



Acta zoológica mexicana

ISSN: 0065-1737

ISSN: 2448-8445

Instituto de Ecología A.C.

Castillo-Rodríguez, Zoila G.; Naranjo-García, Edna; Amezcua-Linares, Felipe  
A new record of *Huttonella bicolor* (Hutton, 1834) (Mollusca, Gastropoda, Streptaxidae) in Mexico  
Acta zoológica mexicana, vol. 34, e3411181, 2018  
Instituto de Ecología A.C.

DOI: 10.21829/azm.2018.3411181

Available in: <http://www.redalyc.org/articulo.oa?id=57560238005>

- How to cite
- Complete issue
- More information about this article
- Journal's webpage in redalyc.org

redalyc.org

Scientific Information System Redalyc  
Network of Scientific Journals from Latin America and the Caribbean, Spain and  
Portugal

Project academic non-profit, developed under the open access initiative

Artículo original  
(Original paper)

A NEW RECORD OF *HUTTONELLA BICOLOR* (HUTTON, 1834) (MOLLUSCA,  
GASTROPODA, STREPTAXIDAE) IN MEXICO

UN NUEVO REGISTRO DE *HUTTONELLA BICOLOR* (MOLLUSCA,  
GASTROPODA, STREPTAXIDAE) EN MEXICO

ZOILA G. CASTILLO-RODRÍGUEZ,<sup>1,\*</sup> EDNA NARANJO-GARCÍA,<sup>2</sup> AND FELIPE  
AMEZCUA-LINARES<sup>1</sup>

<sup>1</sup>Instituto de Ciencias del Mar y Limnología, Departamento de Biodiversidad y Ecología Acuática, Universidad Nacional Autónoma de México, Apartado Postal 70-305, Cd. de México. C.P. 04510. <[zgcr@cmarl.unam.mx](mailto:zgcr@cmarl.unam.mx)>; <[amezcua@cmarl.unam.mx](mailto:amezcua@cmarl.unam.mx)>

<sup>2</sup>Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, Cd. de México C.P. 04510. <[naranjo@unam.mx](mailto:naranjo@unam.mx)>

\*Autor para correspondencia: <[zgcr@cmarl.unam.mx](mailto:zgcr@cmarl.unam.mx)>

Recibido: 13/06/2017; aceptado: 20/10/2017; publicado en línea: 16/03/2018

Editor responsable: Alfonso Correa Sandoval

Castillo-Rodríguez, Z. G., Naranjo-García, E., & Amezcua-Linares, F. (2018) A new record of *Huttonella bicolor* (Hutton, 1834) (Mollusca, Gastropoda, Streptaxidae) in Mexico. *Acta Zoológica Mexicana* (n.s.), 34(1), 1-6.

Castillo-Rodríguez, Z. G., Naranjo-García, E. y Amezcua-Linares, F. (2018) Un nuevo registro de *Huttonella bicolor* (Mollusca, Gastropoda, Streptaxidae) en México. *Acta Zoológica Mexicana* (n.s.), 34(1), 1-6.

**ABSTRACT.** A specimen of *Huttonella bicolor* = *Gulella bicolor* (Hutton, 1834) was collected from clayey-sandy soil in Tabasco, Mexico, which constitutes its second record in the state and the third in Mexico. This small gastropod is a predator that has mainly spread through tropical and island regions as an exotic species. Its introduction to Asian and Caribbean Islands is noteworthy. Its pupiform shell and the lamella or tooth complex were compared against previous descriptions. In Mexico, this species has been found in northern Veracruz and Tabasco, which confirms that it is spreading along the Gulf of Mexico from the United States towards Brazil. The features of this streptaxid as a potential hazard through its preferred prey are discussed.

**Key words:** Exotic species, land snail, *Gulella*, Tabasco.

**RESUMEN.** Un ejemplar de *Huttonella bicolor* = *Gulella bicolor* (Hutton, 1834) fue capturado en suelo limo-arenoso en Tabasco, México; el cual constituye el segundo registro para el estado y el tercero para México. Este pequeño gasterópodo es un depredador que se ha extendido como especie exótica en regiones preferentemente tropicales e insulares; destaca su introducción en islas de Asia y del Caribe. La concha tiene forma de pupa con lamelas o dientes en la abertura. Se comparó con la descripción de la especie. La distribución de la especie en México se extiende a los estados de Veracruz y en Tabasco, lo cual confirma el avance en su distribución a lo largo de la costa del Golfo de México de los Estados Unidos hasta Brasil. Las características de este estreptaxido en cuanto al riesgo a través del tipo de presa preferida son discutidas.

