

Supplementary Information

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Delineating *Microhyla ornata* (Anura, Microhylidae): Mitochondrial DNA barcodes resolve century old taxonomic misidentification

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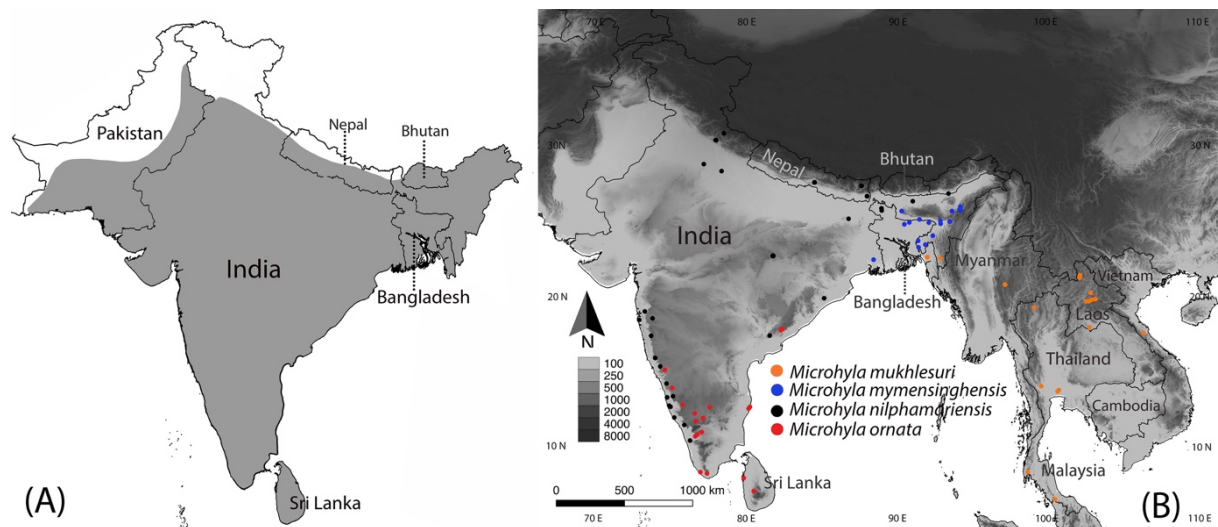


Figure S1. (A) Known distribution of *Microhyla ornata* before this study, (B) Revised distribution of *M. ornata* along with three morphologically and genetically related species (*M. mukhlesuri*, *M. mymensinghensis* and *M. nilphamariensis*) based on genetically confirmed samples.

