

SHORT COMMUNICATION

Reassessing overlooked information about the diagnosis of *Brachycephalus atelopoide* (Anura: Brachycephalidae), a neglected problem for the taxonomy of the genus

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The anuran genus *Brachycephalus* is divided into three phenetic species groups based on body shape and presence/absence of hyperossification (Ribeiro *et al.* 2015), characteristics that are relatively easy to examine in preserved specimens. Pie *et al.* (2018) reported a third feature (the *linea masculinea*) that differentiates these species groups, in addition to body shape and hyperossification. On the basis of these characters, all species of *Brachycephalus* can be assigned to one of the three species groups (e.g., Bornschein *et al.* 2019) except for one—*B. atelopoide* Miranda-Ribeiro, 1920, whose

holotype is presumed to be lost (Pombal 2010). In 1920, Miranda-Ribeiro described four varieties of *B. ephippium* (Spix, 1824)—viz., *atelopoide*, *nodoterga*, *garbeana*, and *bufonoides* (Miranda-Ribeiro 1920). At the time, these “varieties” were not recognized as species because some frogs were found on the presumptive type localities that departed from their original description (Miranda-Ribeiro 1920). Seventy years later, the variety *nodoterga* was recognized as a full species of *Brachycephalus* (Heyer *et al.* 1990) when it was found at Estação Biológica de Boracéia, municipality of Salesópolis, state of São Paulo, Brazil.

Pombal (2010) reassessed the taxonomic status of the varieties of *Brachycephalus* described by Miranda-Ribeiro (1920) and

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recognized all of them as valid species. He also confirmed that specimens of *B. garbeanus* Miranda-Ribeiro, 1920 had been collected at the municipality of Nova Friburgo, state of Rio de Janeiro, Brazil, with additional reports of populations of this species having been reported since (e.g., Clemente-Carvalho *et al.* 2011, Dorigo *et al.* 2012). No recent reports exist of known populations of *B. atelopoide* and *B. bufonoides* Miranda-Ribeiro, 1920.

The *atelopoide* variety described by Miranda-Ribeiro (1920) was based on one individual of 30 that “perfectly” matched *B. ephippium* collected at Piquete, on the slope of the Mantiqueira Mountain Range, municipality of Piquete, state of São Paulo, Brazil. The *atelopoide* variety was distinguished by lacking “cephalic coating” and “dorsal shields”, and by having “protruding warts over the skin” (Miranda-Ribeiro 1920). *Brachycephalus ephippium* lacks protruding warts and has conspicuous hyperossification plates on the dorsal surfaces of head and body (e.g., Clemente-Carvalho *et al.* 2009); see the plate depicting *B. ephippium* in Miranda-Ribeiro (1920).

Hyperossification associated with a bufoniform body shape is the diagnosis of the *Brachycephalus ephippium* species group (Ribeiro *et al.* 2015), which includes *B. bufonoides*, *B. garbeanus*, and *B. nodoterga* Miranda-Ribeiro, 1920 (Bornschein *et al.* 2016a). However, *B. atelopoide* was not included in any of the three species groups of *Brachycephalus* (*sensu* Ribeiro *et al.* 2015) because presence/absence of hyperossification could not be determined (Bornschein *et al.* 2016a). In addition to the *B. ephippium* group, *Brachycephalus* also includes the *B. pernix* and *B. didactylus* groups that lack hyperossification. Both the *B. pernix* and *B. ephippium* groups have bufoniform bodies that distinguish them from members of the *B. didactylus* group with their leptodactyliform body shape (Ribeiro *et al.* 2015). Miranda-Ribeiro (1920) did not describe the body shape of *B. atelopoide*, but given that he distinguished *B. atelopoide* from a series of

specimens identified as *B. ephippium* based on ossification characteristics and skin texture (Miranda-Ribeiro 1920), one would expect that it also had a bufoniform body.