**Palabras clave:** Especie exótica, caracol terrestre, *Gulella*, Tabasco.

## INTRODUCTION

The state of Tabasco is rich in benthonic fauna (Bueno *et al.*, 2005), among which brackish and marine mollusks are relatively well-studied, while terrestrial micromollusk parasite vectors are in need of attention (Espinosa & Ortea, 2009).

The Streptaxidae Gray, 1860 family includes the *Huttonella* Pfeiffer, 1856 genus with *Huttonella bicolor* (Hutton, 1834) as its type species. However, various authors consider it to pertain to the genus *Gulella* Pfeiffer, 1856 (Vermeulen, 2007) and the subgenus *Huttonella* (Cowie,

1997; Simone, 2013). It is also known as *Rhabdogulella bicolor* (Fernández-Garcés, 2008). *Huttonella bicolor* is a species of India (Christensen & Kahn, 2017). This species has been introduced in various tropical areas, such as islands in the Caribbean region and several regions in the western and southwestern Gulf of Mexico that include the United States of America (USA) and Caribbean countries such as Mexico, Nicaragua, Panama, Venezuela and Brazil. Its distribution in North America comprises: Bermuda, UK (Bieler & Slapcinsky, 2000; Pilsbry, 1900); Florida (Burch, 1962), Mississippi (New Orleans), Louisiana (Baton Rouge), South Carolina and

Texas in the USA (Auffenberg & Stange, 2001; Dundee, 1974; Dundee & Baerwald, 1984; Hermann *et al.*, 1965; Schalie, 1948; Turgeon *et al.*, 1988, 1998); and Veracruz and Tabasco in Mexico (Correa-Sandoval, 1999; García *et al.*, 2006). In Central America, it has been found at: Taboga Island, Panama (Pilsbry, 1926); and the old city of Panama (Pilsbry, 1926, 1930); and Nicaragua (López, 1999; Pérez & López, 2003; Pérez *et al.*, 2008). The sites in South America are: Brazil (Pilsbry, 1926; Santos *et al.*, 2008; Simone, 2013); French Guyana (Tillier, 1980) and Venezuela (Ojasti *et al.*, 2001; Venmans, 1963). Presence has been observed in the Antilles-Caribbean at: Jamaica (Rosenberg & Muratov, 2006); Cuba (Aguayo, 1944; Fernández-Garcés, 2008; Maceira *et al.*, 2013; Pilsbry, 1900, 1926; Sarasúa, 1944); Puerto Rico (Schalie, 1948); Trinidad Tobago, Grenada, Saint Thomas (Dundee, 1970, 1974; Pérez & López, 2003; Pilsbry, 1900; Tryon, 1885); Dominica (Robinson *et al.*, 2009) and Guadalupe (Bouchet & Pointier, 2003 in Santos *et al.*, 2008). Distribution includes other regions such as: Africa; the Indo-Pacific (Cole & Herbert, 2009; Herbert & Rowson, 2011; Rowson *et al.*, 2011); Australia (Stanisic, 1981); Borneo, Southeastern Asia (Vermeulen, 2007); Southwestern China (Yen, 1939); the Philippines (Van Benthem Jutting, 1950); India (Ramakrishna & Mitra, 2010; Tryon, 1885; Van Benthem Jutting, 1961); Burma, Cochin China (Southern Vietnam), the Indian Archipelago, China, New Caledonia (Tryon, 1885); Africa, South and East Asia, the West Indies (Van Benthem Jutting, 1950); Seychelles Islands, Indian Ocean (Gerlach & Bruggen, 1999; Tryon, 1885); Japan (Azuma, 1982); Kenya (Clench, 1964); Malaysia (Van Benthem Jutting, 1961); Singapur, Central Asia (Ho, 1995; Van Benthem Jutting, 1961); Sri Lanka, Myanmar (Blanford & Godwin-Austen, 1908); Thailand (Chaijirawong *et al.*, 2008), Nepal (Budha *et al.*, 2015) and the Society Islands, French Polynesia (Christensen & Kahn, 2017).