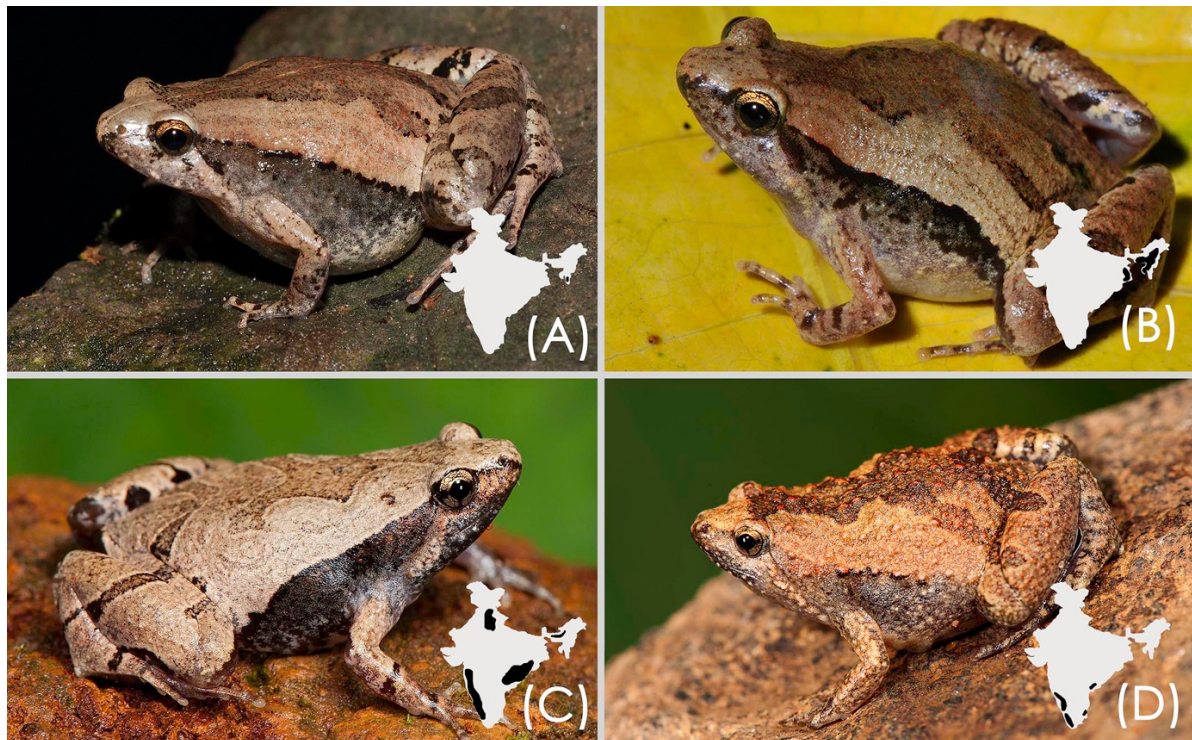


Figure S2. The four closely related *Microhyla* species and their distributions in India: (A) *M. mukhlesuri*, (B) *M. mymensinghensis*, (C) *M. nilphamariensis*, and (D) *M. ornata*.

Table S1. List of samples used in the study. Geographical coordinates are included for samples reported in the present study.

