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## A NEW FROG FROM PANAMA

### *Dendrobates galindoi*

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In the course of operating a series of forest tree stations for the study of the canopy mosquito fauna associated with the transmission of jungle yellow fever, I have had opportunity during the past two years to collect large series of *Dendrobates* in the tropical rain forest near Almirante, Panama. In this forest, about ten kilometers northwest of Almirante, at an altitude of 500 to 700 feet, there are two common *Dendrobates*. One, a relatively large species (body length 35 to 40 mm.) strikingly marked with an irregular pattern of black and metallic green, for the present may be called *Dendrobates auratus* Girard. The second is a smaller species (body length about 20 mm.), deep red both above and below, but with the forefeet, hind feet, and thighs black, flecked with metallic green on the dorsal aspect and metallic pale blue on the ventral aspect. The dark color of the hind limbs extends into the concealed surfaces of the groin and to varying degrees forward on the belly. Occasional individuals have the red dorsal body color peppered with tiny flecks of black. Professor E. R. Dunn, who has studied this genus extensively both in the field and in museums, has suggested that the available name for this form is *Dendrobates pumilio* Schmidt. The study of the frogs of this genus, except in life, is made particularly difficult by the fact that on preservation in formalin they turn a uniform drab black, the brilliant and distinctive colors and patterns so evident in life are lost, and only structural characters may then be discerned. In preserved material, however, *D. pumilio* may be told from young *D. auratus* by the fact that the former has a very finely rugose skin, while the skin of the latter is smooth. I have seen neither of these forms near sea level at Almirante, although I have taken both in an old cacao plantation at sea level at Wachope, near Limón, Costa Rica, some 60 miles west of Almirante. I am informed by Dr.

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Dunn, however, that he has seen them near Chiriquicito on the Chiriqui Lagoon.

The island of Bastimentos, 14 miles east of Almirante, is one of the barrier islands protecting the Bahia de Almirante. At the edge of the village of Bastimentos, on the northwestern shore of the island, there is a sizable patch of the large-leaved terrestrial araceous "otoe," *Xanthosoma violaceum*, grown for its tuberous edible root. Several years ago, while aspirating water from the axils of these plants in the search for mosquito larvae, my colleague, Pedro Galindo V., took several tadpoles. Also crouched on the plant petioles and in the water accumulated in the leaf axils were a number of small orange-red frogs strongly spotted with black. A preserved series of these presented to me at the time had lost the orange-red pigment and were drab black and gray.

Recently it has been possible to visit this island, as well as the adjacent Isla de Colon, to collect living material of this frog. The species was found to be extremely common at Bastimentos, but none were found in searches of *Xanthosoma* at several places on the Isla de Colon. Residents of the adjacent mainland, familiar with the area from Almirante to the Costa Rican border, when shown specimens of this frog, reported that they had never seen any like it before. It may be concluded for the present that this form is endemic on Bastimentos Island.

From the preserved material previously available it had been supposed that the red *Dendrobates* of Bastimentos, similar in size to the red *D. pumilio* of the mainland, was possibly a race, in which the flecks of black on the body of occasional specimens of *pumilio* had become more fully developed into a pattern of black spots. It was only when the Bastimentos frog was seen in life that it was apparent that this was a distinct species with the venter white, not red as in *pumilio*, and with other coloration and structural differences.

#### ***Dendrobates galindoi* sp. nov.**

*Type*.—Chicago Natural History Museum no. 71053, collected November 22, 1952, altitude 20 feet, in a patch of *Xanthosoma violaceum* at the edge of the village of Bastimentos, island of Basti-

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FIG. 36. Three paratypes of *Dendrobates galindoi* sp. nov., showing variation in extent of dark markings of dorsum. Upper: the specimen with the least black pigment. Middle: one in the intermediate condition. Lower: one showing development to the point where the dark marks have become fused to form irregular longitudinal bars.

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mentos, Bocas del Toro Province, Republic of Panama, by Harold Trapido, Pedro Galindo V., and Wilfred Hills.

*Paratypes*.—Same data as the type. Chicago Natural History Museum nos. 71054–71087.

*Diagnosis*.—A small (20 mm.) *Dendrobates* presumably related to *D. pumilio*, but with the red dorsum punctate, maculate, or longitudinally barred with black. The venter is enamel white, not red as in *pumilio*. The fingers, toes, legs, and thighs are light, spotted or maculate with black or brown, not black flecked with metallic green or blue as in *pumilio*. There is a chromatic form comprising a small part of the population with the ground color of the dorsum cream, pale yellow or green, rather than red. The body is finely rugose as in *pumilio* but is slightly longer and stouter, and the terminal finger disks are more expanded.