Specific studies on *H. bicolor* published hitherto have been related to its carnivorous type of feeding, status as an exotic species, biological control measures (Davis & Butler, 1964; Mead, 1961), preferred prey (Srivastava, 1968; Srivastava *et al.*, 1975), effectiveness as a predator of *Subulina octona* (Bruguière, 1798), a Subulinidae (Mead, 1961) and Vertiginidae = pupillids (Dundee & Baerwald, 1984), taxonomic implications (Annandale & Prashad, 1920; Naggs, 1989), and its anatomy, radula and genital system (Berry, 1965; Chaijirawong *et al.*, 2008; Dundee & Baerwald, 1984; Simone, 2013).

According to reports from other countries, the presence of the predator *H. bicolor* could pose a threat to

Mexico due to its condition as an exotic species. Consequently, the present study contributes a second record of the species in the state of Tabasco. At the same time, it aims to assist governmental and executive authorities to become more aware of the importance of this issue, bringing needed attention to the records from 1999, 2006 and the present work. Such records address the introduction of this exotic species in addition to others that until now had remained hidden, as well as their potential dispersion towards other regions of the country, and in particular, the short and long term impact they may have on biodiversity, agriculture and human health in this and other regions of Mexico.

## MATERIAL AND METHODS

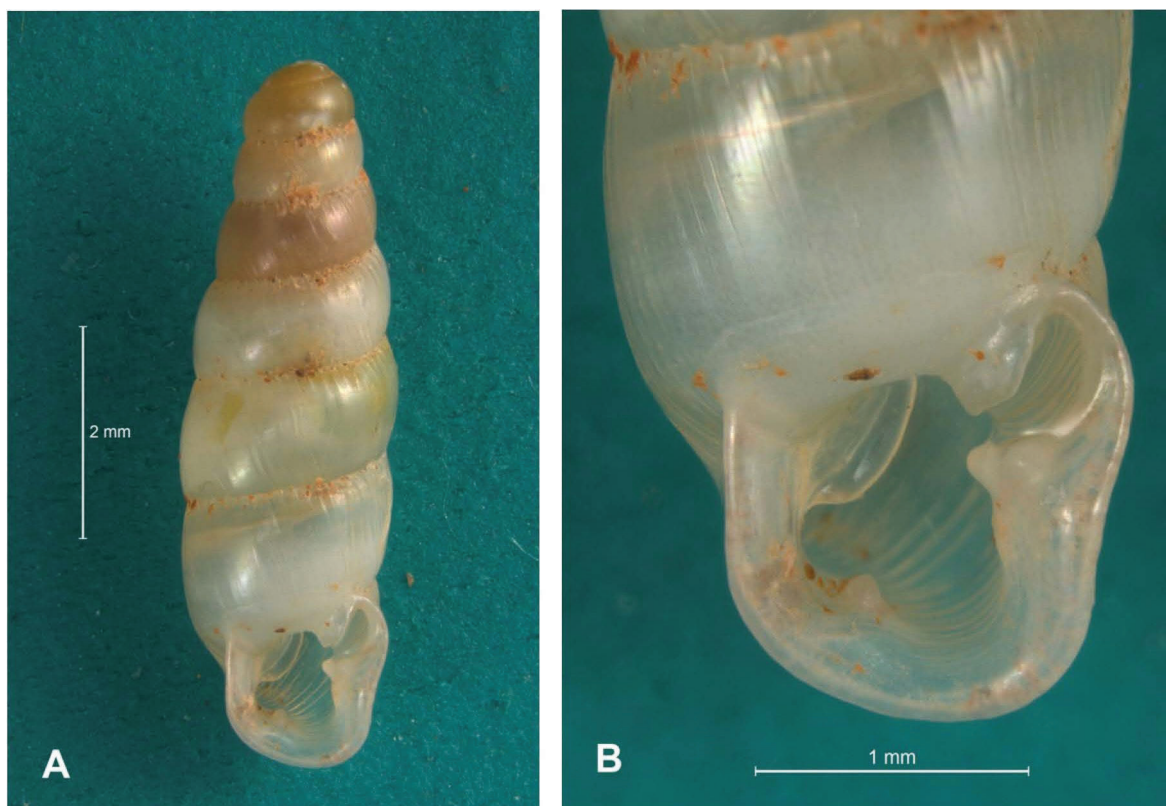
*Huttonella bicolor* was collected on August 4th, 2010 at Puente San Manuel, a town in the municipality of Huimanguillo (17° 49' 01.52" N, 93° 23' 10.58" W) near the Mezcalapa River, southeast Mexico, state of Tabasco, at a linear distance of 115.71 km and a road distance of 139 km from Coatzacoalcas, Gulf of Mexico. Two empty shells were obtained after lifting a compacted fragment of sandy-mud by hand. The shells were kept dry, and one specimen was placed in the Colección Nacional de Moluscos, Instituto de Biología, Universidad Nacional Autónoma de México, # CNMO 6539. Digital photographs and measurements of the embryonic shell were taken using a Zeiss STEMI 2000 Stereomicroscope.

