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The identity of the crackling, luminescent frog of Suriname *(Rana typhonia* Linnaeus, 1758) (Amphibia, Anura)

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Abstract

Review of the literature and recently available field notes from the collector of the type allows a reconsideration of the identity of the Linnaean name *Rana typhonia*. We provide evidence to demonstrate that the Linnaean species is neither a bufonid nor an Asiatic ranid, but a Neotropical hylid. Subsequently, we consider *Rana typhonia* as an older synonym of *Rana venulosa* Laurenti, 1768, redescribing its holotype under the new combination, *Trachycephalus typhonius* (Linnaeus, 1758).

Key words: Nomenclature, *Trachycephalus venulosus*, *Rana typhonia*, Holotype

Introduction

Although more than 250 years of Linnaean taxonomy have elapsed since the publication of Linnaeus's (1758) Systema Naturae, longstanding mistakes related to some of the very first species described under the Linnaean era (i.a., Dubois and Ohler, 1996; Lavilla *et al.* 2010) still persist. Here, we analyze the identity of *Rana typhonia* Linnaeus, 1758, and come to a radically different view on the identity of that frog. The tenth edition of Systema Naturae (Linnaeus 1758) marks the beginning of Linnaean taxonomy in zoology. In this work, Linnaeus included seventeen species of anurans, fifteen of which come from his previous contributions or those by diverse other authors. The remaining two, the only ones originally described by Linnaeus in that work, were the Paleartic *Rana variegata* (today in the genus *Bombina*) and the Neotropical *Rana typhonia*. During the last 250 years the name *Rana typhonia* was associated with a group of Neotropical toads with dorsolaterally expanded supratympanic crests (the *Bufo typhonius* or *margaritifer* phenetic group, *sensu* Duellman and Schulte 1992; Frost 2010). *Rana typhonia* was considered a junior synonym of the Asiatic *Hoplobatrachus tigerinus* (Daudin, An XI [1801]) by Hoogmoed (1989), based on Andersson (1900), who first proposed the synonymy. Although the priority of *Rana typhonia* Linnaeus, 1758 over *Rana tigerina* Daudin, An XI is evident, no formal taxonomic action was done. However, the identity of *Rana typhonia* is still an open question for several other reasons.

First, the Asian provenance of *Rana typhonia* is challenged by the fact that Linnaeus (1758) explicitly expressed that its origin was "America". Furthermore, he also explicitly quoted the name of the collector, Rolander (an exception among the amphibians included in the tenth edition of the *Systema Naturae*), referring to one of his disciples who traveled to Surinam. Second, based on: (a) Boie (1827), who analyzed a fragment

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of Daniel Rolander's diary (the *Diarium Surinamicum, quod sub itinere exotico conscripsit Daniel Rolander, tomus I and II*), which remained unpublished in the Danish Botanical Library for more than 250 years and (b) on the integral translation done by a team led by James Dobreff (with Clarck Dahlman, Joseph Morgan and Joseph Tipton) and edited by Hansen (2008), it is now possible to demonstrate without a doubt that the Linnaean *Rana typhonia* is neither a bufonid nor an Asian ranid, but a Neotropical hylid.

Thus, this contribution focuses on: (1) the clarification of the attribution of the Linnaean name *Rana typhonia*, (2) establish a type locality for this neotropical taxon, and (3) the re-description of the holotype of the Linnean species, based on its identification among the specimens of the *Donatio Alströmer* (Thunberg 1787, Lönnberg 1896; Wallin 2001).

Material and methods

The first part of this contribution is a bibliographic inquest and, as such, the analyzed materials were [almost] all the texts that, starting with Linnaeus (1758) and ending with Hansen (2008), dealt with the life and work of Daniel Rolander and his collections. Only those contributions considered relevant are included in the text.
The second part consists of a re-description of the holotype of *Rana typhonia* under the new combination *Trachycephalus typhonius* (Linnaeus 1758), as a senior synonym of *Trachycephalus venulosus* (Laurenti 1768), based on the individual number 134 at the Evolution Museum of Uppsala University (UUZM).

Measurements were taken with digital calliper to the nearest 0.1 mm; abbreviations (in mm) are: SVL (snout–vent length); HL (head length); HW (head width); IND (internarial distance); END (eye to nostril distance); ED (eye diameter); UEW (upper eyelid width); IOD (interorbital distance); TD (tympanum diameter); HAL (hand length); THL (thigh length); TL (tibia length); FL (foot length, including tarsus). Webbing formulae follow Savage and Heyer (1997).

