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B ASILISKS: FROM GREEK MYTHOLOGY TO RUNNING THE WATERS

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A Basiliscus world

Basiliscus is a genus of Neotropical Corytophanid medium size lizards, containing four described species: the common brown basilisk Basiliscus basiliscus (Linnaeus, 1758), the western basilisk Basiliscus galeritus Duméril, 1851, the emerald basilisk Basiliscus plumifrons Cope, 1875 and the stripped or northern basilisk Basiliscus vittatus Wiegmann, 1828. Laurenti (1768) coined that name for the already described by Linnaeus Lacerta basiliscus, as Basiliscus americanus, dedicated of course to the mythical creature (see below). All species are Neotropical, ranging from southwestern Ecuador to Northeastern México. They are active foragers close to water courses. All are well known for having a particular escape mode, running bipedal over the water. Here I propose an approach to these magnificent lizards, common but little known.

> All basilisks are inhabitants of riparian situations in different types of forests (humid evergreen, cloudy, dry, mangrove) and even coasts.

Adult male *B. b. basiliscus* from Uvita, Costa Rica. Photo: César Barrio-Amorós



Portraits of *B. basiliscus*. Art by Jose Manuel Fernández Cortes, @zcortesstudio

Basiliscus basiliscus (Linnaeus, 1758)

Definition. Adult males up to 25 cm (9.8 in) SVL (snot-vent length), 90 cm (35.4 in) TL (total length), with females noticeably smaller.

Three crests are characteristic in adult males: a solid single high head crest with a pointy tip backwards, a high dorsal and a high caudal crest.

Coloration olive-brown with more or less dark crossbands on body, crests and tail; a white postocular stripe is constant, and white facial mouth corners can be more or less extended. The postocular white stripe extends laterally to the tail; the supralabial white stripe extends backwards laterally through the cheeks, neck, shoulders

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laterally on the flanks to the start of the tail; this is more obvious in juveniles and young males and females. Iris olive green to reddish.

Subspecies. Basiliscus b. barbouri Ruthven, 1914. Ruthven (1914) distinguishes this subspecies from the nominal by the shape of the crest, but Maturana (1962) doubted about the taxon recognition, showing intergrade forms in the crest shape.

The most striking character to differentiate both taxa would be the adult male pattern on the head, being striped in white and black in *B. b. barbouri* and without any pattern in *B. b. Basiliscus*.

Distribution. *B. b. basiliscus*: Pacific southwestern Nicaragua, Costa Rica and Panamá; eastern Caribbean Iowlands of Panama (Köhler 2003). *B. b. barbouri*: Northern Colombia and NW Venezuela, west of the Andes (except for several reports east of the Andes in Tachira (Barrio & Orellana 2001), and as far east as Yaracuy (Barrio-Amorós & Rivas, 2003).

It is not clear the limit between subspecies, as it is not clear the valid taxonomic status of *B. b. Barbouri*. This species can reach up to 2000 m a.s.l. In Central America, *B. b. basiliscus* ascends up to 1400 m a.s.l.

B. b. barbouri from Minca, Colombia (photo: César Barrio-Amorós).

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Portraits of *B. galeritus*. Art by Jose Manuel Fernández Cortes, @zcortesstudio

Basiliscus galeritus Duméril, 1851

Definition. There are two divergent populations: Chocoan and Magdalena Valley.

Chocoan (B. galeritus sensu stricto): Males up to 77 cm (30.3 in); females up to 65 cm (25.6 in). Body moderately compressed; crest on head of males extended, rounded, its basal part fleshy; in females only a low lobar-rounded projection backwards; dorsal crest reduced to serrated series of trihedral compressed tubercles separated by one or more scales; wide fringes more developed on the toes; top of head, neck and crest reddish; underside of jaw and dewlap white; body reddish to green, with irregular brown crossing bands; sides of body without longitudinal bands; two white bands, one from the corner of the mouth and the other from the chin to the rear end of the jaw in juveniles; belly uniform white; throat with a blackish stripe on each side, iris is brown.

Magdalena Valley (*B. sp.* aff. *galeritus*): Males with a cephalic crest large and round, its basal part fleshy; in females only a low lobarrounded projection backwards; dorsal crest reduced to serrated series of conical or triangular tubercles separated by one or more scales; top of head and crest green; underside of jaw and dewlap dirty white; body emerald green, with whitish narrow cross bands or white sparkled; sides of body without longitudinal bands; belly uniform yellow green. Iris greyish blue.