Recent studies have shown that the extent of hyperossification in species of the *Brachycephalus ephippium* group varies intraspecifically and ontogenetically (Clemente-Carvalho *et al.* 2009, 2011, Campos *et al.* 2010, Pombal 2010). Pombal (2010) mentioned that the extent of hyperossification varies individually in *B. garbeanus*, being less well developed in smaller (and presumably more immature) frogs (see also Clemente-Carvalho *et al.* 2009, 2011). Hyperossification also varies ontogenetically in *B. ephippium* (Campos *et al.* 2010, Goutte *et al.* 2019). Thus, we might question the level of developmental maturation of the specimen described as *B. atelopoide*, as well its specific status.

Herein, we revise the diagnosis of *Brachycephalus atelopoide* by reviewing its original description and comparing this taxon with the other varieties that were described by Miranda-Ribeiro (1920), redescribed by Pombal (2010), and referenced in other taxonomic studies. We agree with Ribeiro *et al.* (2015), who suggested that the taxonomic status of *B. atelopoide* should be revisited. The type material of the other varieties described by Miranda-Ribeiro (1920) was not examined because the specimens are in poor condition and because there are excellent photographs available in Pombal (2010). The material we have examined of the other species is listed in Appendix I.

Upon reviewing Miranda-Ribeiro (1920), we noted three features in the description of *Brachycephalus atelopoide* that warrant discussion with respect to the description of *B. nodoterga*, which also was described based on a single individual. First, Miranda-Ribeiro (1920) mentioned that the varieties *nodoterga* and *atelopoide* have the same body shape, but *nodoterga* differs by having more abundant, large, elongate warts, in pairs, that might be ossified [osteoderms?]. This may indicate that

nodoterga lacked hyperossification (i.e., “cephalic coating” and body “dorsal shields”), as does *atelopoide*. However, in the redescription of *B. nodoterga*, Pombal (2010) reported hyperossification along the vertebrae and a pair of bony dorsal plates. Hyperossification of the trunk and of the center and sides of the head of the type of *B. nodoterga* is evident in Pombal (2010: Fig. 2); see also Figs. 5 and 6 of Clemente-Carvalho *et al.* (2009) and Fig. 6 of Haddad *et al.* (2010). Second, Miranda-Ribeiro (1920) reported that *nodoterga* was 15 mm long and apparently immature, like *atelopoide*. Pombal (2010) reported that the holotype of *nodoterga* was 12.4 mm in snout–vent length (SVL). Finally, Miranda-Ribeiro (1920) commented that *nodoterga* has a larger number of warts, which were themselves larger and more elongate, than did *atelopoide*. However, in the redescription of *B. nodoterga*, Pombal (2010) mentioned only the presence of “sparse protuberances, like warts”.

The characteristics of the holotype of *Brachycephalus atelopoide* relative to those of *B. nodoterga* suggest that *B. atelopoide* is a juvenile only about 12 mm long, having few warts on the body and presumably about the same level of hyperossification on the head and back as the holotype of *B. nodoterga*. These features were overlooked by Pombal (2010), as well as in most other studies of *Brachycephalus*. Of the 20 species of *Brachycephalus* species described between 2011 and 2020, most authors disregarded *B. atelopoide*. Thirteen species were described without mentioning *B. atelopoide* in their diagnoses—viz., *B. albolineatus* Bornschein, Ribeiro, Blackburn, Stanley, and Pie, 2016, *B. auroguttatus* Ribeiro, Firkowski, Bornschein, and Pie, 2015, *B. boticario* Pie, Bornschein, Firkowski, Belmonte-Lopes, and Ribeiro, 2015, *B. coloratus* Ribeiro, Blackburn, Stanley, Pie, and Bornschein, 2017, *B. curupira* Ribeiro, Blackburn, Stanley, Pie, and Bornschein, 2017, *B. fuscolineatus* Pie, Bornschein, Firkowski, Belmonte-Lopes, and Ribeiro, 2015, *B. guarani* Clemente-Carvalho, Giaretta, Condez, Haddad,


