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## NEW GENERIC NAMES FOR SOME NEOTROPICAL POISON FROGS (DENDROBATIDAE)

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### ABSTRACT

*Two new generic names are provided in advance of a more extensive phylogenetic analysis of alkaloid-producing frogs of the family Dendrobatidae. Epipedobates, n. gen., accommodates an assemblage of 22 species of relatively primitive dendrobatids recently assigned either to Phyllobates (s.l.) or Dendrobates (s.l.). Minyobates, n. gen., contains eight miniature poison frogs formerly in Dendrobates. The older genera, Dendrobates and Phyllobates, are believed to be monophyletic after these changes. Taxonomically useful characters are found in larval structure, adult morphology and color pattern, behavior and vocalization, and biochemistry of noxious and toxic skin alkaloids.*

### INTRODUCTION

The Dendrobatidae are a well-defined family of diurnal Neotropical frogs with a unique life history (Myers and Daly, 1983; Weygoldt, 1987). One lineage is comprised of mostly brightly colored species that share one outstanding attribute, namely the production, and release in defensive skin secretions, of a remarkable array of over 200 lipophilic alkaloids (Daly et al., 1987). Certain of these alkaloids (batrachotoxins) are used by Emberá and Noanamá Indians of western Colombia for poisoning blowgun darts, but statements that dendrobatid toxins are similarly used by tribes east of the Andes seem to be only a modern literary myth that feeds on itself (Myers et al., 1978).

John Daly and I started a laborious field survey of dendrobatids and their alkaloids in 1966, and our interest gradually came to include the problem of generic limits within the Dendrobatidae. The classification has never been satisfactory, mainly because dendrobatids share such a similar morphology (Myers and Ford, 1986: 9-12) that taxonomists had access to few characters (e.g., relative finger length and presence or absence of teeth and foot webbing). Silverstone (1975, 1976), in two beautifully prepared monographs, arranged

the toxic dendrobatids almost equally between the genera *Dendrobates* Wagler and *Phyllobates* Bibron, and was partly successful in setting up natural species groups. By this time, however, Daly and I had come to suspect that neither *Dendrobates* nor *Phyllobates* was a monophyletic group, but that accumulating data on skin alkaloids, vocalizations, and behavior could be brought to bear on an improved classification (e.g., Myers and Daly, 1976a; Myers et al., 1978).

Our first step in establishing natural genera based on a strict concept of monophyly was to redefine *Phyllobates* to include only those frogs that produced steroidal alkaloids (batrachotoxins). The remaining species were temporarily transferred to *Dendrobates* "until relationships can be further analyzed in this group of frogs" (Myers et al., 1978: 332). Mention was made in several publications of ongoing study, and at least one reference was given to a Myers and Daly manuscript in preparation (Maxson and Myers, 1985: 51). That manuscript has grown rather lengthy and authorship has been joined by Linda S. Ford, who also is involved in a phylogenetic study of the Dendrobatidae.

Inasmuch as some workers (e.g., Weygoldt, 1987: 52) appear unaware of our intentions, and because at least one European aquarist is showing a desire to coin names in ignorance of systematic theory and standard nomenclatural practice (e.g., International Commission on Zoological Nomenclature, 1985, appendix A-2), it seems advisable to publish two new generic names in advance of the phylogenetic analysis. The study by Myers, Daly, and Ford will detail the phylogenetic rationale. Meanwhile, I hope that the new generic arrangement will prove useful to students of dendrobatid biology.

#### **Epipedobates, new genus**

Type Species: *Prostherapis tricolor* Boulenger, 1899.

#### **Etymology**

From the Greek *epipedos* (on the ground) + *bates* (a walker), in reference to the primarily terrestrial nature of most species. Gender masculine.

