

A New Species of *Philautus* (Anura: Ranidae) from the Western Ghats of India

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ABSTRACT.—A new frog, *Philautus griet* sp. nov., is described from Munnar in the Western Ghats of India. Molecular phylogenetic analyses of a 548 bp fragment of the mitochondrial 16S rRNA-gene confirm its placement in the genus *Philautus* (Anura, Ranidae, Rhacophorinae). In its small size, general brown coloration, and reduced webbing on toes, the new species is similar to *Philautus bombayensis* and *Philautus timniens*. However, relative to *P. griet*, *P. bombayensis* differs by the invariable presence of greyish-black and yellow spots in the groin and on the inside of the thighs, and *P. timniens* can be distinguished by the dark side of the head and the yellow inner fingers and toes. Phylogenetic analyses of Indian and Sri Lankan *Philautus* have identified *Philautus charius* as the sister taxon of *P. griet*. However, the latter can be readily distinguished by its smaller adult size (20.7–22.1 mm, $N = 5$, vs. 27.5–30.9 mm, $N = 10$, in *P. charius*) and lack of black coloration with yellow spots on the posterior surface of the thighs. The 30 km wide Palghat Gap, dividing the Western Ghats into northern and southern components, may have played a role in the vicariant isolation of these species.

Although the Western Ghats (a range of hills along the west coast of India) are considered one of the global hotspots of biodiversity (Myers et al., 2000), taxonomic knowledge of amphibians in this region remains incomplete. One of the main reasons for this is that most species were described by British zoologists during the colonial past. For example, some 80% of all southern Indian and Sri Lankan *Philautus* species currently recognized were described during the 19th century (Bossuyt and Dubois, 2001). Because of the primitive state of descriptive taxonomy at that time, this period produced brief descriptions of species whose type locality was mainly defined in terms of large geographic regions, such as "Madras Presidency," "Malabar," or "Travancore" (Dutta, 1997).

After the work of Boulenger (1890), no revisions were published on the amphibian fauna of the Western Ghats until the publications of Daniel (1963a,b, 1975), Daniel and Sekar (1989), and the biogeographic overview of Daniels (1992a). However, these publications did not cover the genus *Philautus*. In the last 50 years, only checklists (Gorham, 1974; Inger and Dutta, 1986; Dutta, 1992, 1997; Frost, 2000) have been published on Indian species of *Philautus*.

The above factors, together with enormous intraspecific variation (Bossuyt and Dubois, 2001), have led to a confused taxonomy of this group. In a review of the species-level taxonomy of the genus *Philautus* Gistel, 1848 (Ranidae, Rhacophorinae), Bossuyt and Dubois (2001) assembled information on the taxonomic status of all available names and their name-bearing types. During that work, we came across several mu-

seum specimens belonging to an undescribed species. Herein, a new species of *Philautus* is described from Munnar in the Western Ghats, India.

MATERIALS AND METHODS

Measurements and terminology follow Bossuyt and Dubois (2001). The following measurements were taken, to the nearest 0.1 mm, using a digital slide-caliper (SVL, HL, and TL) or a binocular microscope with a micrometer ocular. SVL (snout–vent length), HW (head width, at the angle of the jaws), HL (head length, from rear of mandible to tip of snout), MN (distance from rear of mandible to nostril), MFE (distance from rear of mandible to anterior orbital border of eye), MBE (distance from rear of mandible to posterior orbital border of eye), SL (snout length, from tip of snout to anterior orbital border of eye), EL (eye length, horizontal distance between bony orbital borders of eye), IUE (inter upper eyelid width, the shortest distance between the upper eyelids), UEW (maximum upper eyelid width), IN (distance between internal border of nostrils), IFE (internal front of eyes, shortest distance between anterior orbital border of eyes), IBE (internal back of eyes, shortest distance between posterior orbital border of eyes), NS (distance from nostril to tip of snout), EN (distance from nostril to anterior orbital border of eye), TYD (largest tympanum diameter), TYE (distance from posterior orbital border of eye to tympanum), FLL (forelimb length, from elbow to base of outer palmar tubercle), HAL (hand length, from base of outer palmar tubercle to tip of third finger), TFL (third finger

