Second paper on brasilian and some closely related species of the genus Leptodactylus

by

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(With plates I—V).

After the publication of my first paper on the brasilian species of \textit{Leptodactylus} in 1926, I found occasion for more observations on the same and some others, partly new, species, for examining some moot questions, and finally for comparing the original text of some descriptions, which induced me to give this supplementary paper.

Definition of the genus \textit{Leptodactylus}.

Though by looking for certain special features it is generally quite easy to determine that a given species may be excluded from the genus \textit{Leptodactylus}, there is an increasing difficulty to give a satisfactory definition of this genus, including all the species indicated by competent authors, and permitting to separate it from all the others of the same family. The differential characters given in the first paper may partly exist in other genera or not appear to all the species heretofore included or may not have been noticed in some of the rather rare or less known species. Such is the case with the ossification of the style of the sternum which cannot be verified on intact specimens and is not of much value, as cartilage might be considered as an anterior phase of bone. The absence of adhesive disks on hands and feet could be considered constant only after eliminating several of the species, heretofore included. The presence of a complete discoidal fold is not constant and its absence seems even to be typic in a certain group. The finger themselves do not correspond properly to the name \textit{Leptodactylus}, as their tips, even when devoid of disks, may be slightly bulbous and their phalanges may frequently show a bony or cartilaginous dilatation of T or ancre shape, as in most of the related subfamilies. Pointed tips, as generally found in \textit{Hyla}, do not occur in \textit{Leptodactylus}, while a terminal bulb has been found only in a few cases.

The presence of a median tooth on the under and of a corresponding pit in the upper jaw is far to common, to be of much value.

There would be a decided advantage in establishing divisions of the genus \textit{Leptodactylus}, (provisionally considered subgenera), determined by the characters of the adult males, the average size and the morphology of fingers and toes. The habits, the voice, the oviposition and the subsequent evolution should also prove helpful when sufficiently known. I have already given a hint of these divisions in my first paper. At present we may recognise a group of large species like \textit{L. pentadactylus}, \textit{ocellatus} and \textit{bo}.
livianus, in which the adult male not only shows two hard, often black and horny points on the inner side of the hand, but develops also a progressive hypertrophy, not only of the muscles, but also of the bones of the anterior limb. These new formations begin to appear in the first nuptial period and increase by degrees to a point which is characteristic for old males (see plate V). For this division I propose the name Pachypus already suggested by Spix. The names Plectromantis and Platymantis, given by Boettger and Steindachner but not generally accepted as generic, might design two subgenera. For mystaceus, mystacinus, troglodytes and related species I suggest the name Cavicolia and Parvulus for nanus, tritivittatus and other very small species. For the species which do not fit in any of these subdivisions the name Leptodactylus would be provisionally retained.

After these explanations I proceed to my first subject:

Leptodactylus caliginosus and the species included under this designation.

In the year 1848 a north-american expedition under the command of Wilkes stopped in Rio de Janeiro where their zoologists collected various batrachians which still might be found amongst the numerous species I possess of this region. They seem to have collected principally in the mountains near Rio, the Organ Mountains and the plains which separate both, all of them much explored by later collectors.

Descriptions and drawings of this material were given by Girard in papers not accessible to me. I have however copies of some descriptions and references to others which partly fit very well, while another part permits some doubts about the species to which they refer.

Leptodactylus caliginosus, described from Rio as a separate species, was not identified by me in many years of collecting, nor was it found there again by others. So I reached the conclusion that it represented only small specimens of L. ocellatus with a good deal of pigmentation on the ventral side while the dorsal failed to show distinct glandular folds.

In 1927 I had an occasion to examine the type and a colype of Girard's. Having been kept already for nearly 80 years, they did not compare well with fresh specimens. The abdominal pigmentation, the general colour and the size did not exclude small ocellatus with somewhat strongly developed pigmentation of the under side and one of the specimens seemed even to show traces of glandular folds; therefore I found no reason to change my opinion.

However today I have abandoned this idea, because I observed twice near to Rio the occurrence of a rare and inconspicuous Leptodactylus of small size which agrees with the conception most authors have of L. caliginosus. It also resembles some specimens collected near Avanhandava by J. Venancio and near the Salto do Marimbondo by Dr. C. Pinto. (Both places are in the north-western part of São Paulo.) Pl. III, fig. 4, 4a & 4b show two of them, taken when these, generally small, specimens were still recent. Of those from Rio de Janeiro which I consider topotypes, I give colored drawings on pl. II and a photograph (Pl. IV, fig. 2).