Following ICZN Art. 8.3 (International Commision on Zoological Nomenclature, ICZN 1999) the name *Rana crepitans* Rolander *in* Boie (1827) (*nomen oblitum*), made available by Hansen (2008), is not considered here a scientific binomen for nomenclatorial purposes, and the name *Rana typhonica* used by Hansen (2008) is considered a misspelling of *Rana typhonia* Linnaeus 1758.

Results

1. Comments on the collector of *Rana typhonia* and his collections

Rana typhonia is unique among the anurans considered by Linnaeus (1758) in having an explicitly named collector, quoted as "Rolander", one of Linnaeus's disciples who traveled to Surinam between 1755 and 1756. The "official history" says that after the trip "*...Rolander brought home a considerable collection of subjects of natural history, but was ungrateful enough not to present his kind patron with any of them...*" (Pulteney 1805: 132); furthermore, Andersson (1900) quoted "*...I do not know whether Rolander, who traveled in Surinam and West India* (sic)*, brought home from these places any collections, among which Linnaeus discovered the type specimen of his* Rana typhonia*...*"

These, and several other more or less offensive comments (including a recent one by Speake 2003, who stated that Rolander lost his mind in Guyana and returned a helpless cripple) are unjustified considering that Linnaeus gave Rolander's name to at least two species [*Cimex (Oblongus) Rolandri* and *Phalaena (Tortrix) Rolandriana*] and in the "*Collectanea*" specified in the Systema Naturae, Linnaeus (1758) included as one of his sources "*D. Rolandri in Surinamum and Eustatium. 1755.*" Furthermore, the tenth edition of the Systema Naturae assigned Rolander as the collector of about one hundred Neotropical taxa, including 85 species of insects (listed in Dobreff, 2009b), at least one bat (*Vespertilio spectrum*), seven birds (*Falco sufflator, F. cachinnans, Gracula foetida, G. barita, Ardea striata, A. aequinoctialis,* and *Loxia minuta*), one amphibian (*Rana typhonia*), one lizard (*Lacerta angulata*), and one snake (*Boa canina*) (names follow Linnaeus 1758).

2. *Rana typhonia* Linnaeus, 1758, the crackling and luminescent frog of Rolander

Searching for the identity of *Rana typhonia* and following ICZN Art. 72.4.1.1, we analyzed Daniel Rolander's *Diarium Surinamicum, quod sub itinere exotico conscripsit Daniel Rolander, tomus I and II. 1754-1756.* As noted above, until the integral English translation published by Hansen (2008), the only clue we had about Rolander's diary was an excerpt published by Boie (1827) (that of Duméril and Bibron 1841 is a French translation of Boie's paper). Hansen (2008) work gives us a completely new prospect on the identity of *Rana typhonia*. Also, thanks to the kindness of Prof. Dr. James Dobreff, leading translator of Rolander's Diary (Hansen 2008) and Editor of Daniel Rolander *Diarium Surinamicum* (in press), we had a deep and first hand analysis of the conflictive first paragraph of the description, published as "...Rana crepitans, *quae* Rana typhonia* *dicitur...*" by Boie (1827) (the asterisk refers in Boie's work to "*Lin. system. nat. Seba thes 1 pag. 114 t. 71 f. 3. 4.*").

According to Dobreff (2009a) the *Diarium*, drafted during the trip, was exhaustively reviewed and updated in Copenhagen between 1763 and 1765, resulting in the inclusion, as notes, of several Linnaean names. Rolander originally diary says "... Rana crepitans, *quae* Rana Surinamensis *dicitur...*", with a footnote referring to "Seba, Thes.I. pag. 114, t. 71, f. 3. 4." Then, some time after the publication of the tenth edition of the Systema Naturae (Linnaeus 1758), Rolander crossed out "S*urinamensis*" and added just above the deletion "*typhonia*", forgetting or likely not bothering to remove the footnote referring to Seba's *Rana, Surinamensis*. Lastly, the Danish naturalist Martin Vahl got the original manuscript of *Diarium Surinamicum* and put an asterisk after "*typhonia*", referring to his own note in the margin "*Lin. Sys.*" (Dobreff *in litt.*, April 10th, 2010).

In Rolander's diary, the species was characterized as:

> "...Rana crepitans, *quae* Rana ~~Surinamensis~~ typhonia *dicitur magnitudine Ranae aquaticae est, supra fusca, subtus flava; puncta elevata, convexa, inaequalia per corpus sparsa conspiciuntur: eadem haec puncta instructa sunt emissariis, e quibus excernere solent humorem illum lacteum, quo totum corpus obducit, ut quae modo fusca erat, intra inomentum albissima appareat. Palmae tetradactylae fissae; plantae pentadactylae, subpalmatae; digitorum apices rotundati, planiusculi. Indis americanis cibo sunt...*".