## RESULTS

*Huttonella bicolor* grows to be 7.5 mm high and 2 mm wide, and has 7 ½ whorls. The shell is smooth and light yellow (Fig. 1A), and the aperture presents four teeth (Fig. 1B). The species was found in sandy mud. No more specimens were located, perhaps because of the environment or because prey is not abundant; nonetheless, a more rigorous effort in the field might demonstrate a true settlement of the species around the site or other areas in the country.

## DISCUSSION

Nearly 50 record entries of *H. bicolor* geographic distribution were found, from its description by Hutton (1834)



**Figure 1.** Shell of the species *Huttonella bicolor* **A)** view of the shell, **B)** Detail of shell aperture.

in India to that by Budha *et al.* (2015) in Nepal. A patent dispersal trend has been observed from its possible place of origin (India, southern Asia) towards island regions in both the Caribbean (Tryon, 1885) and Asia (since 1908). It has also reached inland tropical regions in the western Atlantic, such as South Carolina, Louisiana and Mississippi in the USA, as well as Mexico, Nicaragua, Panama, Venezuela, French Guyana and Brazil. As for the Pacific region, records are few and far between; López (1999) recorded *H. bicolor* in Nicaragua (Pacific). Scarce information concerning pathways, environmental factors and food items may be limiting factors.

*Huttonella bicolor* is distributed in 17 islands, of which about 10 are in the Caribbean region, while the other 7 are in Asia, Africa and Australia.

The Gulf of Mexico possesses rainy areas with wet and muddy substrates; such climatic conditions are perhaps advantageous to the development and survival of *H. bicolor*. The species, in addition to having been found in sandy mud, lives in forests, beneath rocks, debris and leaf litter, at the base of house foundations, trunks, and garden walls and/or on plant roots (Annandale & Prashad,

1920; Barker & Efford, 2004; Dundee & Baerwald, 1984; Naggs, 1989; Santos *et al.*, 2008; Smith & Stanisic, 1998; Solem, 1988).

Regarding food, *H. bicolor* is a predator of subulinids such as *S. octona* (Srivastava, 1968; Srivastava *et al.*, 1975), a land snail that has been widely introduced around the world and is common around disturbed habitats. This prey, a hermaphroditic micro-snail, is a detritus feeder (herbivore), is found within organic debris, and is distributed and frequent in the Caribbean (Deisler & Abbott, 1984) and tropical America (Dundee, 1974; Pilsbry, 1946). It is a gregarious snail, closely associated with human activities such as house gardens (Juříčková, 2006), which gives the species great potential for colonizing new habitats. *S. octona*, the prey, is distributed in: Florida, USA; Veracruz, Tabasco, Campeche (the cities Campeche and Ciudad del Carmen) and Yucatán (Izamal and Mérida), Mexico; the Caribbean and Central America (Belize, Guatemala, Nicaragua, Costa Rica); South America and the Caribbean Islands.

This close alimentary dependence between *H. bicolor* and *S. octona*, both of which presently inhabit Mexico,



is of great relevance health wise, since the latter is an intermediate host of the trematode *Postharmostomum galatinum* (Witenberg, 1923), a parasite of domestic chickens, of *Angiostrongylus cantonensis* (Chen, 1935) (De Almeida Bessa *et al.*, 2000; De Faria Duarte, 1980) and there is an association with rats (Kliks & Palumbo, 1992). The eventual introduction of the nematode *A. cantonensis* into Mexico could be of great concern, since it can cause eosinophilic meningoencephalitis (De Almeida Bessa *et al.*, 2000; De Faria Duarte, 1980). *S. octona*, which is the intermediate host of nematodes and the favorite prey of *H. bicolor*, is distributed in Mexico in the states of Veracruz, Tabasco, Campeche and Yucatán. It is not known whether *H. bicolor* started to feed on *S. octona* after its expansion to different places in the world, or if the presence of *S. octona* and various pupillid species (upon which *H. bicolor* also feeds) have been a significant factor in the dispersal of this species.

Introduced molluscan species can be parasite vectors, whether inadvertently introduced or not. *H. bicolor* is associated to *S. octona*, a phytophagous snail that also possibly entered tropical countries on ornamental or edible plants; both species can disrupt the trophic dynamics in the environment into which they come. It is thus of vital importance that studies of the impact these vectors may have on public health in Tabasco and other places in Mexico be offered incentives and support.

Malacological studies focused on agriculture are scarce in Mexico, even though exotic species identified as pests live on vegetables. On the other hand, the tropical states of Mexico along the Gulf coast are subject to river floods, clayey-sandy soils with alluvial sediments abound, and additional river water from rain is frequent. Vegetation debris, organic (leaf litter) and non-organic matter and wet decaying wood, together with plant coverage are a refuge and a suitable substrate for colonization by exotic land snails. Human activity, is the main reason that such exotic land snails are able to flourish, in addition to the abundance of food, first of detritivores (such as *S. octona*) and later of carnivores of the first and second order.

Land mollusks are difficult to control, particularly when they possess an abundant population that will inflict more damage. In scenarios such as this one, several countries are attempting agro-ecological control. Consequently, in-depth knowledge of the taxonomy, biology and ecology of exotic land snails is of vital importance because of the risk they pose to public health, as well as the loss of biodiversity of native species, many of which are unknown to science.

## LITERATURE CITED

- Aguayo, C. G.** (1944) *Leptinaria lamellata* y otros moluscos introducidos en Cuba. *Revista de la Sociedad Malacológica Carlos de la Torre*, 22, 51-58.
- Annandale, N. & Prashad, B.** (1920) Observations on a carnivorous land-snail. *Records of the Indian Museum*, 19, 189-194.
- Auffenberg, K. & Stange, L. A.** (2001) Snails eating snails of Florida. *EDIS, University of Florida IFAS Extension*. <http://edis.ifas.ufl.edu/in523> April 25, 2017
- Azuma, M.** (1982) *Colored illustrations of the land snails of Japan*. Osaka: Hoikusha Publishing Company, Ltd.: Osaka, xv + 333 pp.
- Barker, G. M. & Efford, M.** (2004) Predatory gastropods as natural enemies of terrestrial gastropods and other invertebrates, 279-403 pp. In: Barker, G.M. (ed.), *Natural Enemies of Terrestrial Molluscs*. Wallingford: CABI Publishing, 644 pp.
- Berry, A. J.** (1965) The genital systems of *Discartemon stenostomus* and *Huttonella bicolor* (Hutton) (Pulmonata, Streptaxidae) from Malaya. *Proceedings of the Malacological Society of London*, 36, 221-228.
- Bieler, R. & Slapcinsky, J.** (2000) Case study for the development of an island fauna: recent terrestrial mollusks of Bermuda. *Nemouria*, Wilmington, 44, 1-100.
- Blanford, W.T. & Godwin-Austen, H. H.** (1908) *The fauna of British India, including Ceylon and Burma. Mollusca, Testacellidae and Zonitidae*. London, 311 pp.
- Bouchet, P. & Pointier, J. P.** (2003) Mollusques terrestres de Guadeloupe: liste des espèces. [http://abela.club.fr/Liste\\_Guadeloupe.html](http://abela.club.fr/Liste_Guadeloupe.html) April 25, 2017
- Brodie, G. & Barker, G. M.** (2011) Introduced land snails and slugs in the Fiji Islands: are there risks involved? In: C.R. Veitch, M.N. Clout, D.R. Towns (Eds.). *Islands invasives: eradication and management* (32-36pp), IUCN, Gland, Switzerland, 542 pp.
- Budha, P. B. Naggs, F. & Backeljau, T.** (2015) Annotated Checklist of the Terrestrial Gastropods of Nepal. *ZooKeys*, 492, 1- 48. <http://doi.org/10.3897/zookeys.492.9175> April 25, 2017
- Bueno, J. S., Álvarez Noguera, F. & Santiago, S.** (Eds.) (2005) *Biodiversidad del Estado de Tabasco*. México UNAM, Instituto de Biología, CONABIO. 370 pp.
- Burch, J. B.** (1962) How to know the Eastern land snails. Wm. C. Brown Co., Publishers, Dubuque, Iowa, 214 pp.
- Clench, W. J.** (1964) *Gulella (Huttonella) bicolor* (Hutton) *The Nautilus*, 77(4), 142-143.
- Cole, M. L. & Herbert, D. G.** (2009) Description of four new species of *Gulella* Pfeiffer, 1856 from Eastern Cape, South Africa, with additional notes on two poorly known species (Mollusca: Eupulmonata: Streptaxidae). *Zoologische Mededelingen*, 83, 547-564.
- Correa-Sandoval, A.** (1999) Primer registro de *Gulella bicolor* (Gastropoda, Pulmonata, Streptaxidae) para México. *Acta Zoológica Mexicana (n.s.)*, 78, 179-181.
- Cowie, R. H.** (1997) Catalog and bibliography of the nonindigenous nonmarine snails and slugs of the Hawaiian Islands. *Bishop Museum Occasional Papers*, 50, 1-66.
- Chaijirawong, R., Nuamsee, K. & Dumrongrojwattana, P.** (2008) Shell and radula morphology and reproductive anatomy of the introduced carnivorous snail, *Gulella bicolor* (Pulmonata: Streptaxi-