and Reis, 2012, *B. leopardus* Ribeiro, Firkowski, and Pie, 2015, *B. mariaeterezae* Bornschein, Morato, Firkowski, Ribeiro, and Pie, 2015, *B. olivaceus* Bornschein, Morato, Firkowski, Ribeiro, and Pie, 2015, *B. quiririensis* Pie and Ribeiro, 2015, *B. tridactylus* Garey, Lima, Hartmann, and Haddad, 2012, and *B. verrucosus* Ribeiro, Firkowski, Bornschein, and Pie, 2015 (Clemente-Carvalho *et al.* 2012, Garey *et al.* 2012, Pie and Ribeiro 2015, Ribeiro *et al.* 2015, 2017, Bornschein *et al.* 2016b). Of the seven other species descriptions that do mention *B. atelopoide* in their diagnoses, we noted the following: (1) one (*B. mirissimus* Pie, Ribeiro, Confetti, Nadaline, and Bornschein, 2018; Pie *et al.* 2018) lacked a comparison because the holotype *B. atelopoide* is lost; (2) another (*B. pulex* Napoli, Caramaschi, Cruz, and Dias, 2011; Napoli *et al.* 2011) was compared without citing the source of data; (3) *Brachycephalus crispus* Condez, Clemente-Carvalho, Haddad, and Reis, 2014 (Condez *et al.* 2014) was compared using features that differ from those of the original description (Miranda-Ribeiro 1920) and redescription (Pombal 2010) of *B. atelopoide*; (4) the four remaining species descriptions included comparisons with the diagnosis of *B. atelopoide*. *Brachycephalus margaritatus* Pombal and Izecksohn, 2011 was compared with a holotype of *B. atelopoide* without hyperossification (Pombal and Izecksohn 2011). *Brachycephalus sulfuratus* Condez, Monteiro, Comitti, Garcia, Amaral, and Haddad, 2016 and *B. actaeus* Monteiro, Condez, Garcia, Comitti, Amaral, and Haddad, 2018 were compared to a holotype with an intermediate condition of hyperossification of the skull and skeleton (Condez *et al.* 2016, Monteiro *et al.* 2018) (these studies agreed with our interpretation, although these authors did not justify their conclusions). And last, *B. darkside* Guimarães, Luz, Rocha, and Feio, 2017 was compared with a holotype with osteoderms (Guimarães *et al.* 2017).

If one assumes that the holotype of *Brachycephalus atelopoide* had an intermediate level of hyperossification, the species resembles

a juvenile *B. ephippium*. Campos *et al.* (2010) reported on the levels of hyperossification in the heads and vertebrae of juveniles of *B. ephippium* with SVLs of 8.1 mm, 10.6 mm, 12.8 mm, and 13.6 in SVL in contrast to adults of this species that attain a SVL to 19.7 mm (Pombal 2001). However, *B. ephippium* does not possess large and elongate warts. If *B. atelopoide* had an intermediate amount of hyperossification, it would also resemble adult *B. nodoterga*, *B. alipioi* Pombal and Gasparini, 2006, *B. crispus*, *B. guarani*, *B. pitanga* Alves, Sawaya, Reis, and Haddad, 2009, *B. toby* Haddad, Alves, Clemente-Carvalho, and Reis, 2010, and *B. vertebralis* Pombal, 2001, all of which have lower hyperossification than do adult *B. ephippium* (Campos *et al.* 2010, Haddad *et al.* 2010, Clemente-Carvalho *et al.* 2012, Condez *et al.* 2014, 2020). In having large warts, *B. atelopoide* resembles *B. nodoterga*, *B. pitanga*, *B. crispus* (Campos *et al.* 2010, Condez *et al.* 2014, 2020), and especially *B. pitanga*, which has fewer of these warts.

In the absence of the holotype of *Brachycephalus atelopoide*, we cannot exclude the possibility that a species described after *B. atelopoide* may be a synonym of this species. For example, both *B. nodoterga* and *B. pitanga* are similar to *B. atelopoide*. Moreover, recently discovered populations of *B. tridactylus* in São Paulo (Appendix I) bear warts that are similar to those described for *B. atelopoide* on the sides of the body (MRB *et al.*, unpub. data, 2019). The taxonomic problem is further complicated by the equivocal descriptions and analysis of Miranda-Ribeiro (1920), who overlooked the presence of hyperossification in *B. nodoterga* and *B. bufonoides* and mistakenly identified three *B. nodoterga* as *B. ephippium* (Pombal 2010). Flaws in diagnoses of recently described species of *Brachycephalus* with respect to *B. atelopoide* also contribute to the confusion. Perhaps the best working solution is to adopt Cochran's (1955) proposal to place *Brachycephalus atelopoide* in the synonymy of *B. ephippium*, thereby avoiding nomenclatural confusion, according to article

#23.9.3 of the International Zoological Nomenclature Code. We hope that in forthcoming taxonomic reviews, the authors will explore the morphological evidence more thoroughly.

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References

- Bornschein, M. R., C. R. Firkowski, R. Belmonte-Lopes, L. Corrêa, L. F. Ribeiro, S. A. A. Morato, R. L. Antoniazzi-Jr., B. L. Reinert, A. L. S. Meyer, F. A. Cini, and M. R. Pie. 2016a. Geographic and altitudinal distribution of *Brachycephalus* Fitzinger (Anura: Brachycephalidae) endemic to the Brazilian Atlantic Rainforest. *PeerJ* 4: e2490.
- Bornschein, M. R., L. F. Ribeiro, D. C. Blackburn, E. L. Stanley, and M. R. Pie. 2016b. A new species of *Brachycephalus* (Anura: Brachycephalidae) from Santa Catarina, southern Brazil. *PeerJ* 4: e2629.
- Bornschein, M. R., M. R. Pie, and L. Teixeira. 2019. Conservation status of *Brachycephalus* toadlets (Anura: Brachycephalidae) from the Brazilian Atlantic Rainforest. *Diversity* 11: 1–29.
- Campos, L. A., H. R. Silva, and A. Sebben. 2010. Morphology and development of additional bony elements in the genus *Brachycephalus* (Anura: Brachycephalidae). *Biological Journal of the Linnean Society* 99: 752–767.
- Clemente-Carvalho, R. G. B., A. C. R. Alves, S. I. Perez, C. F. B. Haddad, and S. F. Reis. 2011. Morphological and molecular variation in the Pumpkin Toadlet *Brachycephalus ephippium* (Anura: Brachycephalidae). *Journal of Herpetology* 45: 94–99.
- Clemente-Carvalho, R. B. G., M. M. Antoniazzi, C. Jared, C. F. B. Haddad, A. C. R. Alves, H. S. Rocha, G. R. Pereira, D. F. Oliveira, R. T. Lopes, and S. F. Reis. 2009. Hyperossification in miniaturized toadlets of the genus *Brachycephalus* (Amphibia: Anura: Brachycephalidae): microscopic structure and macroscopic patterns of variation. *Journal of Morphology* 270: 1285–1295.

- Clemente-Carvalho, R. B. G., A. A. Giaretta, T. H. Condez, C. F. B. Haddad, and S. F. Reis. 2012. A new species of miniaturized toadlet, genus *Brachycephalus* (Anura: Brachycephalidae), from the Atlantic Forest of southeastern Brazil. *Herpetologica* 68: 365–374.
- Cochran, D. M. 1955. Frogs of southeastern Brazil. *United States National Museum Bulletin* 206: 1–423.
- Condez, T. H., R. B. G. Clemente-Carvalho, C. F. B. Haddad, and S. F. Reis. 2014. A new species of *Brachycephalus* (Anura: Brachycephalidae), from the highlands of the Atlantic Forest, southeastern Brazil. *Herpetologica* 70: 89–99.
- Condez, T. H., J. P. C. Monteiro, E. J. Comitti, P. C. A. Garcia, I. B. Amaral, and C. F. B. Haddad. 2016. A new species of flea-toad (Anura: Brachycephalidae) from southern Atlantic Forest, Brazil. *Zootaxa* 4083: 40–56.
- Condez, T. H., C. F. B. Haddad, and K. R. Zamudio. 2020. Historical biogeography and multi-trait evolution in miniature toadlets of the genus *Brachycephalus* (Anura: Brachycephalidae). *Biological Journal of the Linnean Society* 20: 1–23.
- Dorigo, T. A., C. C. Siqueira, D. Vrcibradic, T. Maia-Carneiro, M. Almeida-Santos, and C. F. D. Rocha. 2012. Ecological aspects of the pumpkin toadlet, *Brachycephalus garbeanus* Miranda-Ribeiro, 1920 (Anura: Neobatrachia: Brachycephalidae), in a highland forest of southeastern Brazil. *Journal of Natural History* 46: 2497–2507.
- Garey, M. V., A. M. X. Lima, M. T. Hartmann, and C. F. B. Haddad. 2012. A new species of miniaturized toadlet, genus *Brachycephalus* (Anura: Brachycephalidae), from southern Brazil. *Herpetologica* 68: 266–271.
- Goutte, S., M. J. Mason, M. M. Antoniazzi, C. Jared, D. Merle, L. Cazes, L. F. Toledo, H. el-Hafci, S. Pallu, H. Portier, S. Schramm, P. Gueriau, and M. Thoury. 2019. Intense bone fluorescence reveals hidden patterns in pumpkin toadlets. *Scientific Reports* 9: 5388.
- Guimarães, C. S., S. Luz, P. C. Rocha, and R. N. Feio. 2017. The dark side of pumpkin toadlet: a new species of *Brachycephalus* (Anura: Brachycephalidae) from Serra do Brigadeiro, southeastern Brazil. *Zootaxa* 4258: 327–344.
- Haddad, C. F. B., A. C. R. Alves, R. B. G. Clemente-Carvalho, and S. F. Reis. 2010. A new species of *Brachycephalus* from the Atlantic Rain Forest in São Paulo state, southeastern Brazil (Amphibia: Anura: Brachycephalidae). *Copeia* 2010: 410–420.
- Heyer, W. R., A. S. Rand, C. A. G. Cruz, O. L. Peixoto, and C. E. Nelson. 1990. Frogs of Boracéia. *Arquivos de Zoologia* 31: 231–410.
- Miranda-Ribeiro, A. 1920. Os brachycephalídeos do Museu Paulista (com três espécies novas). *Revista do Museu Paulista* 12: 306–318.
- Monteiro, J. P. C., T. H. Condez, P. C. A. Garcia, E. J. Comitti, I. B. Amaral, and C. F. B. Haddad. 2018. A new species of *Brachycephalus* (Anura, Brachycephalidae) from the coast of Santa Catarina state, southern Atlantic Forest, Brazil. *Zootaxa* 4407: 483–505.
- Napoli, M. F., U. Caramaschi, C. A. G. Cruz, and I. R. Dias. 2011. A new species of flea-toad, genus *Brachycephalus* Fitzinger (Amphibia: Anura: Brachycephalidae), from the Atlantic Rainforest of southern Bahia, Brazil. *Zootaxa* 2739: 33–40.
- Pie, M. R. and L. F. Ribeiro. 2015. A new species of *Brachycephalus* (Anura: Brachycephalidae) from the Quiriri mountain range of southern Brazil. *PeerJ* 3: e1179.
- Pie, M. R., L. F. Ribeiro, A. E. Confetti, M. J. Nadaline, and M. R. Bornschein. 2018. A new species of *Brachycephalus* (Anura: Brachycephalidae) from southern Brazil. *PeerJ* 6: e5683.
- Pombal Jr., J. P. 2001. A new species of *Brachycephalus* (Anura: Brachycephalidae) from Atlantic Forest of southeastern Brazil. *Amphibia-Reptilia* 22: 179–185.
- Pombal Jr., J. P. 2010. A posição taxonômica das “variedades” de *Brachycephalus ephippium* (Spix, 1824) descritas por Miranda-Ribeiro, 1920 (Amphibia, Anura, Brachycephalidae). *Boletim do Museu Nacional, Zoologia* 526: 1–12.
- Pombal Jr., J. P. and E. Izecksohn. 2011. Uma nova espécie de *Brachycephalus* (Anura, Brachycephalidae) do estado do Rio de Janeiro. *Papéis Avulsos de Zoologia* 51: 443–451.
- Ribeiro, L. F., M. R. Bornschein, R. Belmonte-Lopes, C. R. Firkowski, S. A. A. Morato, and M. R. Pie. 2015. Seven new microendemic species of *Brachycephalus* (Anura: Brachycephalidae) from southern Brazil. *PeerJ* 3: e1011.
- Ribeiro, L. F., D. C. Blackburn, E. L. Stanley, M. R. Pie, and M. R. Bornschein. 2017. Two new species of the *Brachycephalus pernix* group (Anura: Brachycephalidae) from the state of Paraná, southern Brazil. *PeerJ* 5: e3603.

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Appendix I. Specimens examined. Abbreviations: CFBH = Célio F. B. Haddad collection, Departamento de Zoologia, Universidade Estadual Paulista, campus de Rio Claro, São Paulo state, Brazil; DZUP = Coleção Herpetológica do Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Paraná state, Brazil; MHNCI = Museu de História Natural Capão da Imbuia, Curitiba, Paraná state, Brazil; MNRJ = Museu Nacional, Rio de Janeiro, Rio de Janeiro state, Brazil; MZUSP = Museu de Zoologia da Universidade de São Paulo, São Paulo, São Paulo state, Brazil; and ZUEC = Museu de História Natural, Universidade Estadual de Campinas, Campinas, São Paulo state, Brazil.

Brachycephalus actaeus. BRAZIL. SANTA CATARINA: Serra da Tiririca, municipality of Itapopá MHNCI 10832–10834, 11024–11030.

Brachycephalus albolineatus. BRAZIL. SANTA CATARINA: Morro Azul, on the border between the municipalities of Pomerode and Rio dos Cedros MHNCI 10291, 10301, 10846; Morro Boa Vista, boundary of the municipalities of Jaraguá do Sul and Massaranduba MHNCI 10290 (holotype), MHNCI 10295–10300 (paratypes), MHNCI 10293 (juvenile), MHNCI two uncatalogued specimens, MNRJ 90349 (paratype); Morro do Garrafão, municipality of Corupá MHNCI 10836–10842; Morro do Schmidt, municipality of Pomerode MHNCI four uncatalogued specimens.

Brachycephalus alipioi. BRAZIL. ESPÍRITO SANTO: Alto Castelinho, municipality of Vargem Alta MHNCI 10804–10806.

Brachycephalus auroguttatus. BRAZIL. SANTA CATARINA: Pedra da Tartaruga, municipality of Garuva DZUP 375 (holotype), DZUP 373–374, 376–385, 387–389 (all paratypes); trail to Pedra da Tartaruga, municipality of Garuva MHNCI six uncatalogued specimens.

Brachycephalus boticario. BRAZIL. SANTA CATARINA: Morro do Cachorro, boundary of the municipalities of Blumenau, Gaspar, and Luiz Alves DZUP 440 (holotype), DZUP 414, 415, 438, 439, 444, 445, 459 (all paratypes), MHNCI three uncatalogued specimens.

Brachycephalus brunneus. BRAZIL. PARANÁ: Abrigo 1, municipality of Campina Grande do Sul DZUP 517–519; Camapuã, Serra dos Órgãos, boundary of the municipalities of Campina Grande do Sul and Antonina MHNCI 10165–10174; Caratuva, Serra dos Órgãos, municipality of Campina Grande do Sul MHNCI 1919, 1920, 10175–10184, 10733, 10734, MNRJ 40289–40291 (paratypes); Mãe Catira, Serra da Graciosa, municipality of Quatro Barras DZUP 140, 230, MHNCI 10784.

Brachycephalus coloratus. BRAZIL. PARANÁ: Estância Hidroclimática Recreio da Serra, Serra da Baitaca, municipality of Piraquara MHNCI 10273 (holotype), MHNCI 10274–10279 (paratypes), MNRJ 89949, 89950 (paratypes), DZUP 600; Pão de Ló, Serra da Baitaca, municipality of Quatro Barras MHNCI one uncatalogued specimen.

Brachycephalus curupira. BRAZIL. PARANÁ: Morro do Canal, municipality of Piraquara MHNCI 10724–10728; Morro do Vigia, municipality of Piraquara MHNCI 10723; Serra do Salto, Malhada District, municipality of São José dos Pinhais MHNCI 10280 (holotype), MHNCI 10281–10287, 10292 (all paratypes).

Brachycephalus didactylus. BRAZIL. RIO DE JANEIRO: municipality of Engenheiro Paulo de Frontin ZUEC 10825; Sacra Família do Tinguá, municipality of Engenheiro Paulo de Frontin ZUEC 1132, 1133 (topotypes), MZUSP 13613–13620, 64810, 64811, 94621 (topotypes).

Brachycephalus ephippium. BRAZIL. RIO DE JANEIRO: Parque Nacional Serra dos Órgãos MZUSP 104140–104147; Vale de Revolta MCZ A-108655. SÃO PAULO: municipality of Cotia MHNCI 2611–2616.

Brachycephalus ferruginus. BRAZIL. PARANÁ: Olimpo, Serra do Marumbi, municipality of Morretes MHNCI 125, 128 (topotypes), DZUP 562 (topotype), MHNCI five uncatalogued specimens (topotypes).

Brachycephalus fuscolineatus. BRAZIL. SANTA CATARINA: Morro do Baú, municipality of Ilhota DZUP 159 (holotype), DZUP 158, 160, 401–405 (all paratypes), MHNCI three uncatalogued specimens; Morro Braço da Onça, municipality of Luiz Alves MHNCI 10850, 10851.

Brachycephalus hermogenesi. BRAZIL. SÃO PAULO: Pinguaba, Parque Estadual da Serra do Mar, municipality of Ubatuba ZUEC 9715 (holotype), ZUEC 9716–9725 (paratypes); Corcovado, municipality of Ubatuba MHNCI 10823–10825.

Brachycephalus izecksohni. BRAZIL. PARANÁ: Torre da Prata, Serra da Prata, boundary of the municipalities of Morretes, Paranaguá, and Guaratuba CFBH 7381, 7382, 7384 (all paratypes), MHNCI 10835, DZUP 561.

Brachycephalus leopardus. BRAZIL. PARANÁ: Morro dos Perdidos, municipality of Guaratuba DZUP 274–283, MHNCI 10783, MHNCI three uncatalogued specimens; Serra do Araçatuba, municipality of Tijucas do Sul MHNCI 10250 (holotype), MHNCI 10239–10249, 10251, 10252 (all paratypes), MHNCI two uncatalogued specimens, DZUP 520–523.

Brachycephalus mariaeterezae. BRAZIL. SANTA CATARINA: Reserva Particular do Patrimônio Natural Caetezal, top of the Serra Queimada, municipality of Joinville MHNCI 9811 (holotype), DZUP 372, 393–399 (all paratypes).

Brachycephalus mirissimus. BRAZIL. SANTA CATARINA: Morro Santo Anjo, municipality of Massaranduba MHNCI 10793 (holotype), MHNCI 10794–10803 (paratypes), MHNCI two uncatalogued specimens.

Brachycephalus nodoterga. SÃO PAULO: Reserva Biológica Tamboré, municipality of Santana de Parnaíba MZUSP 147711–147716.

Brachycephalus olivaceus. BRAZIL. SANTA CATARINA: base of the Serra Queimada, municipality of Joinville MHNCI 9813 (holotype), DZUP 371 (paratype); Castelo dos Bugres, municipality of Joinville MHNCI 9814–9818 (paratypes), MHNCI 10 uncatalogued specimens; Morro do Boi, municipality of Corupá MHNCI 10288, 10289; Pico Jurapê, municipality of Joinville MHNCI one uncatalogued specimen.

Brachycephalus pernix. BRAZIL. PARANÁ: Anhangava, Serra da Baitaca, municipality of Quatro Barras MNRJ 17349 (holotype), CFBH 2597, 2598 (paratypes), MHNCI 1818, 1889, 3000–3004 (all paratypes), MHNCI 1820, ZUEC 9433–9437 (paratypes), MHNCI 9806–9810, 10153–10164.