The description of Nieden, given in the 'Tierreiche', was made to include more than one species and therefore is not very satisfying. The characters cited are generally not very distinctive and the indication of a discoidal fold is a downright error. It cannot be stated that the fingers have membranous fringes, because this is exceptional and not the rule. Already Steindachner suspected that
this is only a nupcial sign; it cannot last very long because it is absent in most of the specimens.

This character is also not constant in the other species of the group Platymantis and in the genera Elodia and Crossodactylus, so that its absence is of no account. For the reasons just explained an indication of the characters, found by me in the true caliginosus, may not come amiss.

Description of the topotype.

_L. caliginosus_, alive or well preserved, is easily distinguished from _ocellatus_ which is much larger. It looks more like an _Elodia bufonia_, but cannot be confused when examining the digits and toes. The main colour is brown, varying from the lightest to the darkest shades. The ground of the under side is white, but always reticulated or vermiculated with brown.

The absence of a discoidal fold, the ventral pigmentation and the characters of the male place the _caliginosus_ in the subgenus _Platymantis_.

This species is undoubtedly small. My biggest male attains a length of about 40 mm. and the largest female (Pl. II) of 42 mm., which I consider near to the maximum; it still remains well below 51 mm., as given by Nieden. The largest specimens cited which might perhaps be referred to the true _caliginosus_, do not exceed 45-46 mm.

The two specimens, represented in the colour plate II, were caught in October of 1920 near to some provisory water works in the Serra da Piedade. The voice of the male, a soft clucking, was heard even in daytime, but both sexes were very much hidden under dead leaves and mud which abounded there. They were rather active and hard to catch, besides having the skin very slippery.

The greatest breadth corresponds to the hindmost part of the head in younger individuals, resembling _Dendrobates_ in shape. Adult specimens have the abdomen more developed and look more robust.

The vomerine teeth form two small and separate groups, well behind and a little inwards of the choanae. The fairly large tongue shows a posterior incision.

The tympanum is brown, its breadth 2/3 of the diameter of the eye, covered above by a not very conspicuous oculo-humeral fold.

The general colour of the dorsum is rather variable showing the many hues of brown, seen in raw leather or in dead leaves, speckled with darker fuscosus or black spots. Green or bronze colours, seen in other species, are never found. White appears in some bars, perpendicular to the maxillary margin, on the anterior or total edge of a an obtiangular dark spot with its base between the eyes and in a wavy ribbon, running from the posterior angle of the eye to the shoulder. The males may show a few more small white spots as seen in the plate. The under side has a yellowish-white ground, reticulated or vermiculated with dark pigment which may completely cover the gula of the male, except for a row of light rounded spots near the margin of the jaw. Younger specimens show the same pigmentation, although less intense.

The dark isolated spots which may occur on the back appear faintly in the darker specimens; on its lateral parts they show elongated warts of glandular nature which may form an interrupted line. Besides those, which are jet black, there are other miliary glands, colorless or black, which may form punctuated lines along the back. In preserved specimens with lax skin there may be an appearance of glandular folds like in some other species; but a careful examination will show that they are not fixed. For the rest the dorsal skin is smooth.
or only finely granular. The head is slightly flattened above with prominent, approximale and forward directed eyes and distinct canthus rostralis. Between the eyes there is an obotriangular dark spot with a white margin, in front of which a lighter area is almost constant. The groundcolor of the upper side of the limbs is always somewhat lighter, crossed by a few short, large and somewhat slanting darker bars.

The digits have no disks but the rounded tip of the phalanx contains a T-shaped bone. There are no webs but the tissue between the metatarsal and metacarpal bones is so thin that it looks like one.

The color of the male is generally lighter and brighter, while the sex is easily recognised by the two thorns on the inner side of the hand.

