 m (Dong et al. 2005) to 563 m asl.

***Amolops indoburmanensis* Dever, Fuiten, Konu, and Wilkinson 2012** (Fig. 3C).—Ilona Jacinta Kharkongor and Bhaskar Saikia collected an adult female Indoburman Torrent Frog (*A. indoburmanensis*) (VIA/NERC/ZSI/1497, SVL 94.7 mm) in Murlen Village on the fringe of Murlen National Park, Champhai, Mizoram, India (23.6622°N, 93.2861°E; elev. 1,401 m asl), on 31 January 2019.

Body stocky; head broad and flat with a distinct canthus rostralis; nostrils closer to the snout tip than to the eyes; vomerine teeth present; tongue notched medially; tympana small, round,

and distinct; forearms stocky; fingers free, fingertips ending in disks with circummarginal grooves; finger lengths I<II<IV<III; inner and outer metacarpal tubercles large and flat; hindlimbs long and stocky; tibiotarsal articulation crosses snout; toes fully webbed and with disks with circummarginal grooves (but disk size smaller than those on fingers); inner metatarsal tubercles elongated and flat, outer absent; dorsum smooth, venter slightly granular. Dorsal coloration greenish-brown with scattered dark spots, ventral coloration dirty off-white.

The frog was found under a boulder in a dry streambed near a banana plantation on the outskirts of Murlen Village. The female was gravid, suggesting that this species breeds before the onset of the monsoon.