Brachycephalus pitanga. BRAZIL. SÃO PAULO: rodovia SP-125, municipality of São Luiz do Paraitinga MHNCI 10733, 10734; Trilha do Ipiranga 50 m from the Rio Ipiranga, Núcleo Santa Virgínia, Parque Estadual da Serra do Mar, municipality of São Luiz do Paraitinga MHNCI 10733, 10734, 10821, 10822, 10843 (all topotypes), DZUP 409 (topotype).

Brachycephalus pombali. BRAZIL. PARANÁ: Morro dos Padres, Serra da Igreja, municipality of Morretes CFBH 8042 (holotype), 8043–8053 (paratypes), DZUP 213–220, 603–613, MHNCI nine uncatalogued specimens.

Brachycephalus quiririensis. BRAZIL. SANTA CATARINA: Serra do Quiriri, municipality of Campo Alegre MHNCI 10261 (holotype), MHNCI 10260, 10262–10272 (all paratypes), DZUP 531–535.

Brachycephalus sulfuratus. BRAZIL. PARANÁ: Caratuval, near the Parque Estadual das Lauráceas, municipality of Adrianópolis DZUP 139; Corvo, municipality of Quatro Barras DZUP 150–157; Fazenda Thalia, municipality of Balsa Nova DZUP 221–224; Mananciais da Serra, municipality of Piraquara MHNCI 10302; Recanto das Hortências, municipality of São José dos Pinhais DZUP 463; Salto do Inferno, Rio Capivari, municipality of Bocaiúva do Sul MHNCI 9800. SANTA CATARINA: Morro do Garraão, municipality of Corupá MHNCI 10826–10828. SÃO PAULO: base of the Serra Água Limpa, municipality of Apiaí DZUP 362; near Jurupará dam, municipality of Piedade MHNCI 10829–10831.

Brachycephalus toby. BRAZIL. SÃO PAULO: Morro do Corcovado, Parque Estadual da Serra do Mar, municipality of Ubatuba MHNCI 10807–10809 (topotypes).

Brachycephalus tridactylus. BRAZIL. PARANÁ: Serra do Morato, Reserva Natural Salto Morato, municipality of Guaraqueçaba MHNCI 10185–10189, 10294, 10729, 10730 (topotypes), CFBH 43887–43890 (topotypes). SÃO PAULO: Bairro Rio Vermelho, municipality of Barra do Turvo MHNCI two uncatalogued specimens; Estrada das Conchas, municipality of Barra do Turvo MHNCI one uncatalogued specimen; Fazenda Fronteira, municipality of Barra do Turvo MHNCI seven uncatalogued specimens; Morro do Bisel, Serra do Guaraú, municipality of Cajati DZUP 687; Serra do Pinheiro, municipality of Cajati MHNCI five uncatalogued specimens; Serra Pelada, municipality of Barra do Turvo DZUP 688–691; Torre Embratel, municipality of Cajati MHNCI 10848, 10852, DZUP 676–686.

Brachycephalus verrucosus. BRAZIL. SANTA CATARINA: Morro da Tromba, municipality of Joinville MHNCI 9819 (holotype), MHNCI 9820 (paratype), DZUP 464–478 (paratypes).

Brachycephalus vertebralis. BRAZIL. RIO DE JANEIRO/SÃO PAULO: Morro Cuscuzeiro, Núcleo Pinguaba of the Parque Estadual da Serra do Mar and Parque Nacional da Serra da Bocaina, boundary of the municipalities of Parati, Rio de Janeiro state, and Ubatuba, São Paulo state MHNCI 10810–10820.

Brachycephalus sp. BRAZIL. PARANÁ: Chapeuzinho, boundary of the municipalities of Morretes and Piraquara DZUP 502–504; Pedra Branca do Araraquara, Serra do Araraquara, municipality of Guaratuba DZUP 400; Serra Canasvieiras, boundary of the municipalities of Guaratuba and Morretes MHNCI 10785, DZUP 452, 453. SANTA CATARINA: Morro da Pedra, municipality of Navegantes MHNCI two uncatalogued specimens; Morro da Prata, municipality of Ilhota MHNCI four uncatalogued specimens; Morro dos Monos; municipality of Luiz Alves MHNCI two uncatalogued specimens.