It was not clear until now which one of the two populations (clearly different species) is the name bearer. Duméril (1851) just mentioned the type locality as New Grenada (the whole country of Colombia). I asked to see the two syntypes of the species at the Museum Nationale de Histoire Naturelle de Paris, and gently, Nicolas Vidal sent me pictures of the syntypes, answering the question of which one is the real galeritus and which one is the new species awaiting description. So now we know that the conspecific population with the syntypes is the Chocoan population.

Only after determining which population belong the syntypes, we can be sure of which of the *B. cf. galeritus* is going to be new to describe.

Distribution. In Central America, it is only present in Panama very close to the Colombian border in the Darien. In Colombia *B. galeritus* extends West to the Andes all along the Chocó (Pacific versant) and Cauca River valley, reaching Ecuador. In Ecuador it is found in the lowlands of Chocó and the adjacent slopes of the Andes in the provinces of Esmeraldas, Carchi, Cañar, Chimborazo, El Oro, Manabí, Los Ríos, Imbabura, Pichincha, Santo Domingo de los Tsáchilas, Cotopaxi and Bolivar, up to 2135 m a.s.l.

The Inter-Andean population in Colombia extends through the Magdalena River Valley in departamentos Bolivar, Antioquia, Santander, Cundinamarca, Tolima and Huila. *B. galeritus* can be sympatric with *B. basiliscus basiliscus* in Panama and Colombia at the northwestern edge of the distribution of the former and the southwestern of the later; and with *B. b. barbouri* along the Magdalena valley.



Adult female of *B. galeritus* from San Cipriano, Colombia (photo: Alejandro Grajales).

Mythology

VI y fsis Aldrouandi

The word basilisk has its origin in the Greek **βἄσἴλίσκος** meaning little king.

In Greek mythology it was considered to be a hybrid between a snake and a rooster, but believed to be the king of snakes. It was believed in Ancient Greece that on some occasions, an old rooster could lay an egg, and from it, a basilisk would hatch.

The creature had a rooster crest with three peaks, which made it be called **Βασιλεύς** (king in Greek).

This infamous beast is able to convert anyone that look at it in stone at a glance. Plinius the Elder already wrote about its natural history. It occurred in the province of Cyrene (Lybia), measured 12 fingers in length (around 1 m) and had a white spot in its head, in a sort of diadem. It could raise the body around the middle. It was so venomous that it was leaving a trail of venom along its way.

That monster is able to burn all bushes by contact and even those which have been breathed upon. It was formerly a general belief that if a man on horseback killed one of these animals with a spear, the poison would run up the weapon and kill, not only the rider, but the horse as well.

The basilisk was only terrified by the odor of a weasel. "The animal is thrown into the hole of the basilisk, which is easily known from the infected soil around. The weasel destroys the basilisk by its odor, but dies itself in this struggle of nature against its own self". It is evident that Plinius the Elder was talking about a Cobra *Naja haje* (Linnaeus, 1758); the only one inhabiting the Lybian desert, but without a white diadema as an ornament on the neck; in the same way, spitting cobras from Africa and Asia can be the origin of the legend of the burning venom), and its historical rivalry with mongooses (a kind of weasel at those times).

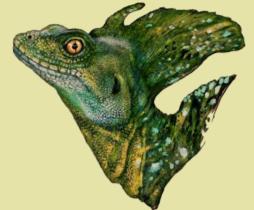
In medieval times, the concept of the basilisk changed to embrace larger monstrous dragon-like creatures with rooster head and chest, reptilian snake-like body and tail, two or more pairs of avian legs and two avian or dragon wings. The basilisk was capable of freezing anyone with its glance, burn its path and surroundings of its borrow with its venom, and was only terrified of the presence of a weasel, the only creature, along with a rooster call, that can kill a basilisk.



Bafiliscus in solitudine Africæ viuens.*

*The illustrations by Ulysses Aldrovandi's (1640) mythological basilisk.