	Species	Locality/Coordinates	Voucher/Source	Accession No.
1	<i>Microhyla achatina</i>	Indonesia: Java	MZB Amp 16402	AB634656
2	<i>Microhyla annectens</i>	Malaysia: Selangor	KUHE 53373	AB634658
3	<i>Microhyla berdmorei</i>	Malaysia: Selangor	KUHE 52034	AB598338
4	<i>Microhyla borneensis</i>	Malaysia: Sarawak	KUHE 53165	AB598329
5	<i>Microhyla butleri</i>	Vietnam: A Roang	KUHE 40591	AB634664
6	<i>Microhyla fissipes</i>	China: Anhui	KUHE 32943	AB201185
7	<i>Microhyla heymonsi</i>	NA	NA	AY458596
8	<i>Microhyla laterite</i>	India: Karnataka	BNHS 5965	KT600670
9	<i>Microhyla malang</i>	Malaysia: Sarawak	KUHE 53018	AB598319
10	<i>Microhyla mantheyi</i>	Malaysia: Selangor	KUHE 15726	AB598333
11	<i>Microhyla marmorata</i>	Laos: Houapan	KUHE 32455	AB634668
12	<i>Microhyla mihintalei</i>	Sri Lanka: Anuradhapura	DZ1468	KU214861
13	<i>Microhyla mixtura</i>	China: Sichuan	CIB 20070248	AB634669
14	<i>Microhyla mukhlesuri</i>	Bangladesh: Chittagong	Morn -Bd11 (IABHU 3879)	AB543608
15	<i>Microhyla mukhlesuri</i>	Bangladesh: Chittagong	Morn -Bd12 (IABHU 3880)	AB543609
16	<i>Microhyla mukhlesuri</i>	India: Mizoram (22.53°N 92.89°E)	SDBDU 2010.1332	MH549575
17	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K3361	KR827917
18	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K3090	KR827918
19	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K3087	KR827919
20	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K3334/2006.2360	KR827920
21	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K3179/2006.2362	KR827921
22	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K3216/2006.2381	KR827922
23	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K4/1997.8359	KR827925
24	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K3252/2006.2391	KR827926
25	<i>Microhyla mukhlesuri</i>	Laos: Luang Prabang	K3154/006.2331	KR827931
26	<i>Microhyla mukhlesuri</i>	Laos: Phongsaly	K1946/2005.0177	KR827928
27	<i>Microhyla mukhlesuri</i>	Laos: Phongsaly	K1634/2004.0426	KR827929
28	<i>Microhyla mukhlesuri</i>	Laos: Viangchan	717D	KR827927
29	<i>Microhyla mukhlesuri</i>	Malaysia: Perlis	JAM 1991	KC822490
30	<i>Microhyla mukhlesuri</i>	Myanmar: Shan	CAS HERP 230957	KC179995
31	<i>Microhyla mukhlesuri</i>	Thailand: Bangkok	0976Y	KR827923
32	<i>Microhyla mukhlesuri</i>	Thailand: Bangkok	KUHE 22064	AB634666
33	<i>Microhyla mukhlesuri</i>	Thailand: Chiang Mai	K3009	KR827924
34	<i>Microhyla mukhlesuri</i>	Thailand: Kanchanaburi	KUHE 35165	AB201186
35	<i>Microhyla mukhlesuri</i>	Thailand: Phang Nga	P306	KR827930
36	<i>Microhyla mukhlesuri</i>	Vietnam: Quang Binh	ZFMK86426	EU157074
37	<i>Microhyla mukhlesuri</i>	Vietnam: Quang Binh	ZFMK86370	EU157075
38	<i>Microhyla mukhlesuri</i>	Vietnam: Quang Binh	ZFMK86752	EU157076
39	<i>Microhyla mukhlesuri</i>	NA	KIZHERP0138	JX678905
40	<i>Microhyla mukhlesuri</i>	NA	NA	JQ621935
41	<i>Microhyla mukhlesuri</i>	NA	NA	AF215371
42	<i>Microhyla mukhlesuri</i>	NA	NA	AF215373
43	<i>Microhyla mukhlesuri</i>	NA	TZ52	AF285202
44	<i>Microhyla mymensinghensis</i>	Bangladesh: Mymensingh	Morn -Bd1	AB530529
45	<i>Microhyla mymensinghensis</i>	Bangladesh: Mymensingh	Morn -Bd2	AB530530
46	<i>Microhyla mymensinghensis</i>	Bangladesh: Mymensingh	Morn -Bd3	AB530531
47	<i>Microhyla mymensinghensis</i>	Bangladesh: Mymensingh	Morn -Bd4	AB530532
48	<i>Microhyla mymensinghensis</i>	Bangladesh: Mymensingh	Morn -Bd5	AB530533
49	<i>Microhyla mymensinghensis</i>	Bangladesh: Mymensingh	Morn -Bd6	AB530534
50	<i>Microhyla mymensinghensis</i>	Bangladesh: Mymensingh	Morn -Bd7	AB530535
51	<i>Microhyla mymensinghensis</i>	Bangladesh: Mymensingh	Morn -Bd8 (DFBGBAU 306)	AB530536
52	<i>Microhyla mymensinghensis</i>	Bangladesh: Sylhet	Morn -Bd9 (IABHU 3898)	AB543606
53	<i>Microhyla mymensinghensis</i>	Bangladesh: Sylhet	Morn -Bd10 (IABHU 3899)	AB543607
54	<i>Microhyla mymensinghensis</i>	India: Assam (24.79°N 92.79°E)	SDBDU 2008.1321	MH549576
55	<i>Microhyla mymensinghensis</i>	India: Assam (24.98°N 92.78°E)	ADWII_BM1	MH549577
56	<i>Microhyla mymensinghensis</i>	India: Assam (24.98°N 92.78°E)	ADWII_BM2	MH549578
57	<i>Microhyla mymensinghensis</i>	India: Manipur	SDBDU 2007.14	MH549579