*L. melanoponotus* Halowell is chronologically the next, but belongs to another section of *Platymantis* and a more distant zone; therefore, I consider immediately the second species ascribed by Boulenger and his followers to *caliginosus*, i. e.:

**Leptodactylus podicipinus** Cope, 1862.

Cope described in 1862 a male of the *Platymantis* group under this strange name, without explaining the meaning of his new word. It came from Paraguay where the same species seems to have been located by several authors. A copy of the original description is given in the appendix. It refers to an adult male of nearly 47 mm. length that showed well the lateral edges of the toes which I never found in the true *caliginosus*. On the ventral side the ground was black, speckled with small and round yellow spots. Besides the description of the type, which is unknown to me, I give on plate IV a photograph of two specimens from Bolivia (Buena Vista, department of S. Cruz), received through Mrs. H. T. Gaige from the Museum of Ann Arbour, Mich. They look very much alike to the figure of Steindachner (Pl. III, fig. 3, a), principally our fig. 1a with the thighs reticulated, while in 2a of pl. IV they are speckled. The upper sides are quite dark, but the light parts of the under side are white in my specimens and not yellow, as given by Cope. Admitting certain variations, the specimens of Caiçara and Buena Vista may be ranged with the paraguayen species. (There is another species from Buena Vista quite alike to *Pl. Petersii*.) Of the first I possess another specimen from the north of Bolivia, marked: *margins of the upper Beni near to the mouth; also a few others but all very poor.*

*P. podicipinus* was observed by Mehlé in material from Paraguay and Berg indicated also Argentine and even Montevideo as habitat of the same species but these statements want corroboration notwithstanding his acknowledged competence.

In connexion with *podicipinus*, ascribed rather late to *caliginosus*, we may also consider the

**Entomoglossus pustulatus** Peters, 1870.

Of this species, placed by Peters in a separate genus, due to the posterior notch of the tongue, but united with *Leptodactylus* by Boulenger, only two specimens are known. Both measure 46 mm. and probably are adult females which does not allow to prove that they belong in the group *Platymantis*, as is most likely. Here the ventral pigmentation has reached the highest degree, sparing only small and isolated spots, yellowish-white or sulfur coloured. Peters gave a drawing in dorso-lateral view which excludes any reference to *caliginosus* or *podicipinus*. His specimen, a female, full of eggs, came from Ceará, the one of Miranda-Ribeiro's from Maranhão (Carolina). Of
the last one there is a description, accompanied by colored drawings; one of the under side has been copied on pl. IV. The species seems rare and of limited distribution.

The young individual from Bahia, figured in my first paper (Pl. 35, f. 5 & 6), does not belong to this species and comes nearer to Petersii.

We leave now the species with strongly pigmented ventral side for others which come nearer to the type of Platymantis petersii, the type of this group. In chronological order they are: melanotus Halowell, 1862, echinatus Brocchi, 1881 and validus Garman, 1887. The first and perhaps some others where united by Boulenger (1881) with caliginosus Girard. He gave as habitat: Bahia, Mexico, Myobamba (Peru) and Sarayacu (Ecuador), according to specimens kept in the British Museum with many others, only labeled South-America. From the Belgian museum he also cites a specimen labeled Tehuantepec.

Boulenger's lead was followed by the herpetologists, as Berg Guenther, accepted it provisionally in the Biologia Centrali-Americana but pointed out some divergencies. Nieden in "Tierreich" also united all the species and gave a collective description with a most unlikely distribution from Buenos Aires to Mexico. Barbour and Noble thought that melanotus and validus were different from caliginosus or rather petersii with which they compared them.

I found considerable difficulty in obtaining the litterature and the specimens required for reviewing these questions. Even so, I did not always see the original text. For valuable specimens and informations I am indebted to the herpetologists of various north-american museums (Dr. Kingsley Noble (Amer. Mus. of Nat. Hist.), Prof. Th. Barbour (Mus. of Comp. Zool. in Cambridge, Mass.), Mrs. H. T. Gaige (Zool. Mus. in Ann Arbor, Mich.) and Miss Doris Cochran (U. S. Nat. Mus., Wash.). Dr. Mertens of the Senckenberg Museum in Frankfurt a. M. favoured me with some specimens of an apparently new species. With this material and some collected by me in Trinidad, Venezuela, and the region of Natal, capital of Rio Grande do Norte, I shall endeavour to discuss the different species.

L. petersii for which Steindachner erected the genus Platymantis was described in the same paper of 1864. He gave also very good drawings of a male, copied on pl. III, fig. 5 & 5a-c, instead of repealing the somewhat lengthy description. The male shows distinctly the sexual characters pertaining to the genus Platymantis and the marking on the posterior face of the thighs, when seen in sitting position, which distinguishes this species from the true caliginosus and several other forms. The color of the dorsum is brown; the venter is white with little brown vermiculation localised principally in the mandibular and gular regions. This distinguishes it easily from podicipinus which is smaller and less robust. On the rostral region the ground may be lighter, as shown in the drawing of Steindachner.