Thus, Rolander's description shows that *Rana crepitans*, which was named *Rana ~~Surinamensis~~ typhonia* has a size comparable to that of *Rana aquaticae* (probably a *Rana temporaria* or a *Rana esculenta sensu* Linnaeus 1758), is dorsally dark and yellowish ventrally, and has elevated, convex, and unequal warts scattered across the body. From these warts, a milky fluid is produced that covers the entire body, so the dark dorsal areas suddenly appear white. The hands have four fingers, separated, and the feet five toes, semipalmated, being the tip of the digits flattened and rounded. The American Indians eat them.

In addition, Boie (1827) included a seemingly textual transcription of Rolander's diary on the events on November, 19th [1755], in order to discuss a case of luminescence in the frog collected by Rolander. In that section, Rolander commented his vicissitudes trying to identify the source of the sounds that bewildered him at night, until he realized that the responsibles were a group of frogs hidden in the roof of a barn, and the fact that on that night he was awakened by a noise similar to that of a crow, describing the situation as "... *somnum mihi ademit crepitatio cornicans, ingratissim*a...".

In summary, Rolander's corrections on his own manuscript suggest that Linnaeus eventually described and named his *Rana crepitans* as *Rana typhonia*. If the explicit note added by Rolander to his manuscript is still considered unconvincing, the reinterpretation of Linnaeus's (1758) diagnosis in light of this new information should help to support the identity proposed herein. *Rana typhonia* was characterized as:

> *R[ana] auricularibus lobis ovatis. Habitat in America, clamitans nocte fono cornicis tetro lucente. Rolander.*

The following translation and analysis of Linnaeus's description further supports our interpretation:

1. *R[ana] auricularibus lobis ovatis*: The "ovate ear lobes" had two different interpretations. Dozens of authors had followed Schneider (1799), who re-defined this character state as "*...Margo capitis aucta membrana altra supra oculos et aures eminente"* (i.e., "...Margins of the head with a noticeable high membrane on the eyes and ears..."); this was the basis for the application of the name *Rana typhonia* to toads now placed in the *Rhinella typhonia* or *margaritifera* group. On the other hand, other authors (i.a., Andersson 1900; Hoogmoed 1989) considered them as "the large blown out vocal sacs" shown by the individual labeled by Quensel in the Stockholm Museum catalogue as *Rana typhonia*. Furthermore, this character state was later the basis for Andersson's (1900) synonymization of *Rana typhonia* with *Hoplobatrachus tigerinus*.
2. *Habitat in America*: Although the origin is imprecise by modern standards, it fits the Linnaean style [note that Linnaeus 1758, described anurans from *America* (5), *Europa(e)* (5), *Exteris regionibus* (2), *Indiis* (2), *Surinami* (2), and *Virginia* (1)].
3. *clamitans nocte fono cornicis tetro lucente*

   Kitchell and Dundee (1994) translated the later sentence as a single phrase, meaning "calling by night with the foul sound of the crow as it grows light". Under the new evidence, we consider the statement to encompass two characters:

   3.1 Clamitans nocte fono cornicis: This characterizes the strident call of the species, similar to that of a crow, and has a noticeable similitude with the reference to the "*...crepitatio cornicans, ingratissima...*" mentioned by Rolander for his *Rana crepitans*, and

   3.2 tetro lucente: Refers to the ability to produce a dim light or glow. Rolander noted that the barn where the frogs were calling seemed as if illuminated by a yellow foxfire ("*...horreum idem forte intravi, quod crepitantibus Ranis, quasi igne flavescente fatuo, illustrabatur...*"), and the glow was purportedly produced by the frogs "...as they alternately open and close their mouths to croak..." (Boie 1827; Hansen 2008).

Considering that Linnaeus was never in Surinam, and almost certainly never heard the mating call of *Rana typhonia*, nor did he observe the alleged bioluminescence, it is highly probable that the origin of these two key characters in Linnaeus's description stem from Rolander's notes.

The diagnosis previously analyzed was followed by a brief description, applicable to various species of treefrogs (Linnaeus 1758):

> *Dorsum rugis quatuor longitudinalibus, punctis elevatis, maculisque nigris. Pedes mutici. Palmae tetradactylae fissae; Plantae pentadactylae palmatae; digitis angustis; secundo longissimo; absque unguibus orbiculatis.*

Kitchell and Dundee (1994) translated the above paragraph as:

> "The back has four longitudinal wrinkles, raised dots, and black spots. The feet are stubby, front feet four-toed and split, rear feet five-toed and palmate. The toes are narrow, the second being the longest, but lacking rounded claws".