		(24.93°N 93.39°E)		
58	<i>Microhyla mymensinghensis</i>	India: Manipur (24.94°N 93.40°E)	SDBDU 2008.1440	MH549580
59	<i>Microhyla mymensinghensis</i>	India: Meghalaya (25.62°N 90.23°E)	SDBDU 2008.1360	MH549581
60	<i>Microhyla mymensinghensis</i>	India: Nagaland (25.71°N 94.05°E)	SDBDU 2007.30	MH549582
61	<i>Microhyla mymensinghensis</i>	India: Nagaland (25.68°N 94.12°E)	SDBDU 2007.209	MH549583
62	<i>Microhyla mymensinghensis</i>	India: Nagaland (25.92°N 94.09°E)	SDBDU 2007.248	MH549584
63	<i>Microhyla mymensinghensis</i>	India: Nagaland (25.62°N 93.54°E)	SDBDU 2009.37	MH549585
64	<i>Microhyla mymensinghensis</i>	India: Tripura (23.41°N 91.79°E)	SDBDU 2009.568	MH549586
65	<i>Microhyla mymensinghensis</i>	India: Tripura (24.00°N 92.28°E)	SDBDU 2009.611	MH549587
66	<i>Microhyla mymensinghensis</i>	India: Tripura (23.23°N 91.34°E)	SDBDU 2009.482	MH549588
67	<i>Microhyla mymensinghensis</i>	India: Tripura (23.66°N 91.31°E)	SDBDU 2009.444	MH549589
68	<i>Microhyla mymensinghensis</i>	India: West Bengal (22.43°N 88.38°E)	SDBDU 2015.2904	MH549590
69	<i>Microhyla nanapollexa</i>	Vietnam: Quang Nam	PT-484	KM509164
70	<i>Microhyla nilphamariensis</i>	Bangladesh: Dinajpur	DB-Hi-FROG 12005	AB201187
71	<i>Microhyla nilphamariensis</i>	Bangladesh: Dinajpur	Morn -Bd1 (IABHU 22135)	AB530537
72	<i>Microhyla nilphamariensis</i>	Bangladesh: Dinajpur	Morn -Bd2 (IABHU 22136)	AB530538
73	<i>Microhyla nilphamariensis</i>	Bangladesh: Dinajpur	Morn -Bd3 (IABHU 22137)	AB530539
74	<i>Microhyla nilphamariensis</i>	Bangladesh: Saidpur	MZH-2360	KP072787
75	<i>Microhyla nilphamariensis</i>	Bangladesh: Saidpur	MZH-2361	KP072788
76	<i>Microhyla nilphamariensis</i>	Bangladesh: Saidpur	MZH-2362	KP072789
77	<i>Microhyla nilphamariensis</i>	Bangladesh: Saidpur	MZH-2363	KP072790
78	<i>Microhyla nilphamariensis</i>	Bangladesh: Saidpur	MZH-2364	KP072791
79	<i>Microhyla nilphamariensis</i>	Bangladesh: Saidpur	MZH-2365	KP072792
80	<i>Microhyla nilphamariensis</i>	Bangladesh: Saidpur	MZH-2366	KP072793
81	<i>Microhyla nilphamariensis</i>	India: Andhra Pradesh (81.54°N 17.43°E)	SDBDU 2007.4987	MH549591
82	<i>Microhyla nilphamariensis</i>	India: Assam (26.27°N 90.96°E)	SDBDU 2015.2905	MH549592
83	<i>Microhyla nilphamariensis</i>	India: Assam (26.77°N 93.31°E)	SDBDU 2015.2915	MH549593
84	<i>Microhyla nilphamariensis</i>	India: Bihar (25.11°N 86.73°E)	SDBDU 2011.869	MH549594
85	<i>Microhyla nilphamariensis</i>	India: Chhattisgarh (22.71°N 81.76°E)	SDBDU 2010.401	MH549595
86	<i>Microhyla nilphamariensis</i>	India: Delhi (28.71°N 77.19°E)	SDBDU 2016.3375A	MH549596
87	<i>Microhyla nilphamariensis</i>	India: Karnataka	NA	AB530627
88	<i>Microhyla nilphamariensis</i>	India: Karnataka	BNHS 5028	AB530628
89	<i>Microhyla nilphamariensis</i>	India: Karnataka	BNHS 5029	AB530629
90	<i>Microhyla nilphamariensis</i>	India: Karnataka	RBRL 040723-04	AB530630
91	<i>Microhyla nilphamariensis</i>	India: Karnataka (15.40°N 74.33°E)	SDBDU 2011.836	MH549597
92	<i>Microhyla nilphamariensis</i>	India: Karnataka (14.27°N 74.75°E)	SDBDU 2011.1376	MH549598
93	<i>Microhyla nilphamariensis</i>	India: Karnataka (12.82°N 74.93°E)	SDBDU 2015.3045	MH549599
94	<i>Microhyla nilphamariensis</i>	India: Karnataka (13.36°N 74.79°E)	SDBDU 2015.3060	MH549600
95	<i>Microhyla nilphamariensis</i>	India: Karnataka (12.75°N 75.01°E)	SDBDU 2017.3600	MH549601
96	<i>Microhyla nilphamariensis</i>	India: Karnataka (75.17°N 13.44°E)	SDBDU 2003.1353	MH549602
97	<i>Microhyla nilphamariensis</i>	India: Kerala (11.55°N 75.92°E)	SDBDU 2008.403	MH549603
98	<i>Microhyla nilphamariensis</i>	India: Kerala	SDBDU 2003.1345	MH549604

		(10.52°N 76.29°E)		
99	<i>Microhyla nilphamariensis</i>	India: Kerala (12.04°N 75.26°E)	SDBDU 2017.3581	MH549605
100	<i>Microhyla nilphamariensis</i>	India: Maharashtra (17.42°N 73.73°E)	SDBDU 2004.4507	MH549606
101	<i>Microhyla nilphamariensis</i>	India: Maharashtra (18.46°N 72.95°E)	SDBDU 2011.1459	MH549607
102	<i>Microhyla nilphamariensis</i>	India: Maharashtra (15.96°N 73.99°E)	SDBDU 2014.2482	MH549608
103	<i>Microhyla nilphamariensis</i>	India: Maharashtra (18.56°N 73.83°E)	SDBDU 2014.2676	MH549609
104	<i>Microhyla nilphamariensis</i>	India: Maharashtra (19.02°N 73.32°E)	SDBDU 2014.2750	MH549610
105	<i>Microhyla nilphamariensis</i>	India: Maharashtra (15.96°N 73.99°E)	SDBDU 2002.1336	MH549611
106	<i>Microhyla nilphamariensis</i>	India: Maharashtra (15.96°N 73.99°E)	SDBDU 2004.1433	MH549612
107	<i>Microhyla nilphamariensis</i>	India: Maharashtra (17.42°N 73.73°E)	SDBDU 2007.1562	MH549613
108	<i>Microhyla nilphamariensis</i>	India: Odisha (19.89°N 85.13°E)	SDBDU 2015.3121	MH549614
109	<i>Microhyla nilphamariensis</i>	India: Uttarakhand (30.28°N 77.97°E)	ADWII_DW1	MH549615
110	<i>Microhyla nilphamariensis</i>	India: Uttarakhand (30.28°N 78.01°E)	ADWII_DT1	MH549616
111	<i>Microhyla nilphamariensis</i>	India: Uttarakhand (30.73°N 78.53°E)	ADWII_ACC059	MH549617
112	<i>Microhyla nilphamariensis</i>	India: Uttar Pradesh (28.25°N 78.37°E)	ADWII_M03 (RJM3F)	MH549618
113	<i>Microhyla nilphamariensis</i>	Nepal: Mechi	JRK201528	KY655950
114	<i>Microhyla nilphamariensis</i>	Nepal: Mechi	JRK201529	KY655951
115	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201501	KY655926
116	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201502	KY655927
117	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201503	KY655928
118	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201504	KY655929
119	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201505	KY655930
120	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201506	KY655931
121	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201507	KY655932
122	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201508	KY655933
123	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201509	KY655934
124	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201510	KY655935
125	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201511	KY655936
126	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201512	KY655937
127	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201513	KY655938
128	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201514	KY655939
129	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201515	KY655940
130	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201516	KY655941
131	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201517	KY655942
132	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201518	KY655943
133	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201519	KY655944
134	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201520	KY655945
135	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201521	KY655946
136	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201522	KY655947
137	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201523	KY655948
138	<i>Microhyla nilphamariensis</i>	Nepal: Narayani	JRK201524	KY655949
139	<i>Microhyla okinawensis</i>	Japan: Okinawa	IABHU5263	AB303950
140	<i>Microhyla orientalis</i>	Indonesia: Bali	KUHE 55073	AB781469
141	<i>Microhyla ornata</i>	India: Andhra Pradesh (17.66°N 82.22°E)	SDBDU 2015.2898	MH549619
142	<i>Microhyla ornata</i>	India: Andhra Pradesh (17.68°N 82.58°E)	SDBDU 2015.2899	MH549620
143	<i>Microhyla ornata</i>	India: Karnataka	ZSIK-A9119	AB201188
144	<i>Microhyla ornata</i>	India: Karnataka	BNHS 5036	AB530632
145	<i>Microhyla ornata</i>	India: Karnataka (11.80°N 76.69°E)	SDBDU 2007.6029	MH549621
146	<i>Microhyla ornata</i>	India: Karnataka	SDBDU 2003.1352	MH549622