#### **Diagnosis**

Relatively primitive poison frogs containing various classes of piperidine-based skin alkaloids, but no 3,5-disubstituted indolizidines. Adults 15-50 mm snout-to-vent length (SVL), most species attaining maximum sizes well in excess of 20 mm SVL (maximum less than 20 mm SVL in *espinosai* and *maculatus*). Teeth present on maxillary arch (except in *bolivianus*, *pulchripectus*, *trivittatus*, and some populations of *pictus*). Appressed first finger equal to or longer than second finger (slightly shorter in one Andean species being described by Myers and Burrowes); finger discs weakly to moderately expanded, with third finger disc of adults normally less than 1.5 times width of finger (rarely 1.6-1.8 times). Vestigial webbing present or absent between toes 2-4. Color pattern most often including a bright (yellow, green, or blue), oblique lateral stripe extending from groin at least partway to eye; pale middorsal or ventrolateral stripes sometimes present, dorsolateral stripes rarely present. Ground color black or brown, except that several species have part or all of head and body red or orange, with or without pale stripes. Bright flash markings often present on upper arm, in groin, and/or on proximoventral part of shank (calf spot). Ventral surfaces usually black or brown with pale (white, blue, or red) marbling or spots, or pale with dark marbling. Tadpole with laterally indented oral disc, 2/3 tooth rows (second upper row broken above beak), and dextral anus; aquatic larvae usually in small streams or terrestrial pools. Cephalic

amplexus utilized in mating. Advertisement call variable, usually consisting of well-tuned notes rising in frequency and perceived as peeps or short whistles, variously grouped as couplets, triplets, or in slow or fast trains; one species (*erythromos*) with a harsh, retarded chirp call. Primarily terrestrial in nature, but sometimes tending to be weakly scansorial in low vegetation.

*Epipedobates* resembles *Phyllobates* in hand structure and presence of teeth on maxillary arch, but *Phyllobates* differs in having batrachotoxin and 3,5-disubstituted indolizidine alkaloids, in having vivid pale dorsolateral stripes at least in juveniles (dorsolateral stripes present in only three *Epipedobates*), in lacking an oblique lateral line and calf spot (also absent in several *Epipedobates*), in having a trill call, and in lacking mating amplexus. *Epipedobates* differs from *Dendrobates* and *Minyobates* in the longer first finger, smaller finger discs, and presence of teeth in most species.

#### Referred Species

*Phyllobates anthonyi* Noble, 1921; *Phyllobates azureiventris* Kneller and Henle, 1985; *Dendrobates bassleri* Melin, 1941; *Prostherapis bolivianus* Boulenger, 1902; *Prostherapis boulengeri* Barbour, 1909; *Dendrobates erythromos* Vigle and Miyata, 1980; *Phyllobates espinosai* Funkhouser, 1956; *Prostherapis femoralis* Boulenger, 1884; *Hylaplesia flavopicta* A. Lutz, 1925; *Dendrobates ingeri* Cochran and Goin, 1970; *Dendrobates maculatus* W. Peters, 1873; *Dendrobates myersi* Pyburn, 1981; *Dendrobates parvulus* Boulenger, 1882; *Phyllobates petersi* Silverstone, 1976; *Hylaplesia picta* Tschudi, 1838; *Phyllobates pulchripectus* Silverstone, 1976; *Dendrobates silverstonei* Myers and Daly, 1979; *Phyllobates smaragdinus* Silverstone, 1976; *Prostherapis tricolor* Boulenger, 1899; *Hyla trivittata* Spix, 1824; *Phyllobates zaparo* Silverstone, 1976; *Dendrobates* n. sp., Myers and Burrowes (1987, in press).

#### Distribution

Northern South America, from about 4.° (west of Andes) or 7.° north latitude to about 20.° south latitude; in lowland tropical rain forest, and in wet Andean forest to approximately 2000 m. Absent in extreme northern South America, but an outlying species may occur in lower Central America (*E. maculatus* in western Panama, see Myers, 1982).

#### Remarks

The genus *Epipedobates* nearly equals *Phyllobates* sensu Silverstone (1976) after removal of most of his *bicolor* group (= *Phyllobates* sensu stricto, fide Myers et al., 1978). As now constituted, *Epipedobates* is recognized by a suite of characters that are mostly primitive within the Dendrobatidae. The genus therefore might or might not be natural, but further splitting is inadvisable unless two or more separate lineages can be objectively determined. Assignment of species to groups will mostly follow Silverstone (1976), with some modification to accommodate species named or resurrected subsequent to his monograph.

#### **Minyobates, new genus**

Type Species: *Dendrobates steyermarki* Rivero, 1971.

#### Etymology

From the Greek *minys* (little, small) + *bates* (a walker), in reference to the diminutive size of the contained species. Gender masculine.