The last character state ("but lacking rounded claws") describes any frog except a treefrog; however, the key is in the latin word *absque*. It can be translated as a negative, as Kitchell and Dundee (1994) did, but *absque* also means "with the exception of" (Various Authors 1968). Thus, we translate the sentence "*...digitis angustis; secundo longissimo; absque unguibus orbiculatis...*" as "... toes narrow, except for the rounded tip, the second being the longest...".

Consequently, and also based on Rolander (*in* Boie 1827 and Hansen 2008) and Linnaeus (1758), we have no doubts that *Rana typhonia* is the name given by Linnaeus to Rolander's *Rana crepitans*.

3. The identity of *Rana typhonia* Linnaeus, 1758

Based on Linnaeus (1758) (L) and Rolander (*in* Boie 1827) (R), it is possible to re-define *Rana typhonia* as a tree frog (R) with a size comparable to a European water frog (R) [about 10 cm SVL], in which males have paired vocal sacs (L). The body is covered by elevated, convex, and unequal warts that produce an abundant milky secretion (R). The hands have four separated fingers (R, L) and the feet five semipalmated (R) or palmated toes (L), with expanded tips (R, L), the second being the longest (L). The mating call is similar to the call of a crow (R, L), and that supposedly produced a gloomy light (R, L). The species was collected by Rolander (L) in America (L).

Aside from an incongruent character-state (i.e., the relative length of the second toe, explainable by considering it as the second digit from the foot's outer edge), the frog's habits, size, number of vocal sacs, skin texture, quality and amount of secretions, characteristics of the mating calls, and geographical origin, lead us to think that *Rana typhonia* is a species comparable to those contained either in the genera *Trachycephalus* Tschudi, 1838 or *Osteocephalus* Steindachner, 1862.

Regarding the alluded luminescence, Rolander noted that when the frogs croack, "... their wide-opened mouth glitters with a yellow colour. This is why, as they alternately open and close their mouths to croak, they seem to be emitting a sort of yellow fire. Thus, if you enter late in the evening a building filled with their croaking, you will notice a sort of yellowish flame, which vanishes during the pauses in their song..." (Hansen 2008). This peculiar trait has never been reported again in a Surinamese frog, and it is unlikely that this would represent any kind of amphibian bioluminiscence. A plausible explanation, following Rolander's observations on the persistence of the light produced by an insect that he called *Cantahris pyrallis* (see entrance of June, 17th), is that the "yellowish will o' the wisp" observed glowing from the frog's mouth was due to the persistence of active remains of luciferin-luciferase complex after eating fireflies.

The key question is: Did Linnaeus have an individual of any of these genera in his hands? A series of circumstancial evidence suggest that in fact he did.

Despite the legend, Linnaeus included Rolander as one of the sources of the Systema Naturae X, described about one hundred species collected by his disciple in Surinam and St. Eustatius, and, based on the field observations referenced in the case of *Rana typhonia*, probably had access not only to a part of Rolander's material, but likely to his notes as well.

Another clue comes from Thunberg (1787), who listed the type of *Rana typhonia* among the material donated by Alströmer to Linnaeus starting in 1749 and extending over a period of several years. The specimen was reported by Lönnberg (1896) as "8) «*Rana typhonia*» Thunberg non Linnaeus is *Hyla venulosa* (Laurenti)", and by Wallin (2001), who identified the specimen as UUZM 134, and considered it a misidentification by Lönnberg (1896) due to an error in Thunberg's label. Lönnberg's and Wallin's confusion and efforts to clarify the specimens' identification are understandable because since the end of the 18th century (probably starting with Schneider 1799) up to the end of the 20th century, the name *Rana typhonia* has been associated with a toad, not with a treefrog. However, it is critical to note that Lönnberg (1896) considered that the Alströmer Donation was a Class B collection, defined as those "...which have been known by Linnaeus, and have been under his care so that the determination of these specimens, when they agree with the descriptions by the same name in «Systema Naturae», have a certain authority. In fact, in such cases when Linnaeus in «Systema Naturae» does not refer to any other specimens, figures or descriptions, it can almost be supposed that some of these animals have been the types. The identification of these specimens thus has a certain value in dubious cases, as it is always sure that Linnaeus has seen them, and known their characteristics..."