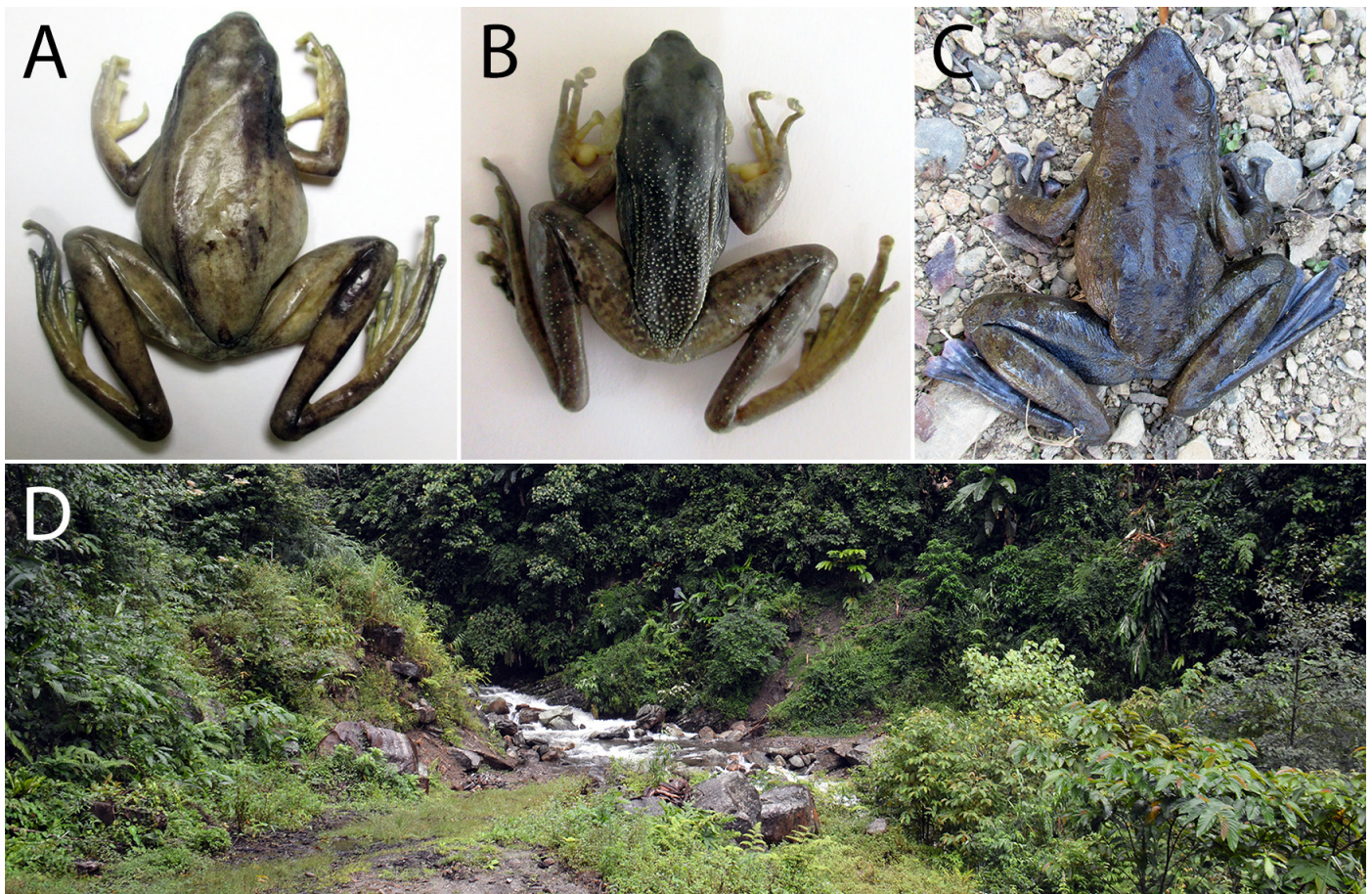


Fig. 3. Preserved specimens of an adult female Adi Cascade Frog (*Amolops adicola*) (A) and an adult male Aniqiao Torrent Frog (*Amolops aniqiaoensis*) (B) from Siyum, Upper Subansiri District, Arunachal Pradesh, India; an adult female Indoburman Torrent Frog (*Amolops indoburmanensis*) from Murlen Village, Champhai District, Mizoram, India (C), and habitat of *Amolops adicola* and *A. aniqiaoensis* near Siyum, Upper Subansiri District, Arunachal Pradesh, India (D). Photographs by Bhaskar Saikia (A–C) and Bikramjit Sinha (D).

Discussion

Jiang et al. (2021) assigned the 14 known species of *Amolops* known to occur in India, including *A. aniqiaoensis* (reported herein), to three morphological species groups: the *A. marmoratus* group (*A. assamensis*, *A. gerbillus*, *A. indoburmanensis*, *A. jaunsari*, *A. senchalensis*), *A. monticola* group (*A. adicola*, *A. aniqiaoensis*, *A. chakratensis*, *A. kohimanensis*, *A. monticola*), and *A. viridimaculatus* group (*A. formosus*, *A. himalayanus*, *A. nidorbellus*, *A. viridimaculatus*). The distribution of species in the *A. monticola* group is known with certainty (Patel et al. 2021), whereas the distribution of species in the *A. marmoratus* group is uncertain. Although Lalronunga et al. (2020) provided a credible report of *A. indoburmanensis* in India from Aizawl and Lunglei Districts of Mizoram, and we herein document the presence of the species from the adjacent District of Champhai. Previous reports of *A. marmoratus sensu stricto* from India (Ahmed et al. 2009; Mathew and Sen 2010) were considered doubtful by Dever et al. (2012). Also, after the resurrection of *A. nepalicus* (Khatiwada et al. 2020; Wang et al. 2020), which had been considered a junior synonym of *A.*

marmoratus, Frost (2022) conditionally recognized *A. senchalensis*, which Dubois (2000) had placed in the synonymy of *A. marmoratus*. Ao et al. (2003) reported the occurrence of *A. viridimaculatus sensu stricto* at Dzuna, Nagaland, India, which is more than 400 km west of the type locality in Tengchong, Yunnan, southeastern China. U. Saikia and Das (2017) also reported the occurrence of *A. viridimaculatus* from Tawang District, Arunachal Pradesh, India, which is another 300 km west of Nagaland. U. Saikia and Das (2017) compared their observation with previous reports from the state (Pawar and Birand 2001; Athreya 2006) and noted that these frogs were “dorsally greenish in colouration with large roundish brown spots,” whereas *A. viridimaculatus sensu stricto* has a brownish dorsum with roundish green spots (Fei et al. 2012; Khatiwada et al. 2020). However, none of these three reports from Arunachal Pradesh confirm that these frogs were *A. viridimaculatus sensu stricto*; instead, they probably represent one or more undescribed lineages in the *A. viridimaculatus* group.

Estimation of species diversity in cryptic groups is difficult without the use of integrative taxonomic tools. B.L.

Stuart et al. (2006) remarked that amphibian diversity remains grossly underestimated due to the erroneous assumption that samples of the same genus collected in sympatry are conspecific. In India, sympatric species of *Amolops* are known from the Darjeeling Hills of West Bengal (*A. himalayanus*, *A. monticola*, *A. senchalensis*) and from Chakrata, Dehra Dun Hills in Uttarakhand (*A. chakrataensis* and *A. jaunsari*). Interestingly, syntopy in Indian species of *Amolops*, although rare, has been documented. Biju et al. (2010) described two syntopic *Amolops* species (*A. kohimaensis* and *A. nidorbellus*) from Nagaland, Dinesh and Radhakrishnan (2019) reported the syntopic occurrence of *A. assamensis* and *A. himalayanus* at Namdapha, Arunachal Pradesh, and we herein report syntopy of *A. adicola* and *A. aniqiaoensis* at Siyum, Arunachal Pradesh.

Acknowledgements

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Appendix 1. GenBank accession numbers for mt 16S rRNA sequences used in the maximum-likelihood phylogenetic analysis of torrent frogs (*Amolops* spp.) (Wu et al. 2020; Jiang et al. 2021; Patel et al. 2021). Sequences from this study are in bold type.

Accession no.	Species	Locality	References
MW794278.1	<i>Amolops</i> sps	India: Sessa Wildlife Sanctuary Arunachal Pradesh	Unpublished
MW794279.1	<i>Amolops</i> sps	India: Sessa Wildlife Sanctuary Arunachal Pradesh	Unpublished
MW794280.1	<i>Amolops</i> sps	India: Sessa Wildlife Sanctuary Arunachal Pradesh	Unpublished
MW794281.1	<i>Amolops</i> sps	India: Sessa Wildlife Sanctuary Arunachal Pradesh	Unpublished
MW794282.1	<i>Amolops</i> sps	India: Sessa Wildlife Sanctuary Arunachal Pradesh	Unpublished
MT124518.1	<i>A. formosus</i>	Nepal: Kimathanka, Sankhuwasabha	Katiwada et al. 2020
MN953750.1	<i>A. sp. 7</i>	Nepal: Mabu, Ilam	Wu et al. 2020; Patel et al. 2021
MT124519.1	<i>A. formosus</i>	Nepal: Lamatar, Taplejung	Katiwada et al. 2020
MT124517.1	<i>A. formosus</i>	Nepal: Kimathanka, Sankhuwasabha	Katiwada et al. 2020
OK138592.1	<i>A. gerbillus</i>	India: Kamle, Arunachal Pradesh	Unpublished
MN953746.1	<i>A. yarlungzangbo</i>	China: Medog, Tibet	Wu et al. 2020
MN953747.1	<i>A. yarlungzangbo</i>	China: Medog, Tibet	Wu et al. 2020
MN953744.1	<i>A. yarlungzangbo</i>	China: Medog, Tibet	Wu et al. 2020
MN953745.1	<i>A. yarlungzangbo</i>	China: Medog, Tibet	Wu et al. 2020
MT124512.1	<i>A. mahabharatensis</i>	Nepal: Pokhara, Kaski District, Nepal	Katiwada et al. 2020
MT124511.1	<i>A. mahabharatensis</i>	Nepal: Pokhara, Kaski District, Nepal	Katiwada et al. 2020
MT124513.1	<i>A. mahabharatensis</i>	Nepal: Barahakshetra, Sunsari District	Katiwada et al. 2020
MT124507.1	<i>A. mahabharatensis</i>	Nepal: Hattibang, Chitwan District	Katiwada et al. 2020
MT124509.1	<i>A. mahabharatensis</i>	Nepal: Hattibang, Chitwan District	Katiwada et al. 2020
MT124514.1	<i>A. mahabharatensis</i>	Nepal: Barahakshetra, Sunsari District	Katiwada et al. 2020
MT124508.1	<i>A. mahabharatensis</i>	Nepal: Hattibang, Chitwan District	Katiwada et al. 2020
MT124510.1	<i>A. mahabharatensis</i>	Nepal: Hattibang, Chitwan District	Katiwada et al. 2020
MT124516.1	<i>A. mahabharatensis</i>	Nepal: Latinath, Darchula District	Katiwada et al. 2020
MT124515.1	<i>A. mahabharatensis</i>	Nepal: Latinath, Darchula District	Katiwada et al. 2020