Portraits of *B. plumifrons* Art by Jose Manuel Fernández Cortes, @zcortesstudio

Basiliscus plumifrons (Cope, 1875)

Definition. Adult males up to 25 cm (9.8 in) SVL, 90 cm (35.4 in) with tail, with females noticeably smaller. Three crests are characteristic: a bipartite high head crest, a high dorsal and a high caudal crest. Coloration emerald green (can change to dirty or greyish green to almost blackish with blue lateral spots (on crests, body and in lesser amount, tail), very distinctive during breeding season; iris yellow.

Distribution. Southeastern Honduras, Caribbean slopes of Nicaragua and Costa Rica; Bocas del Toro (Panama). There is a long-established discussion about its presence in the Southern Pacific of Costa Rica. While Savage (2002) shows six localities in his map of the species in that region, no one is defended by a voucher. Federico Bolaños and Gerardo Chaves from the Universidad de Costa Rica explained how they found a recently dead green Basiliscus in Palmar Norte, Puntarenas, but it was too big to collect it. It was recently killed by a Bothrops asper (Garman, 1884) and probably close to being swollen. In the combined experience

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of several herpetologists, both national and foreigners, doing research in the central and southern Pacific regions for a long time, no one has seen with confidence any *B. plumifrons* or other green basilisk. If a green Basilisk occurs at the area, it should be interesting to compare both, morphological and molecular, to the other species. One voucher, however, UCR 22769, from Hatillo de Savegre de Aguirre, Puntarenas province, Costa Rica, a juvenile specimen, corresponds to *B. plumifrons* (using Savage's key 2002: 427-428) in having occipital scales small, supraoccipitals also small, and no throat pattern.



Adult male of *B. plumifrons* showingn extreme metachrosis, from emerald green A to dull grey B (Río Celeste, Costa Rica, photos: John Borhman).

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In adition, *Basiliscus* are dominant components of their habitats. It is very rare that no more individuals, especially adults with green color, have been recognized in the last 22 years at least on the Pacific side of Costa Rica.



Juvenile *B. plumifrons* from Hatillo de Savegre, Puntarenas, Costa Rica (UCR22769), identified by G. Chaves and me using Savage (2002) key. The absence of throat pattern (A, B) is characteristic, as well as having the occipital and supraoccipitals scales small (vs. presence of throat pattern and those scales much bigger) (photo: G. Chaves).



Juvenile *B. plumifrons* showing the normal coloration, Fortuna, Costa Rica. (Photo: Marion Moh.)



Basiliscus vittatus Wiegmann, 1828 (photo: Gerardo Ramos)

Basiliscus vittatus Wiegmann, 1828

Definition. Adult males up to 17 cm (7.6 in) SVL, 59 cm (23.2 in) TL, with females noticeably smaller. Only a prominent crest on the head, rounded to triangular, but lacking fins found in other Central American species; a short vertebral crest is present in adult males.

Coloration dull brown to olive green, adult males sometimes with yellow on the head; white to yellow postocular line extending towards midbody, where it fades, and supralabial stripe; iris bluish.

Distribution. The species with a widest distribution, from western Panama to Mid México, Jalisco to the northwest and southern Tamaulipas to the northeast. Common in the Caribbean lowlands of Costa Rica and widespread in Nicaragua, Honduras, Guatemala, El Salvador, Yucatán and Belize. Introduced in Florida, U.S. It is sympatric with B. plumifrons in the Caribbean versant of Nicaragua, Costa Rica and Panama, Nahuat-Cervera & Avilés Novelo found two males sleeping inside a karstic cave in Yucatan, México. One of the males had a bifurcate tail.

Adult green male *B. sp.* aff. *galeritus* from Falán, Tolima, Colombia (photo: Alejandro Grajales; Birding & Herping).

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Vernacular names of Basiliscus



Infographic: Responsible Herpetoculture Journal

Natural history of Basilisks

Diet and predators. All four (or five) species of basilisks are almost strict carnivores, both when juveniles and as adults. Hallinan (1920) reports Lepidoptera, Coleoptera, Odonata, Orthoptera, a fish and some fruits in the stomachs of three specimens of B. basiliscus from Barro Colorado, Panamá. Barden (1943) examined 106 specimens of *B. basiliscus* from Panama and Costa Rica, finding 22% of vegetal matter and 78% of animal matter. The vegetable material included fruits, berries, nuts, flowers, leaves, twigs, moss, grass, sedges, fungi and charcoal, much of it fragmentary and probably taken by accident. Varying amounts of vegetable matter were present in fifty stomachs.