### Diagnosis

Miniature poison frogs containing piperidine-based skin alkaloids mainly of the pumiliotoxin-A and decahydroquinoline classes, but no histrionicotoxins or 3,5-disubstituted indolizidines. Size very small, 12-19.5 mm SVL, most species less than 17 mm SVL. Teeth absent. Appressed first finger appreciably shorter (one-half to three-fourths) than second, or barely shorter than second in *steyermarki*; finger discs expanded, with disc of third finger usually greater than 1.5 times finger width (except in *steyermarki*) and often approaching or exceeding 2 times finger width. Toes lacking webs. Color pattern variable: Black with yellow, green, or red dorsolateral stripes, often with an incomplete oblique lateral line in groin and sometimes an indication of a middorsal stripe; or head and body uniformly red; or light metallic yellow or green with black spots; or uniformly dark metallic green; or overall black with golden flash marks in axilla and groin. Never a complete oblique lateral line to eye; no calf spot. Tadpole with oral disc laterally indented, 2/3 tooth rows (second upper row broken above beak), and dextral anus; aquatic larvae in bromeliads or leaf axils. Cephalic amplexus at least in *steyermarki*. Advertisement call a well-spaced sequence of soft notes in *steyermarki* or a buzz call in other species where known. Terrestrial to scansorial or arboreal in nature.

*Minyobates* resembles *Dendrobates* in hand structure and in lacking teeth, but *Dendrobates* differs in generally larger size (to 50 mm SVL, with maximum adult size of most species well over 20 mm SVL), in not having an oblique lateral line (absent through loss in some *Minyobates*), in lack of cephalic amplexus, in presence of histrionicotoxins and 3,5-disubstituted indolizidines, and in larval characters (oral disc laterally unindented and anus median).

### Referred Species

*Dendrobates abditus* Myers and Daly, 1976; *Dendrobates altobueyensis* Silverstone, 1975; *Dendrobates bombetes* Myers and Daly, 1980; *Dendrobates fulguritus* Silverstone, 1975; *Dendrobates minutus* Shreve, 1935; *Dendrobates opisthomelas* Boulenger, 1899; *Dendrobates steyermarki* Rivero, 1971; *Dendrobates viridis* Myers and Daly, 1976.

### Distribution

Disjunct in wet lowland and montane forest: Western and central Panama from sea level to about 1000 m; Pacific lowlands of Colombia; the Serranía de Baudó (1070 m) and northern Andes of Colombia to above 2000 m; Amazonian versant of Ecuadorian Andes (1700 m); and Cerro Yapacana (600-1200 m), an isolated Venezuelan tepui on upper Orinoco.

### Remarks

*Minyobates* is equivalent to the *Dendrobates minutus* species group of Silverstone (1975) after removal of several species assigned to a *quinquevittatus* species group by Myers (1982), and with the addition of species subsequently described by Myers and Daly (1976a, 1976b, 1980). *Minyobates steyermarki*, isolated on a Venezuelan table mountain, seems to be relatively primitive compared with the Andean and Central American species.

### TAXONOMIC SUMMARY

Dendrobatids that produce lipophilic alkaloids are a monophyletic group that is now partitioned among four genera. No unique character is yet known for *Epipedobates* (22 named spp.), and it stands as the primitive group to

*Minyobates* (8 spp.), *Phyllobates* (5 spp.), and *Dendrobates* (21 spp.), which are variously definable by derived features of larval and adult morphology, color patterns, behavior, and skin toxins. In this arrangement, *Phyllobates* (type sp. *P. bicolor* Bibron in Ramón de la Sagra) and the greatly reduced *Dendrobates* (type sp. *Rana tinctoria* Cuvier, see Dubois, 1982, and Lescure, 1982) are sister groups as defined by the loss of cephalic amplexus (cephalic embrace sometimes retained in an aggressive context), loss of the primitive oblique lateral line, and first appearance of 3,5-disubstituted indolizidine alkaloids. The probable relationships of species within these genera will be treated elsewhere using a greater variety of characters. The classification is intended to be predictive of the distribution of traits not yet coded for all species, and also of new characters. History suggests that new data eventually may prove the arrangement in need of further modification.

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