The type came from Maribitanas, extreme north of Brazil, near to Venezuela. Specimens obtained by me in Ocumar on the coast near to the port of Caracas, correspond perfectly to the indications given by Steindachner. Specimens from the capital of Trinidad show slight aberrations, not sufficient for establishing another species.

We do not think the same of a species from Br. Guiana received under the name of caliginosus which I call:

**Leptodactylus pallidirostris** n. sp.

(Pl. I, fig. 3).

This species is easily distinguished by the general coloring, ochraceous
merging into ferruginous, like in *validus* Garman. There are lighter and dark spots. From the interocular space, crossed by a dark stripe of irregular wavy shape, extends anteriorly a light area colored like old and yellowish ivory. The same hue is seen on the tympanum which is close to the eye, very large and somewhat excavated. The marking of the thighs is like that of *Petersii*, though less well defined.

The underside is nearly white and little vermiculated, even in the males. These are smaller, somewhat darker and have the forearm thickened, while the upper arm is thin in both sexes.

Of this species collected in Katarbo by Mr. Beebe, I have numerous specimens, all rather alike and easily recognised. As seen in plate I they resemble *validus* Garman from the Antilles. There is, however, also a species very much alike to *Petersii* in Br. Guiana, of which I saw samples from Bunoon.

There is still to consider the *validus* Garman of which I have two good specimens, one from S. Vicente and the other from Grenada. Though alike to *palidirostris*, its light area on the forehead is more limited and the dorsal glands are more developed, at least in the specimen shown on the colour-plate I. A copy of the original description is found in the appendix.

**Other species of Platymantis.**

*Leptodactylus krefftii*, collected in the south of Chile by an expedition from Hamburg to the strait of Magellan, is small but shows all the attributes of *Platymantis*. The description is found in the «Tierreich».

I have still to cite two forms of *Platymantis* which, though nearly allied to the true *Petersii*, are easily distinguished and may be considered separate species with limited area of distribution. Both belong to Brasil but only the first one has been observed alive and in a large number of specimens.

**Leptodactylus natalensis** n. sp. (Pl. I, figs. 7 & 7a, pl. III, figs 1 & 2).


Length of head and body about 35 mm. Short form with large abdomen and muscular limbs. The old males with the entire arm thickened. Due to their general shape, the sitting position, the cutaneous glands and the rather dull color they look somewhat like toads.

Groundcolor of the back isabel or *café au lait*, but so densely stippled with black that it looks dark gray. There are dark blotches on the dorsum, elongate on the trunk and appearing as crossbars on the limbs. On the legs there are about 10, rather broad ones forming half cercles. There is a typical obtriangular spot with its base between the eyes, prolonged in a dark median stripe with two dilatations, while anteriorly it is limited by a very light transversal ribbon. The space in front of this and between the lores may also be rather light. The jaw is divided in the middle by a light perpendicular line while on each side there are three or four dark bars with light edges. The tympanum, coloured like the ground and with a raised edge, occupies the middle of an elongate dark spot, limited above by a dark glandular fold and below by a light wavy ribbon, running from the eye to the dorsal root of the humerus. This is very striking in fresh specimens, but may vanish gradually in museum material. (The same marking occurs in other species, as for instance in *validus* Garman).

The transparent under eyelid has a black edge. The pupil is large, subhomboidal and shows below (sometimes also above) a small black line dividing the edge of the iris and simulating an im-
perfect colobome. The rest of the iris has the colour of gold, brilliant at the free edge and duller on the rest.

The snout is rounded with the canthi well defined and the lores nearly vertical and somewhat excavated. The distinct nostrils about midways between the eyes and the end of the snout.

On the sides of the back there is a raised black glandular fold, interrupted in the anterior half but nearly perfect in the posterior. There are many papular glands, spread over the upper side of trunk and limbs and forming two more punctuated lines on the flanks.

The ventral side is milky white, almost totally or more or less vermiculated with black, specially at the throat and the under side of the thighs. The gula is always very dark up to the margin of the jaw which is black with light dots, arranged in a line that shows at its end a superior and inferior supernumerary dot, forming an oblique line with the terminal one. The ventral pigmentation is more intense in adult females which are also somewhat larger.

On the hand the first digit is shorter than the second and in the male carries to hard points, often appearing horn-covered and black. The finger and toes show no well accentuated membranous edges. There is no discoidal fold.