*Color description of holotype from life* (colors from Ridgway).—Dorsum of body near Grenadine Red, marked with black spots that are from one to two mm. in diameter. Eyes black, nostrils and mouth very narrowly edged with black. Dorsal aspect of the limbs also Grenadine Red spotted with black. Dorsal aspect of fore and hind feet between white and Dull Opaline Green, with tiny black spots. Ventral aspect of body and forelimbs enamel white, with a diffuse wash between white and Pale Nile Blue on ventral aspect of hind limbs. Plantar surface of fore and hind feet Cinnamon Brown mixed with Pale Nile Blue. Black marks of the thighs becoming Cinnamon Brown on lower legs and feet. A few tiny patches of metallic blue-green mixed with the Grenadine Red on the dorsum of the body.

Examination under magnification (from 10 to 30 diameters) reveals that the entire body surface is pustulate, with circular black dots crowning each pustule. The skin color apparent to the naked eye is determined by the coloration of the slopes of the pustules and the interpustular space. Thus, while the venter is apparently unmarked enamel white, it is actually white finely punctate with black.

*Measurements of holotype before preservation*.—Body length, 22 mm.; tibia, 9.5 mm.; heel to tip of third toe, 13.3 mm.; longest toe, 5.4 mm.; internarial distance, 3 mm.; anterior interorbital distance, 4.4 mm.; nostril to anterior corner of eye, 2 mm.; greatest breadth of body, 10 mm.

*Variation in coloration*.—The principal variation is in the size of the black marks on the red dorsum. The holotype represents the median condition, with black spots from one to two mm.



FIG. 37. Upper: habitat of *Dendrobates galindoi* sp. nov. in a patch of the araceous plant, *Xanthosoma violaceum*, at the edge of the village of Bastimentos, on Bastimentos Island, Panama. These little frogs are extremely common on the leaves and petioles and in the axils of these plants, as well as on the ground shaded by the large leaves. Lower: the water-holding axils of these plants with the sheltering leaves cut away. In these accumulations of water the tadpoles develop.

in diameter. Some have only small flecks of black, while at the other end of the series the spots may be fused to form incomplete longitudinal bars. All specimens have at least some black marks. While the venter is usually immaculate white a few specimens have occasional black spots irregularly distributed on the belly. The dark markings of the dorsal aspect of the hind limbs vary in size and intensity. When the marks are small, from one to two mm. in diameter, they appear black; when they are enlarged they become paler and brown in color. In specimens with very large marks the hind limbs appear blotched with brown, with only a narrow network of the red ground color between the blotches.

Quite apart from this normal variation in coloration a part of the population presents a color form with the same variation in pattern but with the dorsal ground color from bronzy-cream to Apple Green or Pale Dull Green-Yellow. Four specimens out of a total of about fifty collected exhibit this coloration, but as a special effort was made to capture the greenish individuals, they probably represent less than 5 per cent of the population.

*Range.*—The species is at present known only from the island of Bastimentos and is thought to be endemic there.

*Breeding.*—Eggs of this frog were not found, nor were adults seen transporting larvae on their backs, a habit observed in other *Dendrobates*. We do know, however, that the tadpoles develop in accumulations of water in the axils of the large-leaved terrestrial *Xanthosoma violaceum*. On November 22, 1952, in addition to the series of adults taken, ten tadpoles and transforming individuals were collected by aspirating water from these plants. The smallest tadpole is 9.5 mm. in length. There are three transforming individuals in the series: one with only the hind limbs emerged is 22 mm. in total length, with the head and body (to anus) 9 mm.; one with the hind limbs emerged and the fore limbs just about to emerge is 24 mm. in total length, with the head and body 10.5 mm.; and one with well-developed fore and hind limbs, which has probably begun the resorption of the tail, is 23.5 mm. in total length, with the head and body 11.5 mm. The species apparently transforms at about 12 to 15 mm.

*Remarks.*—These frogs, at the time of year they were collected at least, seem quite colonial. In an area some thirty yards square about fifty individuals were collected in half an hour with the help of native children. Those taken represented only a small fraction of the ones seen and not collected. During the day these frogs are

very active, hopping about on the ground and on the petioles and leaves of the "otoe." As many as three or four could be seen at a time crouched in the axils of these plants, both in the water and on the petioles just out of the accumulated water. In this ecological niche their poison secretion must be of considerable survival value, for a number of domestic fowl were foraging in the patch of "otoe" but they made no attempt to eat these bright red frogs. No other frogs were seen in the area.

A number of these frogs have been kept alive in terraria in the laboratory for several months, where they do very well feeding on fruit flies (*Drosophila*) and mosquitoes (*Anopheles albimanus*), which happen to be conveniently available insects. They call intermittently during the day. The call is a series of grating insect-like chirps, from twenty to thirty in a series, commencing with well-spaced chirps that rapidly increase in frequency and end in almost a trill. The upper abdomen and pectoral region are considerably inflated during calling, the throat only moderately so. Single chirps are also given with fair frequency. The frogs are active during the day, as are other *Dendrobates*, and readily climb the glass walls of terraria to pursue mosquitoes resting on the covering screen. At night they are quiescent, for the most part resting in groups toward the tops of the leaves of plants in the terrarium.













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