Lönnberg's (1896) statement strongly supports the idea that the individual identified by Thunberg (1787) as *Rana typhonia* was the one on which Linnaeus based his description, a point of view also supported by the presence of the individual hitherto considered the holotype of *Gymnoderus foetidus* (Linnaeus 1758) (=*Gracula foetida*), also colleted by Rolander during the same field collection of *Rana typhonia* (Thunberg 1787; Lönnberg 1896).

In summary, we consider that the individual UUZM 134, today identifiable as *Trachycephalus venulosus* (Laurenti, 1768) as the holotype of *Rana typhonia* Linnaeus, 1758, following ICZN Arts. 72.4.1.1 and 73.1.2 (ICZN 1999) and based on the following circumstantial evidence:

1. Linnaeus (1758) cited "Rolander" as the collector of his *Rana typhonia*, and stated "America" as the locality of the specimen.
2. Rolander explicitly stated the synonymy of his *Rana crepitans* with Linnaeus (1758) *Rana typhonia*.
3. The morphological and ethological characteristics of Rolander's *Rana crepitans* match with some of those of *Trachycephalus*.
4. The ocurrence of Rolander specimens described as new species by Linnaeus (1758) scattered among diverse collections [i.a., De Greer's, for almost all insects (Dobreff 2009 a, b); *Adolphi-Friederici* for *Boa canina* (= *Corallus caninus*) (Thunberg 1787; Lönnberg 1896), and *Jonae Alströmer* for *Gracula foetida* (=*Gymnoderus foetidus*) (Thunberg 1787; Lönnberg 1896)] supports the idea that the *Rana typhonia* specimen in the Alströmer Donation (Thunberg 1787) corresponds to the one collected by Rolander.
5. Based on the comments under Type B collections in Lönnberg (1896), it is highly probable that the specimen cited by Thunberg (1787) as *Rana typhonia*, and later identified as *Hyla venulosa* by Lönnberg (1896) and Wallin (2001), was the one studied by Linnaeus.

This challenges the current conception of the identification of the holotype of *Rana typhonia*. Furthermore, the sources of the uncertainty on its existence and whereabouts are twofold:

(a) The mistaken characterization of *Rana typhonia* as a toad by Schneider (1799), a fact that likely led Lönnberg (1896) and Wallin (2001) to overlook the specimen deposited at Uppsala Museum under the name *Rana typhonia* because it was clearly a tree-frog, and
(b) The erroneous belief that the holotype was housed at the Stockholm Museum, a fact that led Quensel (followed by Andersson 1900) to identify the individual NRM 142 (a male of *Hoplobatrachus tigerinus*), under the name *Rana typhonia*, with the known subsequent story[1].

The holotype of *Rana typhonia* (UUZM 134) is preserved in good condition at the Evolution Museum of Uppsala University. Our examination of this specimen reveals that *Rana typhonia* is in fact a member of the genus *Trachycephalus*, and more specifically it corresponds to what is currently known as *Trachycephalus venulosus*. Thus, *Trachycephalus venulosus* (Laurenti, 1768) is considered a junior synonym of *Trachycephalus typhonius* (Linnaeus, 1758), nov. comb.

4. Characterization of the Holotype of *Trachycephalus typhonius* (Linnaeus, 1758) (Figure 1)

Adult male, UUZM 134 (Rolander and Linnaeus's characters in brackets). Robust build; head wider than long, HL 92% of HW, HL 29% of SVL, HW 32% of SVL. Snout truncated in dorsal view, rounded in profile; *canthus rostralis* rounded; loreal region slightly convex. Nostrils closer to tip of snout than to eyes; internarial distance longer than eye to nostril distance and 60% of eye diameter. Eye to nostril distance shorter than eye diameter, than upper eyelid width and than interorbital distance, but longer than tympanum diameter. Tympanum ovate, annulus distinct; tympanum largely separated from eye, its diameter shorter than eye diameter, TD 49% of ED. Dorsal skin coarsely warty, warts mostly irregular in shape, low, and flat, with a few scattered ones enlarged and conical, most common on the posterior half of the dorsum (R: *puncta elevata, convexa, inaequalia per corpus sparsa conspiciuntur*; L: *punctis elevatis, maculisque nigris*); skin on head and eyelids slightly granular; flanks warty, with warts larger than those on dorsum; dorsal folds absent (L: *Dorsum rugis quatuor longitudinalibus*; not coincident); skin on belly and groin coarsely areolate; anal region