- dae) from Chon Buri Province. *Kasetsart Journal*, 42, 251-255.
- Christensen, C. C. & Kahn, J. G.** (2017) First records of the invasive predatory land snail *Gulella* (*Huttonella*) *bicolor* (Hutton, 1834) (Gastropoda: Streptaxidae) from the Society Islands, *French Polynesia*. *Bishop Museum Occasional Papers*, 121, 1-11.
- Davis, C. J. & Butler, G. D. Jr.** (1964) Introduced enemies of the Giant African snail, *Achatina fulica* Bowdich, in Hawaii (Pulmonata: Achatinidae). *Proceedings of the Hawaiian Entomological Society*, 183, 377-89.
- De Almeida Bessa, E. C., Dos Santos Lima, W., Daemon, E., Cury, M. C. & De Barros Araujo, J. L.** (2000) Desenvolvimento biológico de *Angiostrongylus vasorum* (Baillet) Kamensky (Nematoda, Angiostrongylidae) em *Subulina octona* Bruguière (Mollusca, Subulinidae) [sic] em condições de laboratório [Biological development of *Angiostrongylus vasorum* (Baillet) Kamensky (Nematoda, Metastrongylidae) in *Subulina octona* Bruguière (Mollusca, Subulinidae) in laboratory conditions]. *Revista Brasileira de Zoologia*, 17(1), 29-41.
- De Faria Duarte, M. J.** (1980) O ciclo evolutivo de *Postharmostomum gallinum* Witenberg, 1923, no estado de Rio de Janeiro, Brasil (Trematoda, Brachylaemidae). *Revista Brasileira de Biologia*, 40(4), 793-809.
- Deisler, J. E. & Abbott, R. T.** (1984) Range extensions of some introduced land mollusks in the Bahama Islands, with first reports for four species. *The Nautilus*, 98, 12-17.
- Dundee, D. S.** (1970) Introduced Gulf Coast molluscs. *Tulane Studies in Zoology and Botany*, Belle Chase, 16(3), 101-115.
- Dundee, D. S.** (1974) Catalog of introduced mollusks of eastern North America (north of México). *Sterkiana*, 55, 1-37.
- Dundee, D. S. & Baerwald, R. J.** (1984) Observations on a micro-predator, *Gulella bicolor* (Hutton) (Gastropoda: Pulmonata: Streptaxidae). *The Nautilus*, 98(2), 63-68.
- Espinosa, J. & Ortea, J.** (2009) *Moluscos terrestres de Cuba*, Espartacus Foundation-Sociedad de Zoología de Cuba, UPC Print, Vaasa, Finlandia, 191 pp.
- Fernández Garcés, R.** (2008) *Rhabdogulella bicolor*: molusco terrestre introducido en Cuba. *Noticiario SEM*, 49, 47- 48.
- García, M. M., Rangel Ruiz, J. L. & Gamboa Aguilar, J.** (2006) Composición y estructura de la comunidad de gasterópodos terrestres en la Reserva Ecológica Yumká, Tabasco. *Memorias de la semana de Divulgación y Video Científico*. Universidad Juárez Autónoma de Tabasco UJAT, 195-199.
- Gerlach, J. & Bruggen, A. C. van.** (1999) Streptaxidae Mollusca: Gastropoda: Pulmonata) of the Seychelles Islands, western Indian Ocean. *Zoologische Verhandelingen*, 328, 1-60.
- Herbert, D. G. & Rowson, B.** (2011) *Pupa menkeana* Pfeiffer, 1853, type species of the speciose land snail genus *Gulella* Pfeiffer, 1856: correction of longstanding misidentification and designation of neotype (Mollusca: Eupulmonata: Streptaxidae). *African Invertebrates*, 522, 1-10. doi: 10.5733/afin.052.0201
- Hermann, P. W., Strickland, B. C. & Dundee, D. S.** (1965) Baton Rouge greenhouse gastropods. *The Nautilus*, 78(4), 131-133.
- Ho, W. H.** (1995) A review of the land-snail fauna of Singapore. *Raffles Bulletin of Zoology*, 431, 91-113.
- Hutton, T.** (1834) On the land shells of India. *The Journal of the Asiatic Society of Bengal*, Calcutta, 3(26), 81-93.
- Juříčková, L.** (2006). *Subulina octona* (Bruguière, 1798) A new greenhouse species for the Czech Republic (Mollusca: Gastropoda: Subulinidae). *Malacologica Bohemoslovaca*, 5, 1-2. <http://mollusca.sav.sk> (April 25, 2017)
- Kliks, M. M. & Palumbo, N. E.** (1992) Eosinophilic meningitis beyond the Pacific Basin: the global dispersal of a peridomestic zoonosis caused by *Angiostrongylus cantonensis*, the nematode lungworm of rats. *Social Science Media*, 34, 199-212.
- López, A. S. J.** (1999) *Huttonella bicolor* and *Euglandina cumingi* carnivores of the Nicaragua tropical snail world. *Of Sea and Shore*, Phuket, 21(4), 229-230.
- Maceira, D., Miquel, S. E., Espinosa, J., Virgillito, M. & Laurantzon, B.** (2013) Moluscos terrestres exóticos y primera cita de la familia Punctidae (Mollusca: Pulmonata: Gastropoda) y de su especie *Paralaoma servilis* para Cuba. *Solenodon*, 11, 95-102.
- Mead, A. R.** (1961) *The Giant African Snail; a Problem in Economic Malacology*. University of Chicago Press, 257 pp.
- Naggs, F.** (1989) *Gulella bicolor* (Hutton) and its implications for the taxonomy of streptaxids. *Journal of Conchology*, 33, 165-168.
- Ojasti, J., González Jiménez, E., Szeplaki Otaola, E. & García Román, L. B.** (2001) Informe sobre las especies exóticas en Venezuela. Ministerio del Ambiente y de los Recursos Naturales Caracas, 220 pp.
- Pérez, A. M. & López, A. A.** (2003) Listado de la malacofauna continental (Mollusca: Gastropoda) del Pacífico de Nicaragua. *Revista de Biología Tropical*, 51(3), 405-451.
- Pérez, A. M., Sotelo, M., Arana, I. & López, A.** (2008) Diversidad de moluscos gasterópodos terrestres en la región del Pacífico de Nicaragua y sus preferencias de hábitat. *Revista de Biología Tropical*, 561, 317-332.
- Pilsbry, H. A.** (1900) The air-breathing mollusks of the Bermudas. *Transactions of the Connecticut Academy of Sciences*, 102, 491-509.
- Pilsbry, H. A.** (1926) The land mollusks of the Republic of Panama and the Canal Zone. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 78, 57-126.
- Pilsbry, H. A.** (1930) Results of the Pinchot South sea expedition-II. Land mollusks of the Canal Zone, the Republic of Panama, and the Cayman Islands. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 82, 339-354.
- Pilsbry, H. A.** (1946) Land Mollusca of North America (North of Mexico). *Academy of Natural Sciences of Philadelphia Monograph*, 3(2), 1-520.
- Ramakrishna, A. D. & Mitra, S. C.** (2010) Annotated checklist of Indian land molluscs. *Occasional Paper of the Zoological Survey of India*, 306, 1-65.
- Robinson, D. G., Hovestadt, A., Fields A. & Breure, A. S. H.** (2009) The land Mollusca of Dominica (Lesser Antilles), with notes on some enigmatic or rare species. *Zoologische Mededelingen*, 83. <http://www.zoologischemededelingen.nl/83/nr03/a13> (April 25, 2017)
- Rosenberg, G. & Muratov, I.** (2006) Status report on the terrestrial Mollusca of Jamaica. *Proceedings of the Academy of Natural Sciences, Philadelphia*, 155(1), 117-161.
- Rowson, B., Tattersfield, P. & Symondson, W. O. C.** (2011) Phylogeny and biogeography of tropical carnivorous land-snails (Pulmonata: Streptaxoidea) with particular reference to East Africa and the Indian Ocean. *Zoologica Scripta*, 40, 85-98.

- Santos, S. B., Viana, T. A. & Fonseca, F. C.** (2008) First record of the micro-predator *Huttonella bicolor* (Hutton, 1834) (Gastropoda, Streptaxidae) on Rio de Janeiro city, Brazil. *Biociências*, 162, 145-148.
- Sarasúa, P. H.** (1944) Los Moluscos de los Jardines Cubanos. *Revista de la Sociedad Malacológica "Carlos de la Torre"*, 22, 59-63.
- Schalie, H. van der.** (1948) The land- and freshwater mollusks of Puerto Rico. Miscellaneous Publications, Museum of Zoology, University of Michigan, 70. University of Michigan Press, 134 pp.
- Simone, L. R.** (2013) Anatomy of predator snail *Huttonella bicolor*, an invasive species in Amazon rainforest, Brazil (Pulmonata, Streptaxidae). *Papéis Avulsos de Zoologia*, 533, 47-58.
- Smith, D. M. & Stanisic, J.** (1998) Pulmonata Introduction. Pp. 1037-1061. In: P. L. Beesley, G. J. B. Ross, A. Wells. (eds.), *Mollusca: the southern synthesis, Fauna of Australia*, 5, (B), CSIRO Publishing, Melbourne.
- Solem, A.** (1988) Non-camaenid land snails of the Kimberley and northern Territory, Australia. I. Systematics, affinities and ranges. *Invertebrate Taxonomy*, 2, 455-604.
- Srivastava, P. D.** (1968) *Gulella* (*Indoeneea*) *bicolor* (Hutton), a predator of giant African snail *Achatina fulica* Bowdich. *Indian Journal of Entomology*, 30, 240-241.
- Srivastava, Y. N., Srivastava, P. D. & Doharey, L. L.** (1975) Predation preference of *Gulella* (*Indoeneea*) *bicolor* (Hutton). *Entomologist's Newsletter*, 5, 50.
- Stanisic, J.** (1981) The carnivorous land snail *Gulella* (*Huttonella*) *bicolor* (Hutton, 1834) in Australia. (Pulmonata: Streptaxidae). *Journal of the Malacological Society of Australia*, 5, 84-86. doi: 10.1080/00852988.1981.10673939
- Tillier, S.** (1980) Gastéropodes terrestres et fluviatiles de Guyane Française. *Mémoires du Muséum national d'histoire naturelle*. Paris, Sér. A, Zoologie, 118, 1-189.
- Tryon, G. W.** (1885) *Testacellidae, Oleacinidae, Streptaxidae, Helicoidea, Vitrinidae, Limacidae, Arionidae*. *Manual of Conchology*, 1, 364 pp. [104, 105].
- Turgeon, D. D., Bogan, A. E., Coan, E. V., Emerson, W. K., Lyons, W. G. & Pratt, W.** (1988) Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks. *American Fisheries Society Special Publication*, 16, 1-277.
- Turgeon, D. D., Quinn, Jr. J. F., Bogan, A. E., Coan, E. V., Hochberg, F. G. & Lyons, W. G.** (1998) Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks. 2nd ed. *American Fisheries Society Special Publication*, 26, 1-526.
- Van Benthem Jutting, W. S. S.** (1950) Systematic studies on the non-marine Mollusca of the Indo- Australian Archipelago II. Critical Revision of the Javanese Pulmonate Land-shells of the Families Helicarionidae, Pleurodontidae, Fruticicolidae and Streptaxidae. *Treubia*, 20, 381-505.
- Van Benthem Jutting, W. S. S.** (1961) The Malayan Streptaxidae Genera *Huttonella* and *Sinoeneea*. *Bulletin of the Raffles Museum*, Singapore 26, 5-33 [8 pp.].
- Venmans, L. A. W. C.** (1963) Caribbean land molluscs: Streptaxidae. *Studies on the fauna of Curaçao and other Caribbean islands*, XIV, 41-76.
- Vermeulen, J. J.** (2007) Notes on the non-marine molluscs of Borneo 10. The genera *Bruggeneea*, *Gulella* and *Sinoeneea* (Gastropoda, Pulmonata, Streptaxidae). *Basteria*, 71, 169-176.
- Yen, T. C.** (1939) Die Chinesischen Land- und Süßwasser-Gastropoden des Natur-Museums Senckenberg. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft*, 444, 1-233.