		(13.98°N 75.11°E)		
147	<i>Microhyla ornata</i>	India: Karnataka (15.17°N 74.63°E)	SDBDU 2011.1314	MH549623
148	<i>Microhyla ornata</i>	India: Karnataka (12.32°N 76.60°E)	SDBDU 2012.1960	MH549624
149	<i>Microhyla ornata</i>	India: Karnataka (12.89°N 75.78°E)	SDBDU 2012.2198	MH549625
150	<i>Microhyla ornata</i>	India: Karnataka (12.00°N 77.14°E)	SDBDU 2014.2539	MH549626
151	<i>Microhyla ornata</i>	India: Karnataka (12.73°N 77.58°E)	SDBDU 2014.2555	MH549627
152	<i>Microhyla ornata</i>	India: Kerala	RGCB15059	KP072794
153	<i>Microhyla ornata</i>	India: Kerala (8.45°N 76.98°E)	SDBDU 2015.2970	MH549628
154	<i>Microhyla ornata</i>	India: Kerala (10.80°N 76.64°E)	SDBDU 2003.1344	MH549629
155	<i>Microhyla ornata</i>	India: Tamil Nadu (8.36°N 77.41°E)	SDBDU 2008.1958	MH549630
156	<i>Microhyla ornata</i>	India: Tamil Nadu (12.63°N 80.15°E)	SDBDU 2014.2733A	MH549631
157	<i>Microhyla ornata</i>	India: Tamil Nadu (12.63°N 80.15°E)	SDBDU 2014.2733B	MH549632
158	<i>Microhyla ornata</i>	India: Tamil Nadu (11.08°N 77.06°E)	SDBDU 2014.2794	MH549633
159	<i>Microhyla ornata</i>	India: Tamil Nadu (10.92°N 76.78°E)	SDBDU 2014.2820	MH549634
160	<i>Microhyla ornata</i>	India: Tamil Nadu (11.08°N 77.06°E)	SDBDU 2003.1341	MH549635
161	<i>Microhyla ornata</i>	India: Tamil Nadu (11.08°N 77.06°E)	SDBDU 2008.1720	MH549636
162	<i>Microhyla palmipes</i>	Indonesia: Bali	MZB Amp 16255	AB634670
163	<i>Microhyla perparva</i>	Malaysia: Sarawak	KUHE 53675	AB634673
164	<i>Microhyla petrigena</i>	Malaysia: Sarawak	KUHE 53743	AB634675
165	<i>Microhyla pulchra</i>	China: Guangdong	NA	KF798195
166	<i>Microhyla rubra</i>	India: Karnataka	NA	AB201192
167	<i>Microhyla sholigari</i>	India	VUB 0066	AF249060
168	<i>Microhyla superciliaris</i>	Malaysia: Negeri Sembilan	KUHE 53371	AB634683
169	<i>Microhyla taraiensis</i>	Nepal: Mechi	JRK201525	KY655952
	Outgroup			
170	<i>Kaloula pulchra</i>	Thailand: Kanchanaburi	KUHE 35171	AB201194

Table S2. Inter and intraspecific uncorrected p-distances (in percent) for the mitochondrial 16S rRNA gene sequences. N1 represents the number of samples per species; N2 represents number of pairwise comparisons between species.

Species			Uncorrected P-distances			K2P distances		
Intraspecific		N1	Mean	Min	Max	Mean	Min	Max
<i>Microhyla mukhlesuri</i>		30	1.5	0	3.3	1.5	0	3.4
<i>Microhyla mymensinghensis</i>		25	0.7	0	2.1	0.7	0	2.2
<i>Microhyla nilphamariensis</i>		69	0.7	0	2.3	0.7	0	2.4
<i>Microhyla ornata</i>		21	0.2	0	0.8	0.2	0	0.8
Interspecific		N2	Mean	Min	Max	Mean	Min	Max
<i>Microhyla mukhlesuri</i>	<i>Microhyla mymensinghensis</i>	750	4.1	2.8	5.4	4.2	2.8	5.6
<i>Microhyla mukhlesuri</i>	<i>Microhyla nilphamariensis</i>	2070	9.2	7.1	10.8	9.9	7.5	11.7
<i>Microhyla mukhlesuri</i>	<i>Microhyla ornata</i>	630	9.8	8.1	11.3	10.5	8.6	12.3
<i>Microhyla mymensinghensis</i>	<i>Microhyla nilphamariensis</i>	1725	7.7	6.2	8.6	8.1	6.4	9.1
<i>Microhyla mymensinghensis</i>	<i>Microhyla ornata</i>	525	8.4	7.7	9.2	8.9	8.1	9.8
<i>Microhyla nilphamariensis</i>	<i>Microhyla ornata</i>	1449	4.8	3.9	5.7	5.0	4.0	5.9