1. In the electronic herpetological database of the Swedish Museum of Natural History, under NRM 142 - *Rana typhonia* is the following remark: "*Systematic position and type status to be evaluated. If Rolander's specimen (the type) was donated to the academy and later catalogued by Hornstedt, that specimen probably was discarded by Sparrman or mixed by Quensel. Evaluation includes finding and examining all specimens included in the catalogue 1802 /EIÅ, 2004*"

not modified; dorsal and ventral surfaces of arms smooth with scarce scattered low and soft granules; dorsal surface of thighs and tibiae smooth. Vocal sacs double, lateral, well developed (L: *auricularibus lobis ovatis*), nuptial pads on thumb, single, rugose, dark brown. Dentigerous process of vomers prominent, almost contacting medially, laying between and at the same level of the choanae, bearing a row of vomerine teeth. Tongue large, rounded, almost completely attached. Hand with robust fingers, webbed, tips expanded, rounded; webbing formulae I - $II2_{1/2}$ - 2III1 - 1IV; finger lengths 3 > 4 > 2 > 1; subarticular tubercles conical, prominent; few small, rounded and low supernumerary tubercles present; outer metacarpal tubercle divided into two elongated, unequal in length, and low tubercles; inner metacarpal tubercle elongated, equal in length to the larger inner tubercle, but more prominent (R and L: *Palmae tetradactylae fissae*). Legs slender, tibia length equals thigh length; SVL 94% of the combined tibia and thigh lengths. Foot length shorter than tibia and thigh lengths, 38% of SVL. Toes robust, webbed (R: *plantae pentadactylae, subpalmatae*, L: *Plantae pentadactylae palmatae*), webbing formula I1 - 2II1 - 2III1 - 1IV1 - 1V; toe lengths 4 > 3 > 5 > 2 > 1; toe tips expanded, disk complete, rounded (R: *digitorum apices rotundati, planiusculi*; L: *digitis angustis ... absque unguibus orbiculatis*); subarticular tubercles large, rounded, supernumerary tubercles not evident; outer metatarsal tubercle round, low, inconspicuous; inner metatarsal tubercle ovate, slightly elevated; sole of tarsus with small inconspicuous granules; tarsal fold absent.

Measurements (in mm): SVL 72.6 (R: *magnitudine Ranae aquaticae est*); HL 21.1; HW 23.0; IND 5.6; END 5.6; ED 9.6; UEW 5.9; IOD 7.2; TD 4.7; HAL 20.0; THL 33.9; TL 34.0; FL 27.35.

Color in preservative: overall dorsal background reddish cream with irregular reddish brown blotches; the most conspicuous mark is an irregular, inverted Y-shaped mark that runs from occipital to sacral regions (R: *supra fusca*); small irregular blotches in interocular region; flanks cream with a reddish brown, irregular, and diffuse stripe, and a large diffuse blotch behind the arm; arms and legs with transverse reddish brown stripes. Tympanic membrane cream, but areas immediately posterior to eyes, around the tympanic membrane, and around the vocal sac, reddish brown. Vocal sacs brown. *Canthus rostralis* and loreal regions cream. Ventral region reddish cream, darker on gular region (R: *subtus flava*). Plantar surfaces faded reddish brown. Fingers and toes cream, barred with reddish brown stripes.

5. Comments on the type locality

Museum records associated with specimen UUZM 134 provide no clues regarding the provenance of the holotype and the only published data mentions “America” in the original description (Linnaeus 1758) rendering inapplicable sections 1 and 2 of ICZN Reccomendation 76A.1.

A first restriction can be made to Surinam, the country visited by the collector and, reading his Journal, it is possible to establish that Rolander caught at least one individual of *Trachycephalus typhonius* on the night of November 19th, 1755, in a barn. Although no locality is mentioned, it was probably located at Brouwershaven, one of Carl Gustav Dahlberg wife’s Plantations, on the left bank of the Wajamo River, a tributary of the Pirica River, at about nine parasangs from Paramaribo (see entrances of July 21st and 22nd in Hansen 2008). Alternatively, based on the Journal (Rec. 76A.1.3), it is possible to establish that Rolander heard frog calls and was aware of their eggs on July, 9th, 1755 in Paramaribo, in one of the funniest passages of his Diary (“...everyday I come across their eggs immersed in a slimy substance and floating on the water's surface. By the cemetery that is next to the church of the Reformed there has been constructed an opera house, where twice a week operas are performed late in the evening. However, the frogs almost always break into the sonorous arrangement and harmony of the musical instruments with their extremely loud, and just as unwelcome, noise so as to disrupt the charm of the music and make for the audience a very unpleasant croaking...”).