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Accession no.	Species	Locality	References
MN953722.1	<i>A. panhai</i>	Myanmar: Pakchan Reserve Forest, Kawthoung, Tanintharyi	Wu et al. 2020
JF794451.1	<i>A. panhai</i>	Myanmar: Tanintharyi	Dever et al. 2012; Katiwada et al. 2020
AB211488.1	<i>A. panhai</i>	Thailand: Phetchaburi	Matsui et al. 2006; Katiwada et al. 2020
MN953720.1	<i>A. panhai</i>	Thailand: Huay Yang National Park, Prachuap Khiri Khan	Wu et al. 2020
MN953721.1	<i>A. panhai</i>	Thailand: Ngao Falls National Park, Ranong	Wu et al. 2020
MN953708.1	<i>A. marmoratus</i>	Thailand: Huai Hea, Chiang Mai	Wu et al. 2020
MN953709.1	<i>A. marmoratus</i>	Thailand: Wachiratarn Falls, Amphoe Chom Thong, Chiangmai	Wu et al. 2020
JF794453.1	<i>A. marmoratus</i>	Myanmar: Mon	Dever et al. 2012; Katiwada et al. 2020
JF794454.1	<i>A. marmoratus</i>	Myanmar: Mon	Dever et al. 2012; Katiwada et al. 2020
MN953694.1	<i>A. indoburmanensis</i>	Myanmar: Upper Bee Hoe Village, Mindat, Chin	Wu et al. 2020
MN953692.1	<i>A. indoburmanensis</i>	Myanmar: Baw Village, Chin	Wu et al. 2020
MN519705.1	<i>A. indoburmanensis</i>	India: Mizoram, Murlen National Park	This study
MN953693.1	<i>A. indoburmanensis</i>	Myanmar: Haka Township, Chin	Wu et al. 2020
JF794460.1	<i>A. indoburmanensis</i>	Myanmar: Rakhine	Dever et al. 2012; Katiwada et al. 2020
JF794431.1	<i>A. afghanus</i>	Myanmar: Kachin,	Dever et al. 2012; Katiwada et al. 2020
MN953773.1	<i>A. afghanus</i>	Myanmar: Indawgyi Lake Wildlife Sanctuary, Kachin	Wu et al. 2020
MN953774.1	<i>A. afghanus</i>	Myanmar: Myitkyina	Wu et al. 2020
MN953654.1	<i>A. afghanus</i>	China: Husa, Yunnan	Wu et al. 2020
FJ417145.1	<i>A. cucae</i>	Vietnam: Van Ban, Lao Cai	B.L. Stuart et al. 2010; Wu et al. 2020
FJ417144.1	<i>A. cucae</i>	Vietnam: Van Ban, Lao Cai	B.L. Stuart et al. 2010; Wu et al. 2020
FJ417129.1	<i>A. wenshanensis</i>	China: Jinxiu, Guangxi	B.L. Stuart et al. 2010; Wu et al. 2020
MN953725.1	<i>A. wenshanensis</i>	China: Xichou, Yunnan	Yuan et al. 2018; Wu et al. 2020
MN953724.1	<i>A. wenshanensis</i>	China: Xichou, Yunnan	Yuan et al. 2018; Wu et al. 2020
FJ417142.1	<i>A. compotrix</i>	Vietnam: Dak Gle, Kon Tum	Stuart et al. 2010; Wu et al. 2020
FJ417141.1	<i>A. compotrix</i>	Laos: Nakai	B.L. Stuart et al. 2010; Wu et al. 2020
MN953739.1	<i>A. vitreus</i>	Laos: Phongsaly, Phou Dendin National Biodiversity Conservation Area	Wu et al. 2020
FJ417164.1	<i>A. vitreus</i>	Laos: Phongsaly, Phongsaly	B.L. Stuart et al. 2010; Wu et al. 2020
MN953678.1	<i>A. daorum</i> 1	China: Jingdong, Yunnan	Wu et al. 2020
