

FIRST RECORD OF *Itapotihyla langsdorffii* FOR CAAGUAZU DEPARTMENT  
(PARAGUAY) AND OBSERVATIONS ON ANOTHER ENDEMIC SPECIES OF THE  
ATLANTIC FOREST

Primer registro de *Itapotihyla langsdorffii* para el departamento Caaguazú (Paraguay) y  
observaciones en otra especie endémica del bosque atlántico

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**Palabras clave:** Amphibia, *Rhinella ornata*, bosque atlántico del Alto Paraná (BAAPA).

Home to more than 700 species of amphibians (70% of which are endemic; Figueiredo *et al.* 2021), the Atlantic Forest is cited as one of the eight conservation priority hotspots by Myers *et al.* (2000) and as a Global 200 Priority Ecoregion for Global Conservation (Olson & Dinerstein 2002). Of its original surface area (1,345,300 km<sup>2</sup>) extending from north east Brazil (92%), to eastern Paraguay (6%), and the north of Argentina (2%), only 16.8% remains (Olson & Dinerstein 2002, Fundación Vida Silvestre Argentina & WWF 2017). More specifically, the Upper Parana Atlantic Forest (UPAF) (471,204 km<sup>2</sup>) harbours the largest ecoregion within the aforementioned system, and contains the most important patches of predominantly subtropical semi-deciduous forest (Di Bitetti *et al.* 2003, Placci & Di Bitetti 2005). The UPAF in Paraguay has experienced a reduction of over 90% of its former area due to selective timber extraction and the conversion of land mainly for agricultural production (Fleytas 2007, Da Ponte *et al.* 2017).

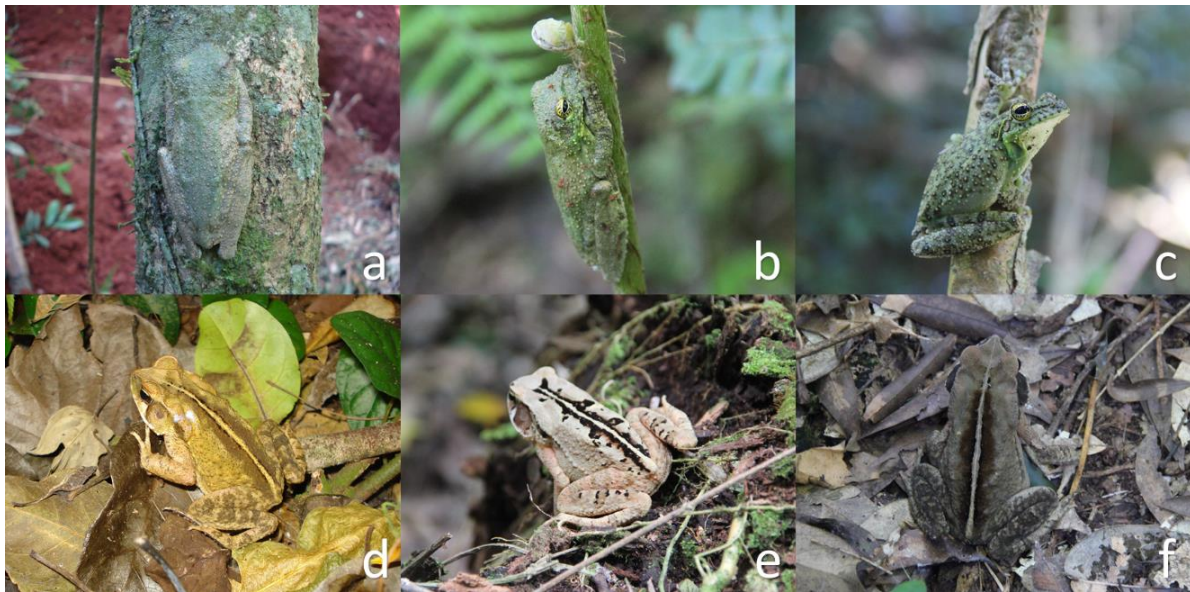
Scientific research and publications on amphibians in Paraguay have increased in the last two decades, yet this group of fauna remains poorly known (particularly the threatened species and those restricted to the Atlantic Forest). Most contributions have been inventories or distribution records with large gaps in systematics, anatomy and physiology, biogeography, ecology, and life histories (Airaldi-Wood *et al.* 2013). In this country, 88 species of amphibians within the Anura (85) and Gymnophiona (3) taxa have been identified (Weiler *et al.* 2013, Caballero *et al.* 2014, Brouard *et al.* 2015, Lavilla *et al.* 2016, Schneider *et al.* 2019). The UPAF ecoregion contains around 60% of the species registered at the national level, almost 61% of the species categorized as threatened, and nine species that are endemic (Motte *et al.* 2019).