This frog has a call whith the strength of a whistle but sounding more like the voice of a cricket. It seems to have also another sound, heard during copulation, like a soft clucking, sometimes repeated by other males, so as to form a general concert. The specimens were caught near to the water but generally well hidden. They cannot be rare, as they were found in several places. After copulation had taken place they ceased to call and were hard to find. They have much in common with the caliginosus Girard from Rio.

Leptodactylus intermedius n. sp.
(Pl. III, fig. 6).

I call intermedius a small and very dark form, found by Ehrhardt in Manacapuri near Manaos, of which I received four specimens through Dr. Mertens from the Senckenberg Museum. They are not unlike podicipinus Cope and curius Barbour and Noble, though different from both and nearly intermediate in size. They are nearer to podicipinus, as they belong to the group Platymantis.

My largest specimen is a female, 3 cm. in length. The second, seen in fig. 7 on pl. III, measures 27.5 mm. from the tip of the snout to the end of the coccyx, which is somewhat protruding. Two other, still smaller ones, may not be quite adult.

The specimens are rather dark but show on the lighter ground of the dorsum some markings well seen in fig. 6, pl. VI. There is a distinctly lighter area before the dark triangle, connecting the upper eyelids by its base.

The thighs show on the side, which is posterior in sitting position, a dark reticulation crossed by some elongate spots, not forming perfect longitudinal stripes. The hind limbs show dark and narrow crossbars from the knees to the tips of the toes. The forefingers also have alternating dark and light segments, but the arms show only some irregularly arranged spots. On all the limbs the last phalanx ends in a T-shaped dilatation.

The ventral side, without a discoidal fold, is today rather light with darker vermiculation, principally on the gula of the male.

The vomerine teeth form two small triangles with their points between the choanae which are distinct and of regular size. The tongue is large and somewhat notched behind. The mandibular tooth is distinct between to very shallow grooves. The tympanum, of dark,
ochraceous brown hue is concave with a raised margin; its diameter equals 3/4 of that of the eye; above there is a narrow but convex glandular fold running from the under eyelid to the shoulder. The posterior part of the back and sides are sprinkled with small glandular warts, but show no longitudinal folds.

On the hands the fingers are short and nearly equal, only the fourth being rather small; the first toe is rather short, the others of regular length. The metatarsal tubercles are inconspicuous.

I received another new species, not belonging to Platymantis, of which the description follows:

**Leptodactylus ochraceus** n. sp.

(Pl. I, figs. 4 & 4a).

General coloring very light ochraceous, like old ivory, with brownish or frankly brown markings.

The type is an adult female from Pernambuco (? Tapera), sent by D. Bento Pickel.

Canthi rostrales sharp and a little inwards bent. Lores excavated. Snout rounded, somewhat projecting over the mouth. Interocular space somewhat larger than an upper eyelid. Below the canthus rostralis there is on both sides a dark stripe reaching the eye; passing above the small and faintly colored tympanum it continues till close to the middle of the lateral region. The under side shows a few dilatations and an irregular outline; the upper limit forms a glandular fold. The interocular spot, so common in other species, is rather faint and largely fenestrated. There are some other small and elongated darker spots, disseminated on the back. On the limbs are a few crossbars rather oblique on the legs; the thighs are immaculate. The forearm is marbled, but the upper arm and the inner side of the thighs are immaculate. On the upper margin of the mouth, mostly under the eyes there are a few dark spots. The ventral aspect is ochraceous without design.

The tongue is short, but rather large and somewhat notched at the free edge. The vomerine teeth form two little separated groups behind the space between the rather faintly marked choanae. The mandibular tooth is obsolete.

The fingers are rather short, the first a little longer than the second. The tips of the digits are rounded and a little thickened. Toes longer, the first near to a rather elongate metatarsal tubercle, while the other tubercle is little accentuated.

On opening the abdomen appear a few rather large creamcolored eggs.

This form, well shown in the colored figure, is easily distinguished. In color it comes near to *bufonius*, seeming also related to *mystaceus, mystacinus* and *bogoglytes* which, however, is more variegated.

**Additional notes on species of Leptodactylus.**

(In alphabetical order.)

1. **Leptodactylus albilabris** (Guenther, 1859).

The frog, given by Brocchi as *caliginosus*, is referred by Boulenger to *albilabris*, which has never been found in South-America. At any rate it lacks the characters of the *Platymantis*-group.

2. **Leptodactylus brevipes** Cope, 1887.