MN953679.1	<i>A. daorum</i> 1	China: Jingdong, Yunnan	Wu et al. 2020
MN953661.1	<i>A. archotaphus</i>	Thailand: Doi Inthanon, Chiang Mai	Wu et al. 2020
MN953660.1	<i>A. archotaphus</i>	Thailand: Doi Inthanon, Chiang Mai	Wu et al. 2020
MN953659.1	<i>A. archotaphus</i>	Thailand: Amphoe Chom Thong, Chiang Mai	Wu et al. 2020
FJ417158.1	<i>A. akhaorum</i>	Laos: Vieng Phou Kha, Luang Namtha	B.L. Stuart et al. 2010; Wu et al. 2020
FJ417159.1	<i>A. akhaorum</i>	Laos: Vieng Phou Kha, Luang Namtha	B.L. Stuart et al. 2010; Wu et al. 2020
MK501808.1	<i>A. mengdingensis</i>	China: Mengding, Yunnan	Yu et al. 2019
MK501809.1	<i>A. mengdingensis</i>	China: Mengding, Yunnan	Yu et al. 2019
MK501810.1	<i>A. mengdingensis</i>	China: Mengding, Yunnan	Yu et al. 2019
FJ417147.2	<i>A. daorum</i> 2	Laos: Vieng Tong, Huaphahn	B.L. Stuart et al. 2010; Wu et al. 2020
FJ417148.2	<i>A. daorum</i> 2	Laos: Vieng Tong, Huaphahn	B.L. Stuart et al. 2010; Wu et al. 2020
FJ417153.2	<i>A. iriodes</i>	Vietnam: Vi Xuyen, Ha Giang	B.L. Stuart et al. 2010; Wu et al. 2020
FJ417152.2	<i>A. iriodes</i>	Vietnam: Vi Xuyen, Ha Giang	B.L. Stuart et al. 2010; Wu et al. 2020
FJ417151.2	<i>A. mengyangensis</i>	Vietnam: Sa Pa, Lao Cai	B.L. Stuart et al. 2010; Patel et al. 2021
KR827703.1	<i>A. mengyangensis</i>	Vietnam: Sa Pa, Lao Cai	Grosjean et al. 2015; Patel et al. 2021
KR827704.1	<i>A. mengyangensis</i>	Vietnam: Sa Pa, Lao Cai	Grosjean et al. 2015; Patel et al. 2021
MZ229774.1	<i>A. kohimaensis</i>	India: Nagaland	Patel et al. 2021
MN953657.1	<i>A. aniqiaoensis</i>	China: Medog, Tibet	Wu et al. 2020
MZ229772.1	<i>A. adicola</i>	India: Arunachal Pradesh	Patel et al. 2021
OK138593.1	<i>A. adicola</i>	India: Arunachal Pradesh, Upper Subansiri	This study
MZ229773.1	<i>A. monticola</i>	India: South Sikkim	Patel et al. 2021
MT636754.1	<i>A. aniqiaoensis</i>	India: Arunachal Pradesh: Upper Subansiri	This Study
MT636755.1	<i>A. aniqiaoensis</i>	India: Arunachal Pradesh: Upper Subansiri	This Study
MN953658.1	<i>A. aniqiaoensis</i>	China: Tibet	Wu et al. 2020
MN953655.1	<i>A. aniqiaoensis</i>	China: Medog, Tibet	Wu et al. 2020
MN953656.1	<i>A. aniqiaoensis</i>	China: Medog, Tibet	Wu et al. 2020
FJ417127.2	<i>A. bellulus</i>	China: Teng Chong Co., Yunnan	B.L. Stuart et al. 2010; Wu et al. 2020
MN953664.1	<i>A. bellulus</i>	China: Teng Chong Co., Yunnan	Wu et al. 2020
MN953665.1	<i>A. bellulus</i>	China: Teng Chong Co., Yunnan	Wu et al. 2020
MN953719.1	<i>A. nyingchiensis</i>	China: Mainling, Tibet	Wu et al. 2020
MN953717.1	<i>A. nyingchiensis</i>	China: Mainling, Tibet	Wu et al. 2020
MN953718.1	<i>A. nyingchiensis</i>	China: Medog	Wu et al. 2020

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Accession no.	Species	Locality	References
MN953716.1	<i>A. nyingchiensis</i>	China: Mainling, Tibet	Wu et al. 2020
MN953715.1	<i>A. nyingchiensis</i>	China: Mainling, Tibet	Wu et al. 2020
MN953699.1	<i>A. deng</i>	China: Medog, Tibet	Wu et al. 2020
MN953698.1	<i>A. deng</i>	China: Zayü, Tibet	Wu et al. 2020
MN953697.1	<i>A. deng</i>	China: Zayü, Tibet	Wu et al. 2020
MN953695.1	<i>A. deng</i>	China: Zayü, Tibet	Wu et al. 2020
MN953696.1	<i>A. deng</i>	China: Zayü, Tibet	Wu et al. 2020
FJ417126.2	<i>A. bellulus</i> 2	China: Teng Chong Co., Yunnan	B.L. Stuart et al. 2010; Wu et al. 2020
MN953668.1	<i>A. chaochin</i>	China: Sichuan, Anxian	Wu et al. 2020; Jiang et al. 2021
MN953669.1	<i>A. chaochin</i>	China: Sichuan, Anxian	Wu et al. 2020; Jiang et al. 2021
MN953766.1	<i>A. chaochin</i>	China: Gansu	Wu et al. 2020
AB211477.1	<i>A. chaochin</i>	China: Sichuan: Mt. Emei	Wu et al. 2020; Jiang et al. 2021
KU840605.1	<i>A. chaochin</i>	China: Sichuan: Mt. Qingcheng	Wu et al. 2020; Jiang et al. 2021
MN953762.1	<i>A. chunganensis</i>	China: Chengkou, Chongqing	Wu et al. 2020
MN953670.1	<i>A. chunganensis</i>	China: Chengkou, Chongqing	Wu et al. 2020
MG991886.1	<i>A. chunganensis</i>	China: Mt. Jinggang, Jiangxi	Lyu et al. 2018
KX507310.1	<i>A. chunganensis</i>	China: Mt. Wugong, Anfu, Jiangxi	Sung et al. 2016
MN953671.1	<i>A. chunganensis</i>	China: Fangxian, Hubei	Wu et al. 2020
MN953714.1	<i>A. "sp. 5"</i>	Nepal: Maimajhuwa, Ilam	Wu et al. 2020
MN953712.1	<i>A. "sp. 5"</i>	Nepal: Rakshe Village, Mechi	Wu et al. 2020
MN953713.1	<i>A. "sp. 5"</i>	Nepal: Mabu, Ilam	Wu et al. 2020
MN953662.1	<i>A. beibengensis</i>	China: Medog, Tibet	Wu et al. 2020
MN953663.1	<i>A. beibengensis</i>	China: Medog, Tibet	Wu et al. 2020
MN953733.1	<i>A. viridimaculatus</i> 1	China: Pianma, Yunnan	Wu et al. 2020
MN953734.1	<i>A. viridimaculatus</i> 1	China: Pingbian, Yunnan	Wu et al. 2020
MN953735.1	<i>A. viridimaculatus</i> 1	China: Pingbian, Yunnan	Wu et al. 2020
MN953731.1	<i>A. viridimaculatus</i> 1	China: Tengchong, Yunnan	Wu et al. 2020
MN953732.1	<i>A. viridimaculatus</i> 1	China: Tengchong, Yunnan	Wu et al. 2020
MN953738.1	<i>A. viridimaculatus</i> 1	China: Gongshan, Yunnan	Wu et al. 2020
AB211480.1	<i>A. viridimaculatus</i> 1	China: Yunnan	Matsui et al. 2006; Khatiwada et al. 2020
MN953737.1	<i>A. viridimaculatus</i> 2	China: Pianma, Yunnan	Wu et al. 2020
MN953736.1	<i>A. viridimaculatus</i> 2	China: Pianma, Yunnan	Wu et al. 2020
MN953740.1	<i>A. wangyufani</i>	China: Zayü, Tibet	Wu et al. 2020
MN953741.1	<i>A. wangyufani</i>	China: Zayü, Tibet	Wu et al. 2020
MN953680.1	<i>A. granulosus</i>	China: Dayi, Sichuan	Wu et al. 2020
MN953681.1	<i>A. granulosus</i>	China: Anxian, Sichuan	Wu et al. 2020
MG991904.1	<i>A. tuberodepressus</i>	China: Yunnan	Khatiwada et al. 2020
EF453743.1	<i>A. loloensis</i>	China: Xichang, Sichuan	Cai et al. 2007; Wu et al. 2020
MN953757.1	<i>A. loloensis</i>	China: Xichang, Sichuan	Wu et al. 2020
MN953705.1	<i>A. loloensis</i>	China: Yuexi, Sichuan	Wu et al. 2020
MN953704.1	<i>A. loloensis</i>	China: Xichang, Sichuan	Wu et al. 2020
AB211478.1	<i>A. loloensis</i>	China: Sichuan	Matsui et al. 2006; Khatiwada et al. 2020
MN953756.1	<i>A. loloensis</i>	China: Xichang, Sichuan	Wu et al. 2020
EF453741.1	<i>A. jinjiangensis</i>	China: Deqing, Yunnan	Cai et al. 2007; Wu et al. 2020
MN953701.1	<i>A. jinjiangensis</i>	China: Chuxiong, Yunnan	Wu et al. 2020
MN953700.1	<i>A. jinjiangensis</i>	China: Deqing, Yunnan	Wu et al. 2020
MK604846.1	<i>A. shuichengicus</i>	China: Shuicheng County, Guizhou	Lyu et al. 2019
MK604845.1	<i>A. shuichengicus</i>	China: Shuicheng County, Guizhou	Lyu et al. 2019
MN953730.1	<i>A. tuberodepressus</i>	China: Jingdong, Yunnan	Wu et al. 2020
MN953729.1	<i>A. tuberodepressus</i>	China: Jingdong, Yunnan	Wu et al. 2020
MN953765.1	<i>A. xinduoqiao</i>	China: Kangding, Sichuan	Wu et al. 2020
EF453742.1	<i>A. mantzorum</i>	China	Unpublished
AB211479.1	<i>A. mantzorum</i>	China: Sichuan	Matsui et al. 2006; Khatiwada et al. 2020
MN953706.1	<i>A. mantzorum</i>	China: Wolong, Sichuan	Wu et al. 2020
MN953707.1	<i>A. mantzorum</i>	China: Dayi, Sichuan	Wu et al. 2020
MN953764.1	<i>A. xinduoqiao</i>	China: Kangding, Sichuan	Wu et al. 2020
MK604877.1	<i>A. chayuenis</i>	China: Xizang	Lyu et al. 2019; Khatiwada et al. 2020
MN953667.1	<i>A. chayuenis</i>	China: Baxoi, Tibet	Wu et al. 2020
MN953666.1	<i>A. chayuenis</i>	China: Baxoi, Tibet	Wu et al. 2020
MN953685.1	<i>A. gyirongensis</i>	China: Gyirong, Tibet	Wu et al. 2020

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Accession no.	Species	Locality	References
MN953683.1	<i>A. gyirongensis</i>	China: Gyirong, Tibet	Wu et al. 2020
MN953684.1	<i>A. gyirongensis</i>	China: Gyirong, Tibet	Wu et al. 2020
MN953686.1	<i>A. gyirongensis</i>	China: Gyirong, Tibet	Wu et al. 2020
MN953682.1	<i>A. gyirongensis</i>	China: Gyirong, Tibet	Wu et al. 2020
MT124524.1	<i>A. nepalicus</i>	Nepal: Dobhan, Sankhuwasabha	Khatiwada et al. 2020
MT124524.1	<i>A. nepalicus</i>	Nepal: Dobhan, Sankhuwasabha	Khatiwada et al. 2020
MT124522.1	<i>A. nepalicus</i>	Nepal: Dobhan, Sankhuwasabha	Khatiwada et al. 2020
MT124523.1	<i>A. nepalicus</i>	Nepal: Dobhan, Sankhuwasabha	Khatiwada et al. 2020
AB211481.1	<i>A. lifanensis</i>	China: Sichuan	Matsui et al. 2006; Khatiwada et al. 2020
MN953702.1	<i>A. lifanensis</i>	China: Maoxian, Sichuan	Wu et al. 2020
MN953703.1	<i>A. lifanensis</i>	China: Maoxian, Sichuan	Wu et al. 2020
AB211482.1	<i>A. lifanensis</i>	China: Sichuan	Matsui et al. 2006; Khatiwada et al. 2020
MN953690.1	<i>A. hongkongensis</i>	China: Hong Kong	Wu et al. 2020
KX507317.1	<i>A. hongkongensis</i>	China: Hong Kong	Sung et al. 2016; Khatiwada et al. 2020
MN953691.1	<i>A. hongkongensis</i>	China: Hong Kong	Wu et al. 2020
MN953689.1	<i>A. hongkongensis</i>	China: Hong Kong	Wu et al. 2020
KX507306.1	<i>A. daiyunensis</i>	China: Mt. Daiyu, Fujian	Sung et al. 2016; Khatiwada et al. 2020
MN953676.1	<i>A. daiyunensis</i>	China: Daiyunshan, Fujian	Wu et al. 2020
MN953675.1	<i>A. daiyunensis</i>	China: Daiyunshan, Fujian	Wu et al. 2020
MN953677.1	<i>A. daiyunensis</i>	China: Daiyunshan, Fujian	Wu et al. 2020
MK263277.1	<i>A. yunkaiensis</i>	China: Ehuangzhang Nature Reserve, Guangdong	Lyu et al. 2018, 2019
MK263271.1	<i>A. yunkaiensis</i>	China: Yunkaishan Nature Reserve, Guangdong	Lyu et al. 2018, 2019
MN953763.1	<i>A. sinensis</i>	China: Gongcheng, Guangxi	Wu et al. 2020
MK263262.1	<i>A. sinensis</i>	China: Guangdong	Lyu et al. 2019; Khatiwada et al. 2020
MN953775.1	<i>A. sinensis</i>	China: Guidong, Hunan	Wu et al. 2020
MN953748.1	<i>A. sinensis</i>	China: Mao'er Shan, Guangxi	Wu et al. 2020
MN953749.1	<i>A. sinensis</i>	China: Mao'er Shan, Guangxi	Wu et al. 2020
KX507312.1	<i>A. yunkaiensis</i>	China: Yunkaishan	Sung et al. 2016; Khatiwada et al. 2020
MK263248.1	<i>A. albispinus</i>	China: Mt. Wutong, Guangdong	Sung et al. 2016; Lyu et al. 2019
MK263249.1	<i>A. albispinus</i>	China: Mt. Wutong, Guangdong	Sung et al. 2016; Lyu et al. 2019
MK263290.1	<i>A. yatseni</i>	China: Zhongshan City, Guangdong	Lyu et al. 2019
MK263250.1	<i>A. yatseni</i>	China: Shangchuan Island, Guangdong	Lyu et al. 2019
MN953723.1	<i>A. yatseni</i>	Vietnam: Sa Pa, Lao Cai	Wu et al. 2020
MN953758.1	<i>A. yatseni</i>	China: Jingxi, Guangxi	Wu et al. 2020
DQ204486.1	<i>A. ricketti</i>	China: Shanghang, Fujian	Orlov et al. 2006; Khatiwada et al. 2020