The objective of this work is to provide data on the distribution and natural history of two threatened endemic species of the Atlantic Forest in Paraguay: *Itapotihyla langsdorffii* (Duméril & Bibron 1841) and *Rhinella ornata* (Spix 1824), which were recorded and photographed during field trips to review the permanent plots of Biodiversity Monitoring Projects of the Faculty of Agrarian Sciences, National University of Asunción (The floristic description of the localities based on its work is presented in Appendix 1).

Two adult *Itapotihyla langsdorffii* frogs were recorded on October 18, 2013 in the riparian forest of the Zanja Ybycui Stream at the Ka'aguy Rory Forest cattle private estate, Department of Caaguazú (24°44'38.2"S, 55°40'38"W). The forest gallery (designated as Protective Forest by Law N° 422/1973) is up to 25 m tall and is made up of three distinct layers. One specimen was found on the trunk of a tree covered with bryophytes and crustose lichens such as *Cryptothecia striata* G. Thor., presenting a coloration similar to that of the substrata (Figure 1a). The other specimen was recorded on the stem of the fern *Didymochlaena truncatula* (Sw.) Sm. near the petiole (Figure 1b). In another location, an adult male of *I. langsdorffii* was also recorded on December 21, 2013 on a tree in a riparian forest 25 m tall with three distinct strata located at the Kangüery Stream, Kangüery Biological Station, Reserve for the San Rafael National Park (RNPSR), Department of Itapúa (26°28'37.15"S, 55°50'5.1"W; Figure 1c). With limited records, *Itapotihyla langsdorffii* has been generally described as arboreal and associated with forests (Núñez 2012), although there are no habitat descriptions from Paraguay. The cryptic coloration exhibited by the specimen is classified as an anti-predatory mechanism used by amphibians for camouflage (background matching variation) called 'Avoid Detection' according to Ferreira *et al.* (2019).