The animal food was about 99 percent invertebrate and 1 percent vertebrate, including one fish, two frogs, three lizards, and two birds. In a more recent approach, Molero (2018) examined 116 specimens of which 89.3% was animal matter and the rest (10.7%) vegetal. Arthropods were 89% of the animal matter, and 11 % were vertebrates, among them, fishes, lizards, and a mammal (Quiroptera). Herein we report a Pristimantis frog (probably P. labiosus Lynch, Ruiz-Carranza & Ardila-Robayo, 1994) eaten at dusk by a juvenile B. galeritus in Chocoan Ecuador. Gutsche (2005) reports *B. vittatus* preying on juvenile Ctenosaura bakeri Stejneger, 1901 in Utila, Honduras. Alvarado et al. (2022) show a case of an adult male *B. plumifrons* hunting and consuming a juvenile Iguana rhinolopha

Wiegmann, 1834 (Fig. 14); Quirós-Rosales et al (2023) show an instance when a female B. plumifrons was consuming an adult Lepidophyma flavimaculatum Duméril, 1851. Solórzano & Hidalgo (2014) show an event of a B. basiliscus eating a snake, Thamnophis proximus (Say, 1823); herein we report a female subadult B. plumifrons preying on an adult Ninia sebae (Duméril, Bibron & Duméril, 1854) at Tirimbina lodge, Sarapiquí, Heredia province, Costa Rica (E. Fernández, pers. comm.). As mentioned, basilisk lizards, as opportunistic predators, can also prey on mammals, like bats, but also rodents, like the case of a Nyctomys sumichrasti (Saussure, 1860) preyed upon by an adult female B. plumifrons (Alvarado & Mora 2023; Fig. 15). Finally, Adriana Aquilar saw this case of a female B. plumifrons at La Fortuna, Costa Rica, eating a colorful honeycreeper Cyanerpes cyaneus (Linnaeus, 1766) (Aves, Passerifomes, Thraupidae) (Fig. 16). This wide array of prey indicates that basilisks are generalist predators and can eat virtually everything moving in front of them. As active diurnal predators, they are foraging or watching its territory from a high point, ready to run to hunt or escape.

Basilisk of all sizes serve as prey to many predators, from other squamates, like very especially snakes (see reports of Corallus ruschenbergerii (Cope, 1875) in Venezuela preying on *B. basiliscus* in Barrio-Amoros (2017) or the photo depicted in Timofeevski et al. (2017) of an adult Clelia clelia (Daudin, 1803) detecting and killing a sleeping female B. basiliscus, or the Imantodes cenchoa (Linnaeus, 1758) swallowing a juvenile B. galeritus in Ecuador (González-Acosta et al 2023). Also, we saw an adult American crocodile (Crocodylus acutus (Cuvier, 1807)) lurking an adult male brown basilisk near Quepos, Puntarenas, Costa Rica, until it hunted and crashed the animal quickly. Hirth (1963) reports ghost crabs eating B. vittatus in Tortuguero, Costa Rica. In his study, Hirth found 33% of broken tails in adult B. vittatus, lost very probably after predatory attempts.

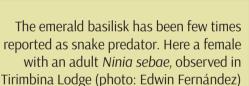
Adult Basiliscus plumifrons eating a juvenile Iguana rhinolopha at Selva Verde Lodge, Sarapiquí, Costa Rica. Photo: Randy Alvarado



Adult female *B. plumifrons* eating a rodent (*N. sumichrasti*), at Selva Verde Lodge, Sarapiquí, Costa Rica (photo: Randy Alvarado).



Adult female *B. plumifrons* consuming a honeycreeper (*C. cyaneus*) in Costa Rica (photo: Adriana Aguilar).



Habitat. All basilisks are inhabitants of

Habitat. All basilisks are inhabitants of riparian situations in different types of forests (humid evergreen, cloudy, dry, mangrove) and even coasts.

They do all activities (reproduction, nesting, hunting, territory display, etc), around and along water courses. Those provide preys, necessary humidity, and many shelters and escape areas, although very agile on the ground, no matter the substrate (muddy, rocky, herbaceous), they can easily climb trees and rocks. Basilisks sleep at night normally on branches, leafs, or rocky walls; but see below). However, they also like the vertical walls of caves or even artificial structures like bridges.

Sleeping behavior. Sleeping behavior is well documented in *B. basiliscus*, and is quite similar in the other species.

Most adults and juveniles tend to sleep perched on wide leafs or branches close or over rivers or streams. They are weary sleepers, and many times these lizards detect us (as predators) much earlier than we detect them, escaping chaotically, falling from the branch to the soil and running desperately; if they fall into the water, they dive until they disappear.

Most youngsters like to sleep close together. Many times, adult pairs (male and female) or even associations of two or more adult males are seen resting at night very close together, as Lewis & Grant (2009) described for a couple of *B. plumifrons*, or like the author sees often around Uvita, Costa Rica with *B. basiliscus*.

One of the latest discoveries about Basilisk behavior is that basilisks, at least

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B. basiliscus, can sleep under the water for prolonged periods.

Barrio-Amorós (2020) reported three instances in which he saw directly three different individuals, two subadult females and an adult male. While it is common that Basiliscus escape once disturbed, even at night, and in many cases fall directly into the water to escape diving, in these three cases the animals were found deeply sleeping.

This obviously could generate the question; they really were sleeping before I arrived?

How can I know I did not disturb them and after that, found them under water hiding as explained by Zuluaga-Isaza et al (2022)?

Well, in the first moment, when I was told by a friend that almost every time he went night

fishing while diving in a river (Baru in Southern Costa Rica) he saw basilisks under water, I immediately though that was precisely because they were disturbed and escaped directly into the water, and were found after by him.

When I went the first time and I saw a subadult female sleeping, I was very aware that in any case we saw or heard the typical splashes of basilisks escaping (they usually are quite loud). In the second case, when I went to a river close to my house in San Josecito with two friends, and saw an adult male basilisk sleeping approximately 60 cm under water, in a very clear river pool, I went inside with a GO PRO camera and filmed and photographed the animal for a long time (but I did not record the time, probably around half hour).

How basilisks can run over the water?

All four species of basilisk are capable of escaping in a way no other lizard can emulate on Earth.

Systematically, always that they feel threatened (by predators or other congeners), they escape running bipedally on the ground (Snyder 1949) or even on water.

How they do that? The presence of scaly flaps or fringes on toes, especially developed along toe 4

that expand significantly augmenting considerably the surface contact with water.

This, with the perfect alignment of the weight along the body and tail, and the quick movement when they run, creates an airbag under their feet, allowing paddling very quickly for several meters, until the gravity, especially on larger individuals, makes them end the escape by swimming or diving.

> All four species of basilisk are capable of escaping in a way no other lizard can emulate on Earth. Juvenile *B. basiliscus* running over water, Sierpe, Costa Rica (photo: Kenner Chaves).

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After one hour, I returned to the pool to see that the animal was missing. A few days later, in the same river pool I saw a subadult female totally reposing on the pool's bottom, one meter under water. Then I started to chronometer the time, and it was 42 minutes totally submerged and deeply slept. After that time taking pictures, just flashing every 5 minutes to detect it, she slowly awakened, and detecting us, escaped guickly (Barrio-Amoros 2020). But I went several times more to the same pool at night, to see continuously that adult male sleeping in the same basic position. And I recorded a maximum time underwater of 75 minutes, corresponding to a new record of a Neotropical lizard sleeping underwater. What is impossible to know was how much time was underwater before I arrived. In any case, it is an interesting behavior worthy to corroborate in practical experiments, perhaps in captivity, measuring how much time they can resist underwater and why they chose this sleeping method where there are many other spaces available.

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Gerardo Chaves Cachí, sent the pictures of the UCR specimen and commented about the topic.

I also am so glad that my admired artists Jose Manuel Fernández Cortés and Carel Brest van Kempen, allowed their spectacular paintings to be part of this article. Nicolas Vidal answered my queries about the syntypes at Paris Museum.

"A question of timing": double-crested Basilisk & Blue Caligo acrylic on illustration board Carel Brest van Kempen

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Portraits of Basiliscus. From up to down: *B. galeritus; B. plumifrons, B. basiliscus.* Art by Jose Manuel Fernández Cortes, @zcortesstudio