I found some difficulties in recognising this species of Cope's, founded on one specimen from Matto Grosso. I finally came to the conclusion that it refers simply to *mystacinus* Burm., which occurs in that region but was never cited by Cope. There are only small and unimportant differences, while other signs agree so well, as to indicate that *brevipes* must be considered as a synonym of *mystacinus*. I do not think that *bufonius* Boulenger may be referred to *brevipes* Cope.
3. Leptodactylus bufonius Boulenger, 1894.  
(Pl. I, fig. 1.)

I have some specimens which, unless new, can only be referred to this species, known from Bolivia and Argentina. They all have the same general coloration. The dorsum, instead of olive, has a light brownish ocraceous ground, somewhat like much discolored ivory; on the rest of the animal it is gray with a lavender tone.

Two of my specimens came from Bolivia where the species seems to extend to the north, as one is labeled: Upper Beni, near mouth, on margin, Pearson leg., Sept. 1924. The specimen of fig. 1, pl. I is either bolivian or argentine. The species comes near to mystacinus, but in my specimens the miliiary glands are always very conspicuous.

4. Leptodactylus curtus Barbour and Noble.  
(L. c. pg. 405)

Fig. 6, pl. I reproduces an excellent colotype. This peruvian species does not belong to the group Platymantis.

5. Leptodactylus diptyx Boettger.

This small species should be easily recognised while alive. In its limited territory (Paraguay, Matto Grosso, and parts of Argentina and Bolivia) it does not seem rare. I saw some specimens from Porto Velho in Matto Grosso.

The subgeneric position is not quite sure but it is certainly different from nanus L. M.


I have not received more specimens but Miranda-Ribeiro described a supposed new species under the name L. pachyderma, which may represent a second sample of the same species. The strange fact, that of so striking species, as flavopictus and vastus only two or three specimens are known, is explained not only by their rare occurrence but also by their nocturnal habits. Fresh specimens could not be confounded with pentadactylus but this might happen in old material.

7. Leptodactylus gigas Spix.

The remarks made by Peters and Lorenz Mueller on the type of Spix do not permit to refer to it the frog from Independencia (Parahyba) mentionned in my first paper as ? gigas. I have not been able to obtain more specimens in the same region; though there were many pentadactylus no intermediate forms were found. The pond where the types came from has been filled up long ago. I shall now call this species Lepto- dactylus vastus n. sp.

8. Leptodactylus longirostris Boulenger.

This species was only known from Santarem, because the references to frogs from the Antillae, the Organ mountains and S. Catharina can not be accepted. I received however from D. Bento Pickel in Tapera (Pernambuco) a perfectly typical specimen which might have been the model of the figure reproduced in my last paper.


Miranda-Ribeiro gave description and an illustration of a large Leptodactylus, collected in Manoaos and found in the Museu Paulista in three cotypes. They have a short snout and large eyes. They cannot be referred to any of the described species of the subgenus Pachyopus. Like flavopictus it has yellow markings on the under side but is different in its appearance and habitat.
10. Leptodactylus mystaceus (Spix, 1824).

Compare the note of poecilochilus Cope and his description.

11. Leptodactylus mystaceus (Burm., 1885).

A figure of Mehély's shows the ground color violet-red. I have received from D. Bento Pickel a quite similar specimen, though the colour has faded since. Hensel also cites an aberrant coloration which might have been more intense during life. It may well be a nupcial decoration.

My specimen from Tapera (Pernambuco) shows the black markings more intense and extensive invading also the back, as in my figure of rhodomyslas from Bahia in the first paper.

These differences in colour and markings do not prevent the recognition of the species.


In the beginning of September I had after dark the chance to hear the call of the males of this species. It is a metallical ping which Budgett also heard in Paraguay where he must have taken the adults of nanus for young specimens of bufonius of which the adults did not call.

L. nanus seems to be widely spread. L. Mueller described the type from the State of S. Catharina but it is also found near Rio de Janeiro and in several places of the states of Rio de Janeiro, Minas and São Paulo from where I have specimens. Even minutus described by Noble from Br. Guyana does not seem clearly different. Its small size and its inclination to hide explain why it has escaped many collectors. But still it is not likely that the specimens of L. Mueller were the first ones that were collected. The figure of Cystignathus parvulus, given by Girard and reproduced in the "Tierreichs" by Nieden, looks quite like this species but for the too pointed fingers, an error which occurred before in drawings from museum specimens. Unfortunately I failed to obtain his original description as well as that given by Cope of his genus Zachaenus which, to judge by the description given in the "Tierreich", may refer to a quite different batrachian.

If the original description or the examination of Girard's type confirm my supposition that he was right in using the name Cystignathus (formely applied to Leptodactylus) nanus would then be substituted by parvulus and become a later synonym. To my believe, the region where Girard collected contains no other species which might be refered to his type, nor is it likely that it may have become extinct.

13. Leptodactylus ocellatus (L., 1758).

This species common and widely distributed is easier to obtain and to observe than any other one. Like the Rana esculenta in Europe, it may be observed at any time near to or inside of the pools, where it settles soon, even when they are quite isolated. Living or well kept specimens are easily recognized, as the few species living in the same regions and somewhat alike, as typhonius and agilis, differ by the characteristics of the males and their call, as well as by their habits. It is hard to understand why the authors should have made so many mistakes concerning this species and its habits, even when they observed these frogs alive, as Hensel and Budgett. However these mistakes have to some extent been corrected by K. and M. Fernandes who published exact biological observations.

The most distinctive character for females and young specimens is the presence of longitudinal glandular folds on the back. They are not all equally distinct, so there may be some doubt about
their number. Generally there are six or eight standing out well. Between them the back shows separate dark spots of median size, generally round or oval, except an obtiangular spot on the nape. The ground is normally olivgreen or bronze, but like in other frogs liable to change, becoming much lighter or darker. Milky white may form a median vertebral stripe or mark a lateral one on each side, besides forming a series of dots on the margin of the jaw. The inguinal regions may show a bluish or yellowish green area. Below the frog is of a milky white, either pure or more or less vermiculated with black, the last condition being favoured by a lower temperature, due either to the station or the locality. Very old individuals may also show a certain degree of melanism.

Miranda-Ribeiro described as *L. ocellatus* var. *macrosternum* a specimen from Bahia. The characters of this form, not referring to the sternum come near to the race observed in Pernambuco and Rio Grande do Norte which displays a good deal of white. M.-R. indicates for his form a length of 65 mm. while the drawing of the sternum gives a length of 85 mm., supposed natural size, as no augmentation is indicated. This is evidently impossible and even, if the frog measured 165 mm. instead of 65 mm. which is barely possible, though unlikely, it is hard to believe in a sternum of that size.

In my specimens I did note an extraordinary development of the sternum or the pectoral girdle. The males, some of them quite old, as shown by the form of the arm, were in sexual activity and showed a special feature not observed in Rio, though existing in a male from the Argentine, province of Cordoba. It consists in an extraordinary development of military skin glands, disseminated or agglomerated in large groups.


Under this name several forms were described, some of them so different, as to be considered new species. L. Mueller distinguished a form of Dominica as *fallax*, the first name *dominicanus* being preoccupied. He also considers Surinam as the *terra typica* of *pentadactylus* and describes the type of Surinam and his specimens from Amazonia. This he calls *pentadactylus pentadactylus* (in distinction from *pentadactylus labirinticus* to which the coloured plates in my first paper correspond); his form is somewhat smaller with dark crossbars and without marking or only with few spots in the groins while the hind part of the thighs are slightly marked with yellow.

As stated before Miranda-Ribeiro described a *L. macroblepharon* from Manaos which seems distinct from *pentadactylus*, *flavopictus* and *vastus*.

*Leptodactylus rubido* Cope, found in Ecuador and Peru, comes near to these forms, notwithstanding the small size indicated the spots given as white may have been yellow or even red in live specimens.

Noble cites from Nicaragua a form with abundant red spots while the marking of the back varied. We may conclude that the material of Central America requires more collecting and studying.

In August and September of 1928 many specimens of *pentadactylus* were caught in the States Rio Grande do Norte and Parahyba. They all belonged to a very variegated form like the one in fig. 3, pl. XXXIV of my first paper. The same form was caught in Bahia and Bello Horizonte, but there appears also the unvariegated form, found more in the south, like the *L. bufo* of Anderson and a specimen of Gliesch, caught in Santa Maria in the State of Rio Grande do Sul.

I have not studied these questions for want of fresh material. However I
believe that forms without red spots on the thighs and without nuptial papillae or traces of such on the breast of the males do not belong to the true *L. pentadactylus labirinticus*. On the other side the hypertrophy of muscles and bones of the arms in the male is a progressive feature which may be wanting in a restricted material without any really old males. The dermal edges on the side of the fingers are of little taxonomic value, as explained before. In my specimens they are barely visible. The fingers have rounded tips while the last phalanx ends in a cartilaginous bulb. All the species of this group have well accentuated crepuscular habits and are only exceptionally caught in daytime. The use of lanterns during the dark hours however gives good results but it is not easy to secure these large and strong animals which slip through the wet hands, unless special precautions are used. So we understand why the collections are poor in the largest forms (which may attain 17-18 and with extended legs 40 cm.), though these are relatively frequent. These frogs are more abundant in the northern States where they are found in tanks and ponds. They are very voracious and their number is kept down by their cannibalistic habits.

15. *Leptodactylus (mystaceus Spix and) poecilochoilus* Cope, 1862.

The denomination of Cope, used by Budgett and Berg is generally and probably rightly considered a synonym of *mystaceus*. The habitat Turbo (formerly New Grenada, now Colombia) speaks for the wide distribution of this species which would be more known if it was easier to get. The ground colour seems changeable and may become roseate, but the dark markings are very characteristic as well as the light stripe on the posterior side of the thigh.


*Rana pygmaea* Spix from Bahia is according to Peters only a small *ocellatus*. Not agreeing with this opinion, Miranda-Ribeiro refers the name to *mys-

tacinus* which in consequence would become a synonym. However his figures disagree completely and are like *ocellatus*, *typhonius* or *trogodytes*. The last form might perhaps be found in Bahia, but never in S. Paulo or Rio Grande do Sul which he also indicates as habitat. *L. ocellatus* and *typhonius* have glandular folds which do not appear in the pictures but may vanish somewhat in old specimens. One might also think of *nanus* L. M. but the Latin description of *Spix* disagrees absolutely.

So I think that the *mystacinus*, well represented in Mehely's and my picture, will keep its name while *pygmaeus* falls into synonymy.


Of this species I received another specimen from Pernambuco, sent by D. Bento Pickel and gathered another half dozen near Natal where it is not rare. It is known by its call which is a kind of whistle but it is hard to catch, as it generally hides in holes, often difficult of access or communicating with other ones. Fresh or well kept specimens are easily recognised. Though the marking is somewhat variable the ground colour is rather characteristic.

18. *Leptodactylus typhonius* (Daudin, 1802).

L. Mueller wishes to change Daudin’s name for *L. sibilatrix* Wied because the name *Rana typhonia* had first been used by Linne for the present *Bufo typhonius*. As none of the two species belongs to the present genus *Rana* and nobody ever confounded them, this change after more than a century seems quite unnecessary.

19. *Leptodactylus vastus* nom. nov.

This name is given to the species cited in my first paper as *? gigas* Spix.

For copies of some of the less accessible original descriptions see appendix in the portuguese text (pag. 14).
Bibliography

1. Leptodactylus caliginosus Girard.

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Explanation of plates

Plate I

Fig. 1.—Leptodactylus bufonius Boulen-ger.
Fig. 2.—L. petersii from Trinidad, inner side of thighs.
Fig. 3.—L. pallidirostris n. sp.
Figs. 4 & 4a.—L. ochraceus n. sp.
Figs. 5 & 5a.—L. validus Garman.
Fig. 6.—L. curtus Barb. & Noble.
Figs. 7 & 7a.—L. natalensis n. sp., male.
All the fig. in 2/3 nat. size.

Plate II

Leptodactylus caliginosus Girard, topotypes.
Fig. 1.—Adult male in dorsolateral view.
Nat. size.
Fig. 2.—Adult female, dtô.
Fig. 3.—The same in ventral aspect.

Plate III

Fig. 1.—Leptodactylus natalensis, under side of adult female.
Fig. 2.—Dtô. of adult male.
Fig. 3.—L. podicipinus from Caçara (Matto Grosso), copied from Steindachner; 3a: dorsal view; 3a: ventral view; 3b: mouth; 3c: hand; 3d: foot.

Plate IV

Figs. 1 & 1a.—Leptodactylus podicipinus Cope, female from Buena Vista (Bolivia) with legs vermiculated below; 3 & 3a: dtô. male with speckled thighs.
Fig. 2: L. caliginosus, male from Rio, ventral view.
Fig. 4:—L. pusulatus Peters. Female (?), from Carolina. Under side. Copied from Miranda-Ribeiro.

Plate V.

Skeleton of a big male of L. ocellatus showing osteophyts on the hands and bony crests on the arms as support for the hypertrophic muscles (2/3 nat. size).