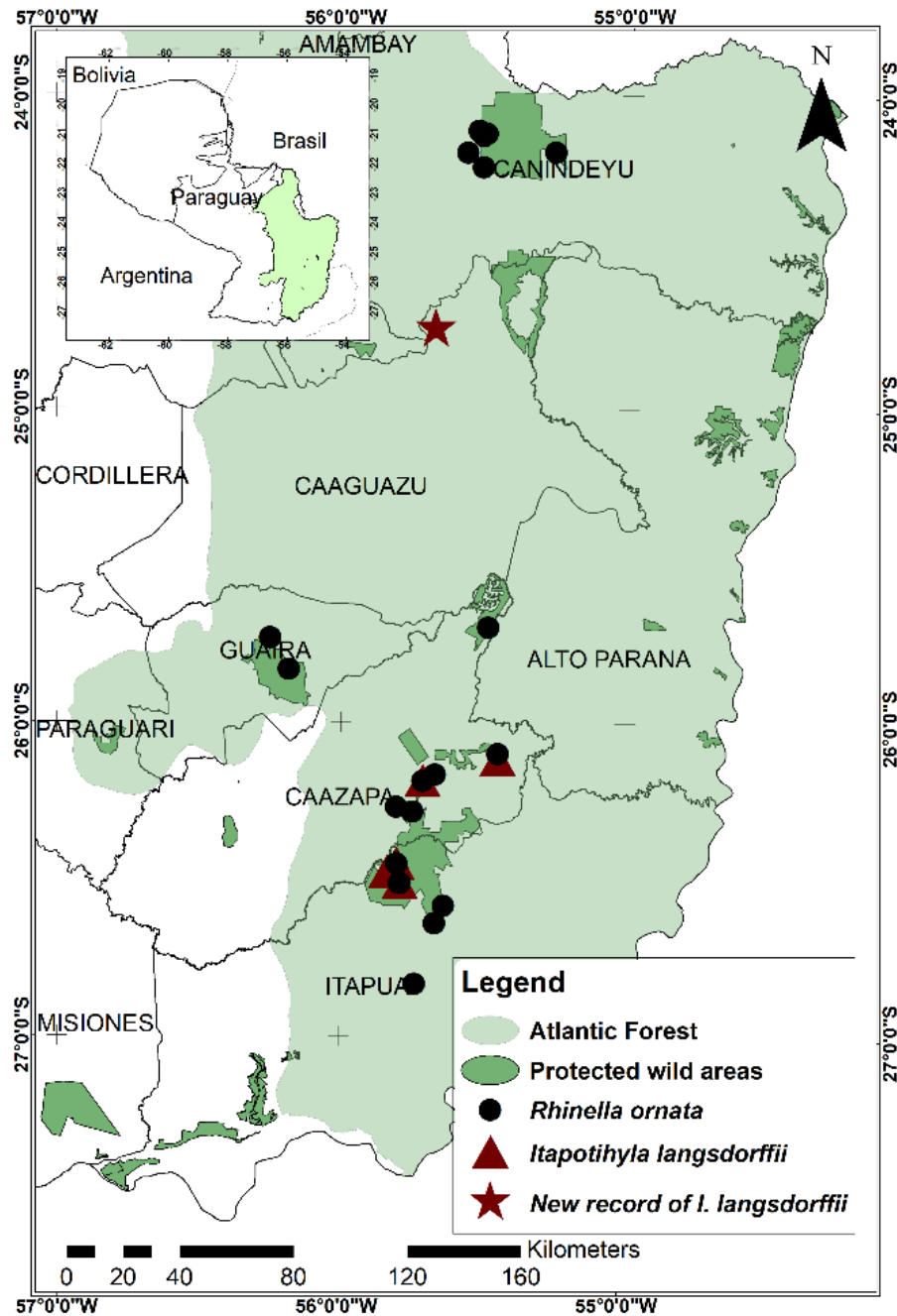
With this work, the first amphibian record for the Ka'aguy Rory property is presented and the distribution of *I. langsdorffii* is extended to the Department of Caaguazú (Figure 2). It has a very restricted distribution in the country: Caazapá (Caazapá National Park, Tapyta Nature Reserve) and Itapúa departments (Reserve for the San Rafael National Park) (Brusquetti & Lavilla 2006, Pérez-Estigarribia *et al.* 2020). *I. langsdorffii* is listed as Least Concern according to the IUCN (Aquino *et al.* 2004) but at the national level is Endangered (Motte *et al.* 2019) and In Danger of Extinction (MADES 2019). The loss of habitat and construction of dams are indicated as their greatest threats, and it is believed that the Paraguayan populations could be seriously threatened.

As for the other species, two individuals of *Rhinella ornata* were recorded in the Tapyta Nature Reserve (TNR), Department of Caazapá (26°17'4.4"S, 55°44'43.8" W), in an area of very dense forest about 28 m tall with three strata. One was photographed on April 17, 2010 on leaf litter in a wooded area and presented a whitish discharge on the parotoid glands (Figure 1d). The other specimen was recorded on October 5, 2013 on the ground between twigs and litter in riparian forest (Figure 1e). *R. ornata* was also recorded in the Mbaracayú Forest Nature Reserve, Canindeyú Department (24°7'33.04"S, 55°30'21.6" W), on May 2, 2015 in dead leaves in a disturbed area of semi-deciduous high forest reaching a height of 36 m with three distinct strata (Figure 1f).



**Figure 1.** *Itapotihyla langsdorffii*: a) Individual on tree bark with lichen and bryophytes, Ka'aguy Rory, b) Individual on fern, Ka'aguy Rory, c) Male, Kangüery Biological Station. *Rhinella ornata*: d) Specimen with whitish discharge, Tapyta Nature Reserve, e) Individual in riparian forest, Tapyta Nature Reserve, f) Individual in high forest, Mbaracayú Forest Nature Reserve. © Photos. L. Pérez de Molas.

The *Rhinella ornata* toad in Paraguay has been associated mainly with forested areas (Núñez 2012), especially riparian forest and along rocky streams (Airaldi-Wood *et al.* 2013) in the following departments: Caaguazú, Caazapá, Canindeyú, Guairá, and Itapúa (Weiler *et al.* 2013, Pérez-Estigarribia *et al.* 2020; Figure 2). The release of skin secretion observed in *R. ornata* (poisonous variation) is a defensive behavior expressed in the final anti-predatory phase called 'counterattack,' according to Ferreira *et al.* (2019). The toads of the genus *Rhinella* are characterized by their parotoid macroglands located behind the eyes (Jared *et al.* 2009) that can be toxic to their attackers (Toledo & Jared 1995).



**Figure 2.** Geographical distribution map of *Itapotihyla langsdorffii* (red triangles) and *Rhinella ornata* (black dots) in Paraguay. The new record of *I. langsdorffii* in Ka'aguy Rory (Caaguazú Department) is indicated by a red star.

*Rhinella ornata* is not threatened at the regional level and is considered Least Concern (Baldisseri 2006) but at the national level Vulnerable (Motte *et al.* 2019) and Under Threat of Extinction (MADES 2019). Although the species was found in the country within

several localities and in protected areas of the UPAF, it was mentioned as a species that merited further observation and research (Airaldi-Wood *et al.* 2013).

The acquisition of data related to biodiversity in conservation units and protected areas has become a key tool for making the correct decisions for the management and conservation of natural environments. The publication of the data presented here contributes to filling the information gaps on the distribution and natural history of species in Paraguay, an essential preliminary action for developing conservation strategies for threatened species.

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**Appendix 1: Sites, respective surface areas (hectares) and floristic descriptions.**

Site/Surface area (ha)	Habitat
Ka'aguy Rory Forest private cattle estate / 14.961 ha	Gallery or riparian forest about 25 m high with three strata. In the upper stratum (19-25 m): characteristic species are <i>Balfourodendron riedelianum</i> , <i>Peltophorum dubium</i> and <i>Nectandra angustifolia</i> ; in the middle stratum (12-18 m) the most representative species are <i>Balfourodendron riedelianum</i> , <i>Muelleria campestris</i> and <i>Cordia americana</i> and in the lower stratum (<12 m) <i>Cabralea canjerana</i> , <i>Balfourodendron riedelianum</i> and <i>Chrysophyllum gonocarpum</i> are present. The understory is dense and species rich, with the presence of herbs and shrubs such as <i>Pereskia aculeata</i> , <i>Manihot grahamii</i> , <i>Trichilia elegans</i> , <i>Chusquea ramosissima</i> , <i>Hennecartia omphalandra</i> , <i>Piper</i> spp., <i>Prockia crucis</i> , <i>Lippia brasiliensis</i> , <i>Brunfelsia</i> sp., <i>Capsicum</i> sp., <i>Pseudananas sagenarius</i> , <i>Maranta sobolifera</i> and <i>Neomarica candida</i> . The ferns present are <i>Didymochlaena truncatula</i> , <i>Neoblechnum brasiliense</i> , <i>Campyloneurum nitidum</i> , <i>Adiantopsis radiata</i> , <i>Doryopteris nobilis</i> and <i>Pteris denticulata</i> . Among the lianas, <i>Dolichandra unguis-cati</i> , <i>Dalechampia</i> sp. and <i>Tetracera</i> sp. are present (Segovia 2014).
Biological Station Kangüery/ Reserve for the San Rafael National Park/ 71.192 ha	Forest about 25 m high, with three strata. In the upper stratum (17-25 m) there are: <i>Holocalyx balansae</i> , <i>Cordia americana</i> , <i>Balfourodendron riedelianum</i> , <i>Myrcianthes pungens</i> , <i>Campomanesia xanthocarpa</i> , <i>Inga uraguensis</i> , <i>Nectandra angustifolia</i> , <i>Nectandra lanceolata</i> , <i>Handroanthus pulcherrimus</i> , <i>Machaerium paraguariense</i> , <i>Muelleria campestris</i> , <i>Helietta apiculata</i> , <i>Apuleia leiocarpa</i> , <i>Diatenopteryx sorbifolia</i> and <i>Peltophorum dubium</i> . In the middle stratum (8.4 - <17 m) are present: <i>Achatocarpus</i> sp., <i>Allophylus edulis</i> , <i>Cupania vernalis</i> , <i>Diatenopteryx sorbifolia</i> , <i>Eugenia uniflora</i> , <i>Guazuma ulmifolia</i> , <i>Inga uraguensis</i> , <i>Muelleria campestris</i> , <i>Machaerium stipitatum</i> , <i>Nectandra angustifolia</i> , <i>Parapiptadenia rigida</i> , <i>Peltophorum dubium</i> , <i>Picrasma crenata</i> , <i>Plinia rivularis</i> and <i>Syagrus romanzoffiana</i> . In the lower stratum (3 - <8.4 m) are: <i>Achatocarpus</i> sp., <i>Actinostemon concolor</i> , <i>Allophylus edulis</i> , <i>Banara tomentosa</i> , <i>Calliandra foliolosa</i> , <i>Casearia gossypiosperma</i> , <i>Chrysophyllum gonocarpum</i> , <i>Citronella paniculata</i> , <i>Citrus aurantium</i> , <i>Diatenopteryx sorbifolia</i> , <i>Eugenia uniflora</i> , <i>Faramea porophylla</i> , <i>Jacaratia spinosa</i> , <i>Luehea divaricata</i> , <i>Picramnia sellowii</i> , <i>Pilocarpus pennatifolius</i> , <i>Plinia rivularis</i> , <i>Ruprechtia laxiflora</i> , <i>Sebastiania brasiliensis</i> , <i>Vitex</i> sp. and <i>Zanthoxylum petiolare</i> . The understory is sparse with the presence of herbs and shrubs such as: <i>Geophila repens</i> , <i>Capparidastrum humile</i> , <i>Allophylus guaraniticus</i> and <i>Piper regnellii</i> . The ferns present are: <i>Adiantopsis radiata</i> , <i>Anemia phyllitidis</i> , <i>Asplenium serratum</i> , <i>Neoblechnum brasiliense</i> and <i>Tectaria incisa</i> ; the lianas present in isolation are: <i>Manettia luteo-rubra</i> , <i>Forsteronia glabrescens</i> , <i>Cayaponia podantha</i> and among the epiphytes are <i>Rhipsalis cereuscula</i> and some species of the Orchidaceae family (L. González-Soria, pers. com).
Tapyta Nature Reserve/ 6.032 ha	Very dense forest about 28 m high with three strata. In the upper stratum (21 - 28 m) the characteristic species are: <i>Apuleia leiocarpa</i> , <i>Inga uraguensis</i> , <i>Matayba elaeagnoides</i> , <i>Muelleria campestris</i> , <i>Alchornea glandulosa</i> , <i>Luehea divaricata</i> , <i>Ocotea diospyrifolia</i> and <i>Nectandra lanceolata</i> ; in the middle stratum (14-21 m) the most representative species are <i>Muelleria campestris</i> , <i>Maclura tinctoria</i> ssp. <i>tinctoria</i> , <i>Dahlstedtia muehlbergiana</i> and <i>Syagrus romanzoffiana</i> . <i>Garcinia brasiliensis</i> , <i>Citrus aurantium</i> , <i>Jacaratia spinosa</i> , <i>Guarea kunthiana</i> and <i>Plinia rivularis</i> are present in the lower stratum (<14 m). The understory is dense and diverse, with the presence of herbs and shrubs such as <i>Peperomia barbarana</i> , <i>Hydrocotyle</i> sp., <i>Geophila repens</i> , <i>Maranta sobolifera</i> and <i>Pharus lappulaceus</i> . The ferns present are <i>Corymborkis flava</i> , <i>Adiantopsis radiata</i> , <i>Adiantum pseudotinctum</i> , <i>Asplenium serratum</i> , <i>Didymochlaena truncatula</i> , <i>Doryopteris concolor</i> , <i>Doryopteris nobilis</i> and <i>Parapolystichum effusum</i> . The lianas present are <i>Dioscorea</i> sp., <i>Forsteronia glabrescens</i> , <i>Mikania</i> spp., <i>Fridericia mutabilis</i> , <i>Amphilophium crucigerum</i> , <i>Dolichandra unguis-cati</i> , <i>Melothria cucumis</i> , <i>Tetracera</i> sp., <i>Bauhinia</i> sp., <i>Hippocratea volubilis</i> , <i>Passiflora</i> sp. and <i>Manettia luteo-rubra</i> . Among the epiphytes are <i>Thaumatococcus bipinnatifidum</i> , <i>Billbergia nutans</i> , <i>Rhipsalis cereuscula</i> , <i>Rhipsalis cruciforme</i> , <i>Miltonia flavescens</i> and <i>Peperomia urocarpa</i> (Villalba 2010).
Mbaracayú Forest Nature Reserve/ 64.634 ha	Tall forest about 36 m high with three strata. In the upper stratum (24-36 m) characteristic species are: <i>Cariniana estrellensis</i> , <i>Handroanthus heptaphyllus</i> and <i>Myracrodruon urundeuva</i> ; in the middle stratum (12-24 m) the most representative species are: <i>Nectandra angustifolia</i> , <i>Maclura tinctoria</i> ssp. <i>tinctoria</i> , <i>Chrysophyllum gonocarpum</i> , <i>Helietta apiculata</i> , <i>Balfourodendron riedelianum</i> , <i>Enterolobium contortisiliquum</i> , and <i>Holocalyx balansae</i> and in the lower stratum, the densest (<12 m): <i>Plinia rivularis</i> , <i>Campomanesia xanthocarpa</i> , <i>Citrus aurantium</i> , <i>Guarea kunthiana</i> and <i>Endlicheria paniculata</i> are present. The understory is dense and diverse with the presence of herbs and shrubs such as <i>Clavija nutans</i> , <i>Cordyline sellowiana</i> , <i>Pseudananas sagenarius</i> , <i>Neomarica candida</i> , <i>Oeceoclades maculata</i> , <i>Maranta</i> sp., <i>Heliconia</i> sp., <i>Lasiacis sorghoidea</i> , <i>Geophila repens</i> , <i>Dasyphyllum brasiliense</i> , <i>Hennecartia omphalandra</i> , <i>Psychotria</i> spp., <i>Piper</i> sp., <i>Acalypha</i> sp. and <i>Urera</i> sp. The ferns present are: <i>Asplenium serratum</i> , <i>Didymochlaena truncatula</i> , <i>Anemia phyllitidis</i> , <i>Adiantopsis radiata</i> and <i>Corymborkis flava</i> . Lianas (twining and climbing) have been identified as <i>Herreria montevidensis</i> , <i>Mikania</i> sp., <i>Serjania</i> spp., <i>Ipomoea</i> sp., <i>Davilla elliptica</i> and <i>Passiflora</i> sp. The epiphytes present are <i>Billbergia nutans</i> , <i>Peperomia</i> spp., <i>Epiphyllum phyllanthus</i> , <i>Rhipsalis cereuscula</i> , <i>Microgramma lindbergii</i> and <i>Miltonia flavescens</i> (Riveros 2016).