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The Rapid Expansion of the Jumping Snail *Ovachlamys fulgens* in Brazil

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Abstract: The exotic Japanese jumping snail, *Ovachlamys fulgens*, was first recorded in Santa Catarina state, Brazil, in 2013. Based on data gathered from the literature, natural history collections, field samplings, and the iNaturalist platform, we assess its current distribution in the country. Our data show that the jumping snail has had a dramatic range expansion since its introduction, reaching six other states from the southern region of the country toward the Midwest. The affected locations are mostly urban but also include three biological reserves and protected areas, and possibly more. We discuss the consequences of this rapid invasion, its means of introduction, its local ecology, and prospects for monitoring and control.

Keywords: Helicarionidae; exotic species; land snails; community science; iNaturalist

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1. Introduction

Because of human activity worldwide, the number of species introduced to areas outside their native ranges continues to increase. While exotic species are not always detrimental to their new habitats, they can often become invasive and cause severe damage to the local ecosystems, native species, and even to human populations [1,2]. When it comes to molluscs, the introduction of exotic snails and slugs is a common occurrence across the world [3–5]. Introduced snails often come into conflict with native species, either directly (e.g., by predation) or indirectly (e.g., competing for resources), and can cause trouble to humans as agricultural pests or disease vectors [3,5].

Brazil, like the rest of South America, has been a stage for several introductions of snails and slugs in the past decades [6,7]. There are circa 30 species of exotic land snails and slugs reported from Brazil [8–11]. The exact number is hard to define because of difficulties in ascertaining the precise origin of some widespread neotropical species that could be native or introduced from somewhere else in the Americas. Some of the most infamous and widespread cases include the giant African snail *Lissachatina fulica* (Bowdich, 1822), the Asian tramp snail *Bradybaena similaris* (Férussac, 1821), the yellow cellar slug *Limacus flavus* (Linnaeus, 1758), and the marsh slug *Deroceras laeve* (Müller, 1774) [6,9]. The study of exotic terrestrial gastropods in Brazil, with the exception of *L. fulica*, has not been a priority for the country's malacological research, resulting in a scarcity of data on their introductions and distributions. In face of the dire need to detect and monitor invasive species, new tools, such as community science, are emerging as useful data sources [12].

The Japanese jumping snail *Ovachlamys fulgens* (Gude, 1900) is an interesting case of an exotic snail introduced to Brazil. First described from Naha, Okinawa, Japan [13,14], it has since been introduced to tropical regions in several countries and territories across the world: Taiwan, American Samoa, USA (Hawaii and Florida), Nicaragua, Costa Rica, Dominican

Republic, Trinidad and Tobago, and Argentina [4,5,15–22]. Further records from shipments originating in Thailand, Singapore, and Colombia still require confirmation [4,23]. Finally, it has also been detected as a greenhouse exotic in temperate regions such as Chicago (USA) and Sweden [4,14].

In Brazil, it was first reported in São Paulo state from a specimen collected on Ilha Porchat in 2015 and several specimens collected across the municipalities of Santos and São Vicente in 2017 [24]. Since then, *O. fulgens* has been reported in the states of Rio de Janeiro [23,25,26], Santa Catarina [27], Paraná [26], and Espírito Santo [12]. The brief timespan and wide geographic range of records show that *O. fulgens* either dispersed quickly across Brazil, went undetected for a long period as it spread, or a combination of both.

The main pathway of the introduction of *O. fulgens* seems to be the flower trade [24,28,29]. It is often associated with agricultural activities and is frequently intercepted in plant shipments from countries where it has become invasive [4,24,28,29]. *Ovachlamys fulgens* is considered a pest of orchids and, to a lesser degree, other ornamental plants, such as *Dracaena marginata* Lam. and *Heliconia* spp., and some food crops, such as avocado *Persea americana* Mill. and mango *Mangifera indica* L. [30].

Considering the alarming spread of *O. fulgens* through Brazil, we aim to give an updated overview of its expansion in the country through time. To achieve this, we combined data from the literature, voucher specimens in natural history collections, the community science platform iNaturalist, and verified photographic records.