Faced with our second goal of determining the type locality for the species, we chose the most conservative of the two options, without prejudice to other clarification (Rec. 76A.1.4). The cemetery alluded by Rolander and called “De Oranjetuin” (the Orange Garden), was sited on today’s Kerkplein (the Church’s square), while the Reformed Church was in the upper floor of a large building placed at the site of the current Royal Bank of Trinidad and Tobago (RBTT Bank), at number 1, Kerkplein Street, Paramaribo, Suriname (http://www.surinameembassyjakarta.org/index2.php?main =visit_historicwalk.php).

FIGURE 1. Holotype of *Trachycephalus typhonius* (Linnaeus, 1758), adult male, UUZM 134, SVL 72.6 mm.

6. Comments on some forgotten names related to *Trachycephalus typhonius* (Linnaeus, 1758)

***Rana vesicaria* Fermin, 1765.**

The species is included among the Anura *incertae sedis* (Frost 2010), but the presence of paired vocal sacs ("*... Cette Grenouille a à chaque côté de la machoire inférieure, une Vessie, qui dans les grandes chaleurs sont remplies d'air...*") and its origin ("Hollande Equinoxiale", i.e., Surinam), leads us to consider it as a synonym of *Trachycephalus typhonius*.

Although Fermin's book was included in the Official Index of Rejected and Invalid Works by Opinion 660 (International Commission on Zoological Nomenclature 1963), only the names of seven species of turtles

were formally included in the list of rejected taxa. The rejection of the book suppress all the contained species, and our comment on *Rana vesicaria* is only intended to tie a loose end in the nomenclature of Neotropical amphibians.

***Hyla micans* Oken, 1836.**

At the end of the French translation of Boie's (1827) paper on Rolander's luminescent frog ("*Rana crepitans*, quae *Rana typhonia* dicitur"), Duméril and Bibron (1841) noted that no subsequent authors (including themselves in the systematic section of the eighth volume of the Érpetologie Générale) cited the species. This statement is partially true; although never mentioned as *Rana crepitans*, Rolander's species, under a different name, was occasionally cited in the literature.

In fact, in 1836 Oken translated into German Boie's (1827) transcription of Rolander's *Diarium Surinamicum*, naming the species as *H[yla] micans*, noting that the author considered this frog as a toad ("*...Bufo typhonius, margaritifer...*"), despite all the evidence contained in the translated paper. *Hyla micans* was overlooked by the great majority of herpetologists and the only references we found hitherto, aside from the original, are those of Clark (1953), Hartwig (1863; 1871), Holder and Holder (1885), Kappler (1887), Korn and Smith (1959), Schoedler (1853), Schumacher (1844), and Shufeldt (1896). All these contributions contain only a couple of lines with the anecdote of the luminescence, in some cases noting (erroneously) that it was due to corporal secretions, but without any new information.

***Discodactylus* Wagler, 1833.**

The name *Discodactylus* was coined for the individuals depicted in figures 1 to 5, plate 71, of Seba (1734), the same plate and figures mentioned by Rolander (see above). The figures represent two different species, named by Wagler *Discodactylus tibicen* (figs. 1–2, males; 3 female) (a replacement name for *Hyla tibiatrix* Laurenti, 1768 and *Calamita tibicen* Merrem, 1820), and *Discodactylus marmoratus* (figures 4 and 5) (a replacement name for *Hyla marmorata* Daudin, An XI). The name *Discodactylus* was coined by Wagler to replace the names *Hyla* and *Calamita* due to their apparent inadequacy.

Although *Discodactylus* Wagler 1833 antedates *Trachycephalus* Tschudi, 1838, Wagler's name fits the considerations of Art. 23.9 of the Code (IZCN 1999) and, consequently, it is possible to apply the reversal of precedence. *Discodactylus* and its contained species (*Discodactylus dumerili*, *D. marmoratus*, *D. phacophorus*, *D. pulcher*, *D. ruber*, *D. tibicen*, and *D. tuberculatus*) were included in Sherborn (1932) Index Animalium, but it was never used again in reference to an amphibian, being ignored to the point that Fitzinger (1843: 18; 95) used it to name a genus of geckos, fulfilling the requeriments of Arts. 23.9.1.1 and 23.9.6. In turn, *Trachycephalus* has been used extensively, e.g., just in the last five years, by at least Abrunhosa *et al.* (2006); Acosta-Galvis *et al.* (2006); Alvarez *et al.* (2009): Barrio-Amoros and Brewer-Carias (2008); Bastazini *et al.* (2007); Bernarde (2007); Borges and Freitas (2007); Borges-Martins *et al.* (2007); Brandão and Araújo (2008); Cabagna Zenklusen *et al.* (2009); Cintra *et al.* (2009); Cisneros-Heredia (2006; 2007); De Freitas and Oliveira Lima (2009); Faivovich *et al.* (2005); Frost *et al.* (2006); Jungfer (2010); Kok and Kalamandeen (2008); Kwet and Sole (2008); Pimenta and Canedo (2007); Ramirez Valverde *et al.* (2009); Rigolo *et al.* (2008); Rodrigues *et al.* (2005); Rodrigues (2008); Wilms *et al.* (2005); Wogel *et al.* (2006); and Ziegler (2008), fulfilling the requirements of Art. 23.9.1.2.