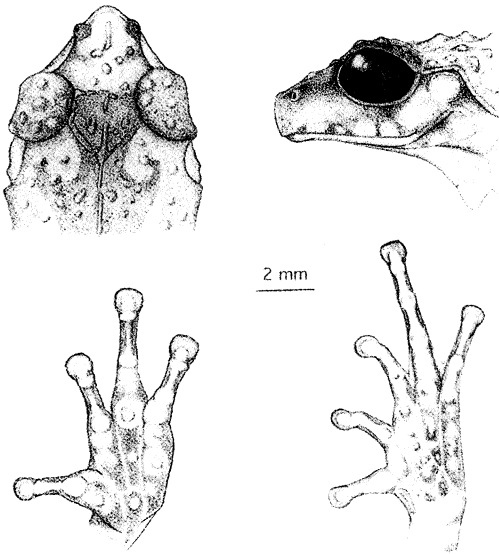


FIG. 1. Holotype of *Philautus griet* sp. nov.: Dorsal (above left) and lateral (above right) view of head; ventral view of hand (below left) and foot (below right).

length, from base of first subarticular tubercle), FD_{I-IV} (disk width on finger I-IV), FW_{I-IV} (width of finger I-IV, at base of disk), TD_{I-V} (disk width on toe I-V), TW_{I-V} (width of toe I-V, at base of disk), TL (tibia length), TW (maximum tibia width), FL (femur length), FOL (foot length, from base of inner metatarsal tubercle to tip of fourth toe), FTL (fourth toe length, from base of first subarticular tubercle to tip of fourth toe), TFOL (distance from heel to tip of fourth toe), MTTF (distance from distal edge of metatarsal tubercle to maximum incurvation of web between third and fourth toe), MTFE (distance from distal edge of metatarsal tubercle to maximum incurvation of web between fourth and fifth toe), TTFE (distance from maximum incurvation of web between third and fourth toe to tip of fourth toe), FTFE (distance from maximum incurvation of web between fourth and fifth toe to tip of fourth toe), IMT (inner metatarsal tubercle length), and ITL (inner toe length).

Because the genus *Philautus* has been confused with many other ranid genera (e.g., *Indirana* and *Micrixalus*) throughout the history of anuran taxonomy (Bossuyt and Dubois, 2001), a molecular phylogenetic analysis was performed to justify the generic allocation of the new species. I followed procedures outlined elsewhere (Bossuyt and Milinkovitch, 2000) for DNA-extraction, PCR-amplification, and sequencing of both strands of a 548 bp DNA-sequence of the 16S rRNA-gene of one of the paratypes (KBIN

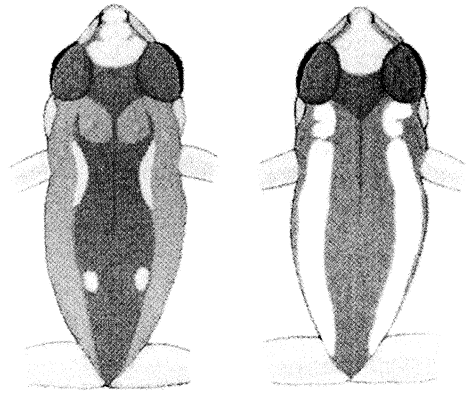


FIG. 2. Color-pattern variation of *Philautus griet* in dorsal view (left: holotype KBIN 1918; right paratype KBIN 1926).

1923). This sequence (deposited in the GenBank database, accession number AF536203) was aligned with sequences of two outgroup species and 10 representatives of southern Indian and Sri Lankan ranid genera having toe disks. Apart from the new species, *Philautus* in this dataset include *Philautus microtympanum*, *Philautus wynaadensis*, and *Philautus charius*. The software SOAP (Löytynoja and Milinkovitch, 2001) was used to produce and compare 20 CLUSTAL W (Thompson et al., 1994) multiple alignments characterized by different gap/extension penalties (11.0–19.0/3.0–9.0, with steps of 2). Positions at which the alignments differed were identified and excluded in the subsequent analyses (Gatesy et al., 1993). Gaps resulting from the alignment were treated as missing data. The complete dataset of 13 species was submitted to a phylogenetic analysis in PAUP* 4.0b7 (D. L. Swofford, Sinauer Associates, Sunderland, MA, 2001, unpubl.), using maximum parsimony (MP) with all characters weighted equally. The stability of relevant clades was estimated by computing bootstrap values (Felsenstein, 1985) and by calculating decay indices ("branch support"; Bremer, 1994). Additionally, a maximum likelihood (ML) analysis was performed with the following settings: empirical nucleotide frequencies, Ti:Tv ratio and proportion of invariable sites estimated by means of ML, Hasegawa-Kishino-Yano (HKY) model (Hasegawa et al., 1985) with rate heterogeneity, rates for variable sites assumed to follow a γ distribution with shape parameter estimated by ML, and tree bisection-reconnection (TBR) branch-swapping.

Philautus griet sp. nov.
Figs. 1–3

Holotype.—KBIN (Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussel) 1919,