2. Materials and Methods

Data used in this study were mainly gathered from specialized and gray literature, specimens from natural history collections (Museu de Zoologia da Universidade de São Paulo, MZUSP, Brazil; Secretaria Estadual do Meio Ambiente do Rio Grande do Sul, MCN, Brazil; and Universidade Estadual "Júlio de Mesquita Filho", MTCLP, Brazil), field samplings, and from the iNaturalist platform (Supplementary Material S1). Data from iNaturalist (https://www.inaturalist.org/; see also https://doi.org/10.15468/ab3s5x, accessed on 30 July 2022). The observations were filtered by taxa (*Ovachlamys fulgens*) and country (Brazil), resulting in 42 records. We revised the identifications of all observations on iNaturalist using current literature (e.g., [24]), as well as comparative specimens from the MZUSP and MTCLP collection, to certify the identity of the species observed as *O. fulgens* (same methodology as [12]).

3. Results

The oldest confirmed record of the jumping snail is from 2013, in the municipality of Blumenau, in the southern state of Santa Catarina (Figure 1A). Based on subsequent records, its range in the country seems to have progressively expanded northward towards the states of Paraná, São Paulo, Rio de Janeiro, Espírito Santo, Minas Gerais, and, most recently, Mato Grosso do Sul in the Midwest (Figure 1B,C). The latter two states are new records from our study. Apart from Blumenau, most of the initial records (2014–2018) were from coastal areas (Figure 1A,B), and the species seems to have reached the countryside from 2019 onward (Figure 1B,C).

The invaded localities include three environmental reserves and protected areas: Parque Estadual Xixová-Japuí ("Xixová-Japuí State Park", São Vicente municipality, São Paulo state), Parque Estadual Serra do Mar–Núcleo Picinguaba ("Serra do Mar State Park", Ubatuba municipality, São Paulo state), and Reserva do Bicudinho-do-brejo ("Bicudinho-do-brejo Reserve", Guaratuba municipality, Paraná state). In all cases, the jumping snails were found in regenerating dense ombrophilous lowland forests. In Parque Estadual Xixová-Japuí, the area is subject to constant disturbance, but at the other two locations, disturbance levels are low.

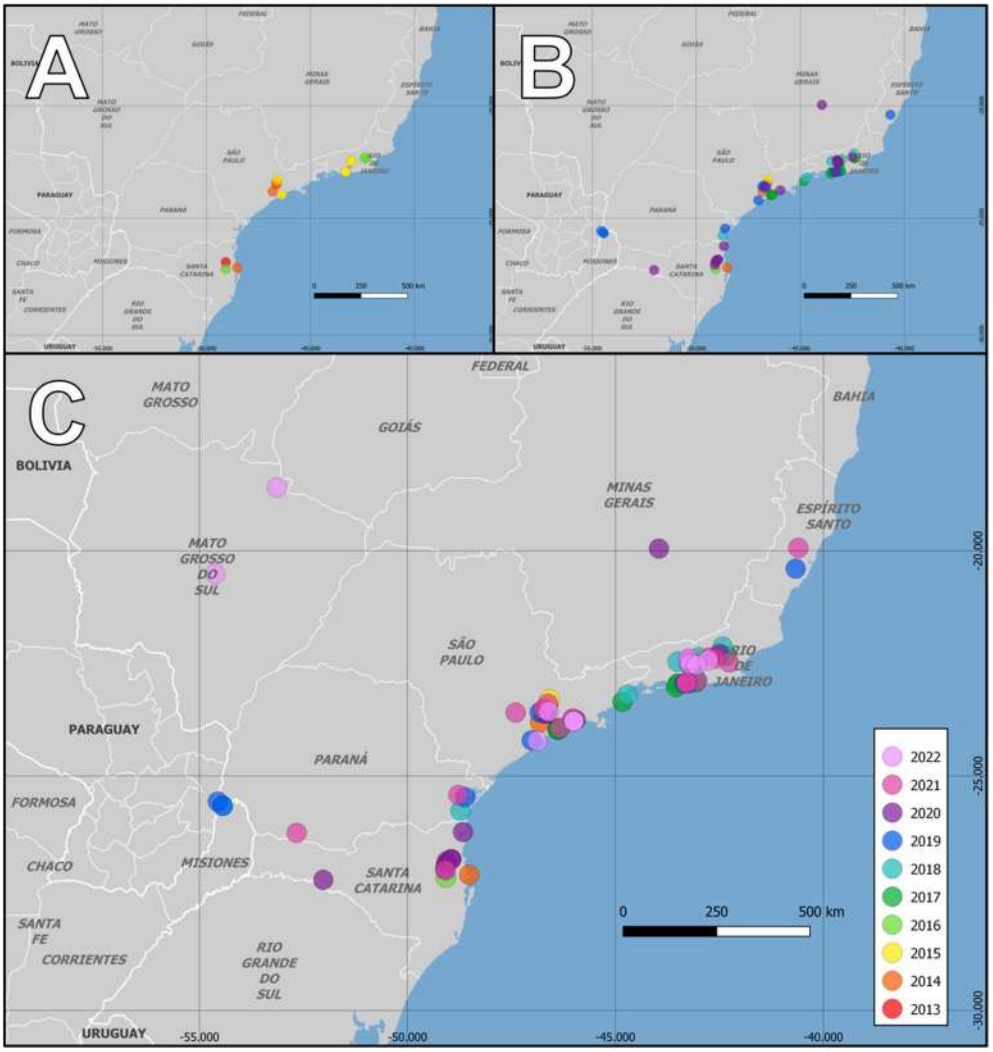

Figure 1. Maps showing the spread of *Ovachlamys fulgens* in Brazil through the years. (**A**) From 2013 to 2016. (**B**) From 2013 to 2020. (**C**) From 2013 to the present. The map was created with QGIS software (QGIS Development Team; https://QGIS.org, accessed on 28 September 2022) using a public domain map from Natural Earth (https://naturalearthdata.com, accessed on 28 September 2022).

The entire area of the Xixová-Japuí State Park is a secondary forest, and the jumping snails were found either near open areas invaded by the white ginger lily *Hedychium coronarium* J. Koenig or in forested areas in advanced regeneration states.

The Serra do Mar State Park is a large area of Atlantic Forest extending across several municipalities in São Paulo state. Urban and rural areas crisscross the park, and most of its forests are secondary. The Park is divided into ten sections called "nuclei", and the present record of *O. fulgens* comes from one of them, called "Núcleo Picinguaba". The jumping snails were found together with the flea-frog *Brachycephalus hermogenesi* (Giaretta & Sawaya, 1998) in an area of regenerating forest [31].

The Bicudinho-do-brejo Reserve is a private protected area, only accessed by boat and 19 km away (in a straight line) from the nearest city. The reserve is named after the marsh antwren (named "bicudinho-do-brejo" in Portuguese), *Formicivora acutirostris* (Bornschein, Reinert, and Teixeira, 1995), which was discovered in that locality. It is near three other protected areas: Guaricana National Park, Lagoa do Parado Municipal Park, and Saint-Hilaire/Lange National Park. The location where the jumping snails were found was historically a king palm plantation (*Archontophoenix alexandrae* var. *beatricae* [F. Muell.] H.Wendl. & Drude) and received several king palm seedlings in 2009. After that, the reserve gained the land, and there were efforts to regenerate it back into a forest. The area

has not received new seedlings or soil from outside sources since 2013, so the record of *O. fulgens* from this reserve might predate the record from Blumenau mentioned above (though we use 2013 as the oldest confirmed record). Jumping snail specimens were found in a location with soggy soil near an open area invaded by tanner grass (*Urochloa* sp.) and white ginger lily, with the snails active on the lily leaves. In three years of monitoring the reserve, the species was found solely in this location, where the exotic slug *Meghimatium pictum* (Stoliczka, 1873) has also been recorded.

Finally, there was also a record from the immediate vicinity of the reserve Parque Estadual da Restinga de Bertioga (Bertioga municipality, São Paulo state). Here, the jumping snails were found in a patch of Restinga forest inside a residential condominium complex surrounded by the park, so its presence inside the park as well is likely. Curiously, this is the only record of this species in a Restinga environment.

4. Discussion

In roughly nine years since the oldest record (and five since the first report [24]), *O. fulgens* has spread to seven Brazilian states (Figure 1). It has potentially already reached areas within those states for which we still have no records. Considering its occurrence in Misiones Province in Argentina, close to the border of Paraguay [20], it is likely present in the latter country as well.

In their survey of the iNaturalist database, Rosa et al. (2022) determined that *O. fulgens* was the ninth most represented terrestrial gastropod from Brazil on that platform (Figure 2) [12]. That is partly a testament to its ubiquity, but it might also be related to its uniqueness. It is a species that stirs people's curiosity due mostly to a caudal horn on its "tail" (Figure 3). It is thus an unusual and different-looking snail in the garden when compared to other species, native or otherwise, and may be a cause for over-representation bias within iNaturalist [12]. The latter case is, in part, supported by anecdotal evidence from emails that some of the present authors (MRB & LT) have received, which started with something along the lines of "I've seen this different snail that I'd never noticed before, is it dangerous?".

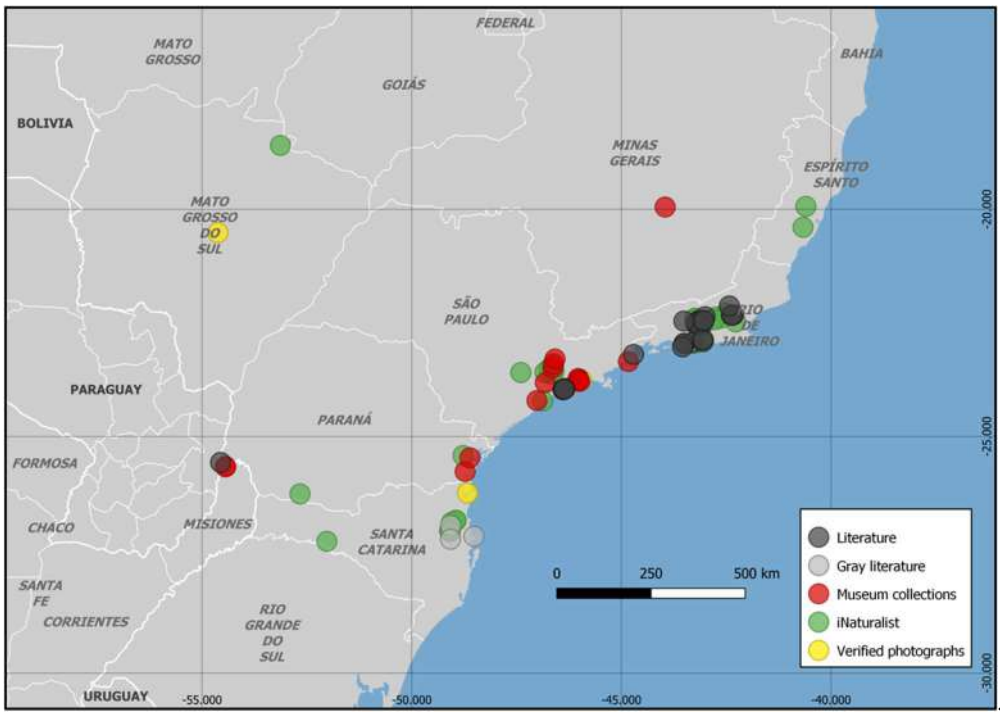

Figure 2. Map showing the distribution of *Ovachlamys fulgens* in Brazil according to the source of the data. The map was created with QGIS software (QGIS Development Team; https://QGIS.org, accessed on 28 September 2022) using a public domain map from Natural Earth (https://naturalearthdata.com, accessed on 28 September 2022).

Figure 3. Live *Ovachlamys fulgens* photographed by iNaturalist user Rogerio Dias (username "rogerriodias") in Alto da Boa Vista, Rio de Janeiro, RJ, Brazil. **Left**: observation #74273898 (3 March 2020); **Right**: observation #74780463 (10 February 2021). Images extracted from iNaturalist (CC BY-NC 4.0).

The main pathway of introduction and spread of *O. fulgens* is the horticultural trade, and the species is considered a fast spreader in some countries where it has been introduced [4]. Its spread through Brazilian territory seems in line with that. A similar case to *O. fulgens* in Brazil is the horntail snail *Macrochlamys indica* Godwin-Austen, 1883. This is another exotic species that has only been recently found in the country [32] but has expanded rapidly since [12].

Most of the present records of *O. fulgens* in Brazil come from urban or otherwise disturbed areas, which is expected for exotic species. However, the few records from reserves mentioned above are a cause for concern. The Xixová-Japuí State Park has a reforestation program and often brings new seedlings and soil to speed up forest regeneration, which could be a source of *O. fulgens*. Additionally, the trail maintenance is mainly volunteers who bring wooden tiles and other artefacts from outside the park that can transport the snails. As explained above, the Xixová-Japuí State Park area is subject to more constant disturbances, but the further two records are from regenerating forests. In the Bicudinho-do-brejo Reserve, the location where *O. fulgens* was found used to be a king palm plantation but it has been a regenerating forest since the early 2010s. Notably, the area has not received new seedlings or soil from outside sources since 2013. The forest with the most "quality", where *O. fulgens* has been recorded, was in Serra do Mar State Park. There, it was found in regenerating forest alongside the flea-frog *B. hermogenesi* (Bornschein et al. 2021). This frog is an ecologically demanding species that only thrives in native habitats or forests in advanced regenerating states [33].

It is presently unknown whether *O. fulgens* have any adverse effects on the native Brazilian fauna, gastropods, or otherwise. Its effects (if any) in other countries where it has been introduced are likewise unknown [4]. Even though several exotic species can cause problems in places where they are introduced, many become naturalized with no adverse effects. The species is phytophagous, feeding on crops and ornamental plants, and is thus considered an agricultural and/or horticultural pest in some places [15,29,30]. We speculate that *O. fulgens* will not cause any harm to native snail species, particularly considering it only reaches moderate population densities in Brazil and elsewhere [4,15; MRB & LT, pers. obs.].

At least one parasite of potential public health significance has been reported in *O. fulgens*, *Angiostrongylus cantonensis* (Chen, 1935), in Hawaii [34,35]. Snails act as intermediate hosts of this nematode's larvae, and this parasite has been detected in many other species of terrestrial and freshwater gastropods, mainly in Asia (e.g., [36–38]). This nematode can cause eosinophilic meningitis in humans who are contaminated through the ingestion of raw gastropods [37].

5. Conclusions

Given the rapid spread of *O. fulgens* across Brazil (Figure 1), the species is potentially past a stage where it could be culled, although control measures are still possible given the present low density of the populations observed in the field (MRB & LT, pers. obs.).

Among such measures are on-farm hygiene and sanitation practices for horticulture and the chemical-free removal of potential pests (e.g., inspection of seedlings, soil solarization, and nontoxic traps using, for instance, beer and dank cardboard).

Presently, we do not know what effect the jumping snail could have in Brazil. Thus, continued monitoring of its spread is a must, and studies focusing on its interactions with the native fauna to determine its impacts should be a concentrated priority. The number of records already present on iNaturalist (Figure 2) show that this platform (and potentially other community science initiatives) will undoubtedly continue to play an important role in monitoring efforts (see also [12,39–42]). Given the public health significance of *O. fulgens* (i.e., its parasites), the monitoring and control tasks should fall under the umbrella of the Brazilian Ministry of Health and the Health Departments of the affected states.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/d14100815/s1, Supplementary Material S1: Published records of *Ovachlamys fulgens* in Brazil.

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References

1. Bright, C. *Life out of Bounds: Bioinvasion in a Borderless World*; W. W. Norton and Company: New York, NY, USA, 1998.
2. Mack, R.N.; Simberloff, D.; Mark Lonsdale, W.; Evans, H.; Clout, M.; Bazzaz, F.A. Biotic invasions: Causes, epidemiology, global consequences, and control. *Ecol. Appl.* **2000**, *10*, 689–710. [CrossRef]
3. Cowie, R.H.; Robinson, D.G. Pathways of introduction of nonindigenous land and freshwater snails and slugs. In *Invasive Species: Vectors and Management Strategies*; Island Press: Washington, DC, USA, 2003; pp. 93–122.
4. Robinson, D.G.; Slapcinsky, J. Recent introductions of alien land snails into North America. *Am. Malacol. Bull.* **2005**, *20*, 89–93.
5. Cowie, R.H.; Dillon, R.T.; Robinson, D.G.; Smith, J.W. Alien non-marine snails and slugs of priority quarantine importance in the United States: A preliminary risk assessment. *Am. Malacol. Bull.* **2009**, *27*, 113–132. [CrossRef]
6. Gomes, S.R.; Picanço, J.B.; Colley, E.; Agudo-Padrón, A.I.; Nakano, E.; Thomé, J.W. A newly introduced and invasive land slug in Brazil: *Meghimatium pictum* (Gastropoda, Philomycidae) from China. *Proc. Acad. Nat. Sci. Phila.* **2011**, *161*, 87–95. [CrossRef]
7. Vogler, R.E.; Beltramino, A.A.; Sede, M.M.; Gregoric, D.E.G.; Núñez, V.; Rumi, A. The giant African snail, *Achatina fulica* (Gastropoda: Achatinidae): Using bioclimatic models to identify South American areas susceptible to invasion. *Am. Malacol. Bull.* **2013**, *31*, 39–50. [CrossRef]
8. Simone, L.R.L. *Land and Freshwater Molluscs of Brazil: An Illustrated Inventory on the Brazilian Malacofauna, Including Neighbor Regions of South America, Respect to the Terrestrial and Freshwater Ecosystems*; EBG/Fapesp: São Paulo, Brazil, 2006.
9. Agudo-Padrón, A.I.; Lenhard, P. Introduced and invasive exotic molluscs in Brazil: A brief overview. *Tentacle* **2010**, *18*, 37–41.
10. Silva, F.S.; Forsyth, R.G.; Salvador, R.B. *Helicodiscus theresa* from Brazil is the exotic species *Helicodiscus parallelus* (Gastropoda, Helicodiscidae). *Strombus* **2020**, *26*, 15–18.
11. Darrigran, G.; Agudo-Padrón, I.; Baez, P.; Belz, C.; Cardoso, F.; Carranza, A.; Collado, G.; Correoso, M.; Cuezzo, M.G.; Fabres, A.; et al. Non-native mollusks throughout South America: Emergent patterns in an understudied continent. *Biol. Invasions* **2020**, *22*, 853–871. [CrossRef]
12. Rosa, R.M.; Cavallari, D.C.; Salvador, R.B. iNaturalist as a tool in the study of tropical molluscs. *PLoS ONE* **2022**, *17*, e0268048. [CrossRef]

13. Gude, G.K. Further notes on helicoid land shells from Japan, the Loo-Choo, and Bonin Islands, with descriptions of seven new species. *Proc. Malacol. Soc. Lond.* **1900**, *4*, 70–80.
14. Richling, I.; Proschwitz, T. Identification problems of travelling snail species—New exotic introductions to tropical greenhouses in Gothenburg, Sweden (Gastropoda: Achatinellidae, Strobilopsidae, Helicarionidae). *PeerJ* **2021**, *9*, e11185. [CrossRef] [PubMed]
15. Barrientos, Z. Population dynamics and spatial distribution of the terrestrial snail *Ovachlamys fulgens* (Stylommatophora: Helicarionidae) in a tropical environment. *Rev. Biol. Trop.* **2000**, *48*, 71–87.
16. Cowie, R.H. New records of alien land snails and slugs in the Hawaiian Islands. *Bish. Mus. Occas. Pap.* **2000**, *64*, 51–53.
17. Cowie, R.H. Decline and homogenization of Pacific faunas: The land snails of American Samoa. *Biol. Conserv.* **2001**, *99*, 207–222. [CrossRef]
18. Cowie, R.H.; Rundell, R.J.; Mika, F.; Setu, P. The endangered partulid tree snail *Samoana thurstoni* on Olosega and the land snail diversity of the Manu'a Islands, American Samoa. *Am. Malacol. Bull.* **2002**, *17*, 37–43.
19. Hwang, C. Annotated type catalogue of land snails collected from Taiwan (Formosa) in the Natural History Museum, London. *ZooKeys* **2014**, *428*, 1–28. [CrossRef]
20. Beltramino, A.A.; Vogler, R.E.; Rumi, A.; Guzmán, L.B.; Martín, S.M.; Peso, J.G. The exotic jumping snail *Ovachlamys fulgens* (Gude, 1900) (Gastropoda: Helicarionidae) in urban areas of the Upper-Paraná Atlantic Forest. *An. Acad. Bras. Ciências* **2018**, *90*, 1591–1603. [CrossRef]
21. Agudo-Padrón, I. Moluscos exóticos no marinos "introducidos" en la isla caribeña de La Española (Hispaniola), Grandes Antillas: Una aproximación a su conocimiento. *Rev. Minerva* **2020**, *3*, 129–138.
22. Vega, G.H.; López, A.; Urcuyo, J.; Canda, L.A. Moluscos de la cuenca del Río Punta Gorda, Caribe Sur, Nicaragua, Centroamérica. *Rev. Colón Cienc. Tecnol. Neg.* **2020**, *7*, 37–54. [CrossRef]
23. Salles, A.C.; Oliveira, C.D.; Absalão, R.S. Redescription of the jumping snail *Ovachlamys fulgens* (Gude, 1900) (Gastropoda: Helicarionoidea: Helicarionidae): An anatomical and conchological approach. *Nautilus* **2018**, *132*, 19–29.
24. Teixeira, L.; Cunha, C.M.; Bornschein, M.R. First record of the Japanese land snail *Ovachlamys fulgens* (Gude, 1900) (Gastropoda, Helicarionidae) in Brazil. *Check List* **2017**, *13*, 703–706. [CrossRef]
25. Oliveira, K.L. *Diversidade de Moluscos Terrestres e Nematofauna Associada em Horticulturas no Município do Rio de Janeiro, RJ, Brasil*; Trabalho de Conclusão de Curso; Instituto Oswaldo Cruz, Fundação Oswaldo Cruz: Rio de Janeiro, Brazil, 2020.
26. Marchi, C.R.; Corrêa-Antônio, J.; Rodrigues, P.S.; Fernandez, M.A.; Thiengo, S.C.; Barbosa, H.S.; Gomes, S.R. An integrative study of the invasive jumping-snail *Ovachlamys fulgens* (Gastropoda, Helicarionidae) in Rio de Janeiro and its fast spreading in Southeastern and Southern Brazil. *An. Acad. Bras. Ciências* **2021**, *93*, e20190138. [CrossRef] [PubMed]
27. Agudo-Padrón, I. Occurrence of the invasive asiatic jumping land microsnail Helicarionidae *Ovachlamys fulgens* (Gude, 1900) in the Southern Brazil region. *BIOMA* **2019**, *5*, 11–15.