In conclusion, we consider *Trachycephalus* Tschudi, 1838 as *nomen protectum* and *Discodactylus* Wagler, 1833 as *nomen oblitum*.

7. Additional remarks.

As currently understood, *Trachycephalus typhonius* is a species distributed from southern Mexico to the North of Argentina (Frost 2010; IUCN 2010). This extensive geographic range, together with its morphological variability (i.a., Duellman 2001; Eterovick and Sazima 2004; McDiarmid 1968), suggest that this taxon may represent a species complex. This situation sets up the scenario for a complex nomenclatorial history, whose resolution will be possible only after of a comprehensive study, including morphology, calls, ecology and genetic data of this taxon throughout its entire distribution.

The following is an abbreviated "state of the art" synonymy, based primarily on Frost (2010). It includes only the original morphonims (in the sense of Dubois 2000) and the various generic combinations of different specific epithets, mentioning in each case only the first author of the *nomina* and only the first page where it appears.

***Trachycephalus typhonius* (Linnaeus, 1758)**

Rana typhonia Linnaeus, 1758: 211.
Trachycephalus typhonius — this contribution
Rana venulosa Laurenti, 1768: 31.
Hyla venulosa — Daudin 1800: 17.
Hypsiboas venulosa — Wagler 1830: 201.
Phrynohyas (Acrodytes) venulosa — Fitzinger 1843: 30.
Scytopis venulosus — Cope 1866: 85.
Hyla tibiatrix Laurenti, 1768: 34.
Auletris tibiatrix — Wagler 1830: 201.
Discodactylus tibiatrix — Wagler 1833: 888.
Dendrohyas tibiatrix — Tschudi 1838: 34
[?] *Hyla viridi-fusca* Laurenti, 1768: 34.
[x] *Rana reticularis* Lacépède, 1788: 296, 458. Rejected.
Hyla intermixta Daudin, *In* Sonnini and Latreille, An. X: 182.
Hyla variegata Daudin, An XI: 20.
Rana meriana Shaw, 1802: 133.
Calamita tibicen Merrem, 1820: 172.
Discodactylus tibicen — Wagler 1833: 888.
[x] *Hyla zonata* Spix, 1824: 41. Rejected.
Hypsiboas zonata — Wagler 1830: 200.
Phrynohyas zonata — Fitzinger 1843: 30.
Hyla bufonia Spix, 1824: 42.
Hypsiboas bufonia — Wagler 1830: 200.
[x] *H*[*yla*]. *micans* Oken, 1836: 471. *Nomen oblitum*.
R[*ana*]. *micans* Schoedler 1853: 587.
Hyla vermiculata Duméril and Bibron, 1841: 563.
Hyla lichenosa Günther, 1858: 327.
Scytopis hebes Cope, 1862: 354.
Phrynohyas hebes — Duellman 1956: 16.
Trachycephalus venulosus hebes — Kwet and Sole 2008: 55
Hyla spilomma Cope, 1877: 86.
Acrodytes spilomma — Taylor 1944: 64.
Phrynohyas spilomma — Duellman 1956: 28.
Hyla paenulata Brocchi, 1879: 21.
Hyla nigropunctata Boulenger, 1882: 366.
Hyla palpebrogranulata Andersson, 1906: 14.
Hyla wettsteini Ahl, 1933: 25.
Hyla zernyi Ahl, 1933: 27.
Acrodytes inflata Taylor, 1944: 63.
Phrynohyas inflata — Duellman 1956: 22.
Acrodytes modesta Taylor and Smith, 1945: 594.
Hyla modesta — Mertens 1952: 30.

Phrynohyas modesta — Duellman 1956: 25.
Hyla macrotis Andersson, 1945: 70.
Phrynohyas ingens Duellman, 1956: 22.
Phrynohyas latifasciata Duellman, 1956: 24.
Phrynohyas corasterias Shannon and Humphrey, 1957: 15.
Hyla adenoderma Lutz, 1968: 3.
Phrynohyas adenoderma — Vanzolini 1986: 31.
Argenteohyla altamazonica Henle, 1981: 134.

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