MN953743.1	<i>A. rickettii</i>	China: Wuyishan, Fujian	Wu et al. 2020
MN953759.1	<i>A. rickettii</i>	China: Shicheng, Jiangxi	Wu et al. 2020
MN953760.1	<i>A. wuyiensis</i>	China: Wencheng, Zhejiang	Wu et al. 2020
MN953761.1	<i>A. wuyiensis</i>	China: Yiwu, Zhejiang	Wu et al. 2020
MN953742.1	<i>A. wuyiensis</i>	China: Wuyishan, Fujian	Wu et al. 2020
KX507304.1	<i>A. wuyiensis</i>	China: Fujian	Sung et al. 2016; Khatiwada et al. 2020
MN953727.1	<i>A. spinaepectoralis</i>	Vietnam: Kon Ka Kinh, Gia Lai	Wu et al. 2020
MN953770.1	<i>A. spinaepectoralis</i>	Vietnam: Tram Lap, Gia Lai	Wu et al. 2020
MN953726.1	<i>A. spinaepectoralis</i>	Vietnam: Ngoc Linh vicinity, Kon Tum	Wu et al. 2020
MN953771.1	<i>A. spinaepectoralis</i>	Vietnam: Central Highland, Ngok Linh, Kon Tum	Wu et al. 2020
AF206456.1	<i>A. spinaepectoralis</i>	Vietnam: Gia Lai	Chen et al. 2005; Khatiwada et al. 2020
MN953768.1	<i>A. spinaepectoralis</i>	Vietnam: Bana resort, Da Nang	Wu et al. 2020
MN953769.1	<i>A. spinaepectoralis</i>	Vietnam: Phong Dien Nature Reserve, Phong Dien, Thua Thien Hue	Wu et al. 2020
MN953772.1	<i>A. spinaepectoralis</i>	Vietnam: Phong Dien Nature Reserve, Phong Dien, Thua Thien Hue	Wu et al. 2020
MN953728.1	<i>A. torrentis</i>	China: Diao Luo Shan forest Park, Lingshui, Hainan	Wu et al. 2020
EF453744.1	<i>A. torrentis</i>	China: Hainan	Wu et al. 2020; unpublished
MN953687.1	<i>A. hainanensis</i>	China: Wuzhishan, Hainan	Wu et al. 2020
MN953688.1	<i>A. hainanensis</i>	China: Wuzhishan, Hainan	Wu et al. 2020
KX507320.1	<i>A. hainanensis</i>	China: Hainan	Sung et al. 2016; Khatiwada et al. 2020
MF061741.1	<i>A. larutensis</i>	Malaysia: Gunung Bubu, Perak	Unpublished
MF061749.1	<i>A. larutensis</i>	Malaysia: Bukit Larut, Perak	Unpublished
MF061745.1	<i>A. australis</i>	Malaysia: Endau-Rompin, Johor (Peta)	Unpublished
MF061721.1	<i>A. gerutu</i>	Malaysia: Gunung Tebu, Terengganu	Unpublished
MN953674.1	<i>A. cremnobatus</i>	Thailand: Doi PhuKa, Chom Poo PhuKa Nature Trail, Nan	Wu et al. 2020
DQ204477.1	<i>A. cremnobatus</i>	Vietnam: Khe Moi	Orlov et al. 2006; Khatiwada et al. 2020

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Accession no.	Species	Locality	References
FJ417143.1	<i>A. cremnobatus</i>	Laos: Kasi, Vientiane	B.L. Stuart et al. 2010; Wu et al. 2020
MN953673.1	<i>A. cremnobatus</i>	Vietnam: Puhu National Reserve, Thanh Hoa	Wu et al. 2020
MN953672.1	<i>A. cremnobatus</i>	Vietnam: Puhu National Reserve, Thanh Hoa	Wu et al. 2020
MN953751.1	<i>Babina hainanensis</i>	China: Lingshui, Diao Luo Shan Forest Park, Hainan	Wu et al. 2020
MN953752.1	<i>Huia cavitympanum</i>	Malaysia: Marak Parak, S. Tahobang, Kota Marudu, Sabah	Wu et al. 2020
MN953755.1	<i>Odorrana jingdongensis</i>	China: Jingdong, Yunnan	Wu et al. 2020
MN953753.1	<i>Rana jiemuxiensis</i>	China: Jiemuxi, Hunan	Wu et al. 2020