28. Leonhardt, K.; Sewake, K. *Growing Dendrobium Orchids in Hawaii: Production and Pest Management Guide*; University of Hawaii: Honolulu, HI, USA, 1999.
29. Robinson, D.G. Alien invasions: The effects of the global economy on non-marine gastropod introductions into the United States. *Malacologia* **1999**, *41*, 413–438.
30. Capinera, J.L.; White, J. *Terrestrial Snails Affecting Plants in Florida*; IFAS Extension; Department of Entomology, University of Florida: Gainesville, FL, USA, 2011.
31. Bornschein, M.R.; Ribeiro, L.F.; Teixeira, L.; Belmonte-Lopes, R.; Moraes, L.A.; Corrêa, L.; Maurício, G.N.; Nadaline, J.; Pie, M.R. A review of the diagnosis and geographical distribution of the recently described flea toad *Brachycephalus sulfuratus* in relation to *B. hermogenesi* (Anura: Brachycephalidae). *PeerJ* **2021**, *9*, e10983. [CrossRef]
32. Agudo-Padrón, I. Primer record confirmado de ocurrencia de un caracol terrestre indo-asiático en Brasil y las Américas. *Rev. Minerva* **2017**, *1*, 19–27. [CrossRef]
33. Bornschein, M.R.; Ribeiro, L.F.; Teixeira, L.; Pie, M.R. New altitudinal record for *Brachycephalus actaeus* Monteiro, Condez, Garcia, Comitti, Amaral & Haddad, 2018 (Anura, Brachycephalidae), with comments on its habitats of occurrence. *Check List* **2019**, *15*, 1031–1036.
34. Qvarnstrom, Y.; Bishop, H.S.; da Silva, A.J. Detection of rat lungworm in intermediate, definitive, and paratenic hosts obtained from environmental sources. *Hawaii J. Med. Public Health* **2013**, *72* (Suppl. 2), 63.
35. Kim, J.R.; Hayes, K.A.; Yeung, N.W.; Cowie, R.H. Diverse gastropod hosts of *Angiostrongylus cantonensis*, the rat lungworm, globally and with a focus on the Hawaiian Islands. *PLoS ONE* **2014**, *9*, e94969. [CrossRef]
36. Asato, R.; Taira, K.; Nakamura, M.; Kudaka, J.; Itokazu, K.; Kawanaka, M. Changing Epidemiology of Angiostrongyliasis Cantonensis in Okinawa Prefecture, Japan. *Jpn. J. Infect. Dis.* **2004**, *57*, 184–186.
37. Lv, S.; Zhang, Y.; Steinmann, P.; Zhou, X. Emerging Angiostrongyliasis in Mainland China. *Emerg. Infect. Dis.* **2008**, *14*, 161–164. [CrossRef] [PubMed]
38. Lv, S.; Zhang, Y.; Chen, S.-R.; Wang, L.-B.; Fang, W.; Chen, F.; Jiang, J.-Y.; Du, Z.-W.; Zhou, X.-N. Human Angiostrongyliasis Outbreak in Dali, China. *PLoS Negl. Trop. Dis.* **2009**, *3*, e520. [CrossRef] [PubMed]
39. Vendetti, J.E.; Lee, C.; LaFollette, P. Five new records of introduced terrestrial gastropods in Southern California discovered by citizen science. *Am. Malacol. Bull.* **2018**, *36*, 232–247. [CrossRef]
40. Gladstone, N.S.; Bordeau, T.A.; Leppanen, C.; McKinney, M.L. Spatiotemporal patterns of non-native terrestrial gastropods in the contiguous United States. *NeoBiota* **2020**, *57*, 133–152. [CrossRef]

41. Balashov, I.; Markova, A. The first records of an invasive land snail *Cepaea nemoralis* (Stylommatophora: Helicidae) in Central and Southern Ukraine. *Ruthenica* **2021**, *31*, 121–125. [CrossRef]
42. Hausdorf, B.; Parr, M.; Shappell, L.J.; Oldeland, J.; Robinson, D.G. The introduction of the European *Caucasotachea vindobonensis* (Gastropoda: Helicidae) in North America, its origin and its potential range. *Biol. Invasions* **2021**, *23*, 3281–3289. [CrossRef]