SOOSIANA, **33**: 25-30, 2016

# The Biodiversity of Hispaniolan Mollusca

JOŽEF GREGO[1] & † JOŽEF ŠTEFFEK[2]

1. Horná Mičiná 219, SK-97401 Banská Bystrica, Slovakia (e-mail: jozef.grego@gmail.com)
2. Department of Applied Ecology, Faculty of Ecology and Environmental Science, Technical Univerzity in Zvolen, T. G. Masaryka 24, SK 960 53 Zvolen, Institute of Forest Ecology, Slovak Academy of Sciences, Štúrova 2, SK 960 53 Zvolen, Slovakia

**Abstract:** Hispaniola as the second largest Island of the Greater Antilles host a remarkable mosaic biodiversity of terrestrial mollusca as a result of its turbulent natural history: repeated joining and separation of multiple sets of paleoislands. This resulted to the presence of Cuban, Jamaican and Portorican elements in the island fauna and flora, but also significant Mesoamerican (Yucatan) and South American influences. Up to date no comprehensive revision of the Hispaniolan terrestrial mollusca had been published. Our estimations of approximately 620 taxons is based on hitherto publications listed in the bibliography. Within known molluscan fauna dominates families as Annualriidae, Urocoptidae and Helicinidae, partly because of the historical studies concentrated with main focus in the first two families. Most likely the real diversity of minor Hispaniolan families is significantly higher, but so far not sufficiently studied.
**Key words:** terrestrial mollusca, biodivesity, Hispaniola, Haiti, Dominican republic

## Introduction

The mollusc fauna of Hispaniola is the less known one from all the Great Antillean islands, with estimate of about 250 species (KAY, 1995; PARKINSON et al., 1989), while the estimates of Cuba shows more then 600 species, for Jamaica 500 species and for Puerto Rico 120 species (KAY, 1995; PARKINSON et al., 1989). Nevertheless the diversity of the Hispaniolan malacofauna is still highly underestimated, as we counted so far more than 530 species described from Hispaniola and additionally few hundred undescribed species can be estimated. CLENCH in 1962 estimated, that the knowledge of Hispaniolan terrestrial and freshwater mollusc is about 10%, compared with that of Cuba. About two third of the known Hispaniolan species are known only from their type locality (CLENCH, 1962) and this situation is not much changed since that time. Almost no data about the species distribution had been published so far.

## Historical Studies

Historical studies of the native malacofauna already began with LINNÉ (1758), who described the most distinct and colourful terrestrial gastropod species as the *Liguus virgineus*. Few other distinct and larger species appeared in the work of O.F. MUELLER (1774), GMELIN (1791) and FÉRUSSAC (1821). The historical studies had been based on material collected by

following expeditions and field collections as: T. Latherrade in 1840; A. Sallé in 1847-1851; D. Richaud in 1851; D.F. Weinland in 1857; J. Hjalmarson in 1857-58; Guigou in 1858-1859; E. Vesco in 1859; H. Kissling in 1864-1866, W. M. Gabb in 1869-1871, W. Newcomb 1871, Linden in probably 1874; V.P. Parkhurst in 1875; Dr. Brown at 1880; H. Rolle in 1887-1888; Paul Bartsch in 1917, 1920 and 1929; W.J. Eyerdam in 1927; C.R. Orcutt in 1929-1930, D.C. Pease in 1932, and W. J. Clench, R A. McLean and H.D. Russell in 1937; S. Rand, C. Ray and J. Rivero in 1957. More recent field collections of F.G. Thompson and R. Franz in 1974-75; Thompson 1977, 1978, 1984-85, 1994, 1997; and J. Grego & J. Šteffek in 2006.

The first overview of non marine molluscs of Hispaniola had been published by CROSSE in 1891. Since that time the Hispaniolan terrestrial gastropods appeared only as a part of more comprehensive works dealing with certain neotropical mollusc families as the Helicidae (Sagdidae and Xanthonychidae in 1892, 1887 and1889) and Oleacinidae (1885) in TRYON´s and PILSBRY´s Manual of Concholgy (1892-1904). PILSBRY in 1902-1904 also revised the family Urocoptidae incl. its Hispaniolan members and the Hispaniolan Urocoptidae had been also studied by BARTSCH, 1932; CLENCH, 1932; 1935 and 1966. PILSBRY in 1933 studied the species collected by Dr. Pease. The most comprehensive work about the Hispaniolan Mollusca within the 20-th century is the revision of the family Annulariidae by P. BARTSCH (1946). Also C. TORRE, P. BARTSCH & J. P. E. MORRISON in 1942 revised the Cyclophorid mollusca of America inclusive the few Hispaniolan species. The more modern studies in this area began by studies of F. G. THOMPSON and his team from Gainesville University, Florida. They performed with R. FRANZ the first anatomical studies of Hispaniolan molluscs at 1976 and their intensive fieldwork yielded also many nice works and description of some very interesting new species (1978, 1987, 1998). The latest studies in 21-st century were performed by tomas G. WATTERS on family Annulariidae (2006, 2010, 2013a. 2013b).

## Natural history development

Despite the above mentioned historical studies and efforts a large geographic areas of Hispaniola are still virtually unexplored for land snails, and many new forms still remains to be undescribed. The island has an extraordinary rich and diverse gastropod fauna originated in very reach natural history development of the island. Hispaniola consists of many Mountain ranges, ridges and isolated hills, which all had during their natural history an independent development of their native fauna and flora as paleo-islands. At least three paleo-islands (Cordillera Central with Sierra de Neiba, Cordillera Septentritonal and Cordillera Oriental formed the Northern Paleo-island, while in Pliocene their were joined by the Southern Paleo-island (with Massif de la Hotte, Massif de la Selle and Sierra de Bahoruco). Additionally during the Pleistocene all the islands had been temporarily joined or separated by alternation of seawater level. Each island had its independent history of fauna and flora development with different external influences, and this complicated history evolved extraordinary reach mosaic faunal regions of Hispaniola reflected also in typical mollusc assemblages. The biodiversity of the island is enhanced by very diverse biotopes presented in the island from dry deserts to xeric grasslands, bush lands, wet forests, rainforests, pine forests and montane cloud forests.

The Cordillaera Central is the malacologically less studied part of the island; consist of mostly igneous and metamorphic rocks and calcareous families as Urocoptidae and Annulariidae are virtually absent. All the mollusc species living in humid acidic environments (Ebano Verde Reserve) have a very thick corneous periorostracum to protect

the shells in the acidic soil environment. This region is a central part of the Northern Paleo-island and the mollusc fauna has a high affinity to Cuba.

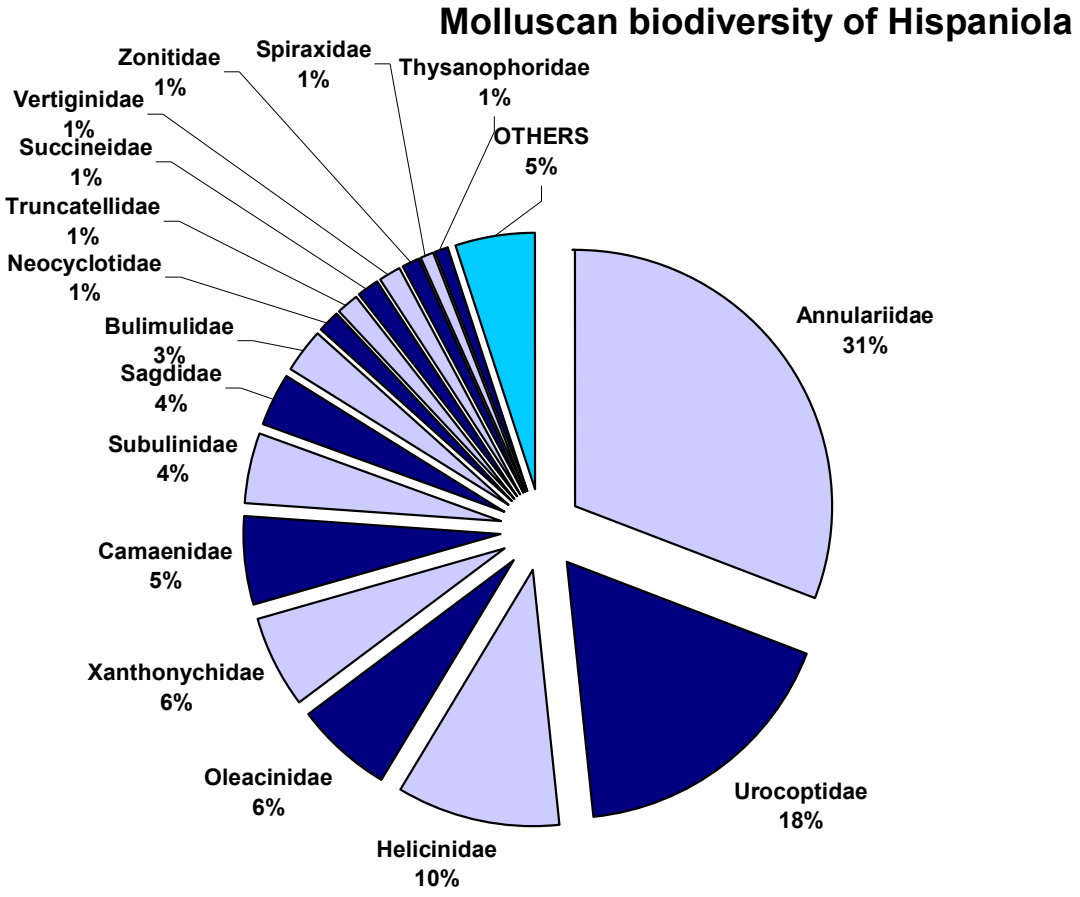
The Calcareous substrates of the Cordillera Septentriotonal and C. Oeriental has high affinity to mollusc assemblages of Puerto Rico, and the Southern Paleo-island, especially the area of Massif de la Hotte, have mollusc diversity resembling those of Jamaica and South Mexico, but surprisingly bears also few components of fauna indicating affinity to Puerto Rico and Venzuela (e.g. *Nenisca*). All the calcareous mountains (paleo-islands), surrounding the Cordillera Central shows an extraordinary high degree of mollusc endemism. The central part of the SW peninsula with Massif de la Hotte and Macaya National Park is one of the malacologicaly less known parts of the island with very high potential of species diversity and endemism and with an estimate of 30% new species to science.

## Mollusc diversity

Hispaniola is the core island of Haitian zoogeographical province as a part of Cuban sub region of Neotropis (PARKINSON et al., 1989). Malacologicaly this region can be characterised by very high diversity of certain typical genera as the genuses *Cepolis* and *Plagioptycha* (family Xanthonychidae), extremely high diversity of families Annularriidae (endemic genuses as *Abbottella, Rolleia, Parachodrisca, Weinlandipoma, Haitipoma, Meganypha*), Urocoptidae (endemic genuses as *Archgeocoptis, Autocoptis, Strophina, Amphicosmia, Liparotes*), and also Sagdidae with many undescribed species. From the family Poteriidae the genuses *Crocidopoma* (8 species) and Megalomastmidae with *Farcimoides* (3 species) are also very important endemic components of the island. The extraordinary rich diversity in family Oleacinidae (*Oleacina, Streptostylops* and *Varicella*) is probably the most diverse one within the Neotropic. Furthermore few interesting endemic taxons as cf. *Simpuloposis dominicensis* and *Coloniconcha prima* are still poorly studied and their taxonomical position have to be clarified. The high diversity of operculate family Helicinidae with few undescribed genuses is also poorly studied. Many species of the family Camaenidae (genus *Polydontes*) and two species of Clausliidae (genus *Nenisca*) suggest also the South American influence in the region. Fortunately the island had been avoided from the introduction of invasive species as *Achatina fulica* and *Eeuglandina rosea*. Among aliens introduced to the island can be found species as *Cornu aspersa, Zonitoides arboreus and Deroceras laeve* from Europe, *Bradybaena similaris* and *Huttonella bicolor*, from *Asia*, and *Lamellaxis gracile, Hawaia minuscula, Guppya gundlachi, Helicodiscus singleyanus, Praticolella griseola* from other parts of America. Up to now the large mollusc families like Ferussacidae, Vertiginidae, Thysanophoridae, Succineidae, Veronicellidae from Hispaniola are poorly studied.

No modern mollusc checklist with deep revision of all families had been published so far, nevertheless in the literature is published up to now 537 probably valid species and additional 87 subspecies. The largest families representing Hispaniola are the Annulariidae (31% of the known mollusc fauna), Urocoptidae (18%) and Helicinidae (10%). All three major families are well adapted to exsiccation of the environment, and could also reflect the human driven changes in the environment. As the first two large families are among best studied ones, it's also possible their high ratio reflects the level of their knowledge. Even the families are still not revised; the figured percentage can display the recent diversity knowledge of each family fairly well. Other important families are Oleacinidae (6%), Xanthonychidae (6%), Camaenidae (5%), Subulinidae (4%), Sagdidae (4%), Bulimulidae (3%). Also the families forming around 1% of the total malacofauna as Poeriidae, Truncatellidae, Succineidae, Vertiginidae, Zonitidae, Spiraxidae and Thysanophoridae. The

following families are mostly poorly studied with their few known representatives and their presence in Hispaniola is detected: Megalomastomidae, Cerionidae, Pupillidae, Veronicellidae, Clausiliidae, Ferussaciidae, Polygyridae, Proserpinidae, Systrophiidae, Helicodiscidae, and Triphoridae.




The diversity of mollusc species is frequently used as an ecological indicator of the habitat destruction, as molluscs cannot move fast or fly and are settled in relatively small area, where many species are sensitive for negative impacts, deforestation and exsiccation. Without reasonable forest patches retenting the moisture and providing refuges they become extinct. The reintroduction of extinct mollusc populations is extremely slow or the extinctions could be irreversible, so the study of historical data and sub fossil / fossil shells from the sediments could give a relatively good picture about recent and sub recent human driven extinctions. Furthermore the mollusc shells in sub recent sediments can help to reconstruct the paleo-climate and paleo-vegetation. The high sensitivity of molluscs to habitat destruction is confirmed by the fact, that from the all worldwide recorded human driven animal species extinctions since 1700 the highest rate of 43% are the extinct mollusc species (HERBERT & KILBURN, 2004), while the second largest animal group affected by extinction, the birds, represent only 19%. The level of historical extinctions in Hispaniola cannot be even estimated due to lack of fossil, recent and historical data.

**Acknowledgements:** We are very grateful to Philippe Bayard and Jean Vilmond Hilaire from Societé d´Audubon Haiti for their excellent organization and support during the Macaya field trip. We would like to express great thanks to Aleyda Coopella from Subsecretario de Áreas Protegidas y Biodiversidad, Dominican Republic and to Eládio Fernandéz for their substantial support of this study.

## Bibliography

ABOTT, R. T., (1989): Compendiun of landshells, American Malacologist inc., Melbourne, Florida.

BARTSCH, P. (1946): The operculate land mollusks of the family Annulariidae of the Island of Hispaniola and the Bahama Archipelago. – Smithsonian Inst. Bulletin, **192:** 1-264.

BLAND, T. (1861): on the geographical distribution on genera and species of land shells of the West Indian Islands with a catalogue of species in each island. – Ibid.: 9-35.

BLAND, T. (1866): Remarks on the origin and distribution of the operculated land shells which inhabit the continent of America and the West indies. – American Journal, **2:** 54-63, 136-143, 349-370.

BLAND, T. (1871): Additional notes on distribution of land shells in the West Indies. – Annals of the Lyceum of Natural History of New York, **9:** 238-241.

BOSS, K. J. & JACOBSON, M.K. (1975): Proserpine snails of the Greater Antiles (Prosobranchia: Helicinidae). – Ibid., **4(51):** 53-90.

CLENCH, W. J. (1962): New species of land mollusks from the Republica Dominicana. Breviora (Cambridge, Mass.), **Nr 173:** 1-7.

CLENCH, W. J. (1932): Some land mollusks from Beata Island, Santo Domingo. – Proceedings of the New England Zoological Club, **12:** 103-107.

CLENCH, W. J. (1935): Some new Urocoptidae from Hispaniola. – Proceedings of Boston Society of Natural History, **41(1):** 1-12.

CLENCH, W. J. (1962): New Land Molluscs in the families Camaenidae and Fruticicolidae from Hispaniola. – Rev Muse. Argentino Cienco, **8(17):** 213-227.

CLENCH, W. J. (1966): Notes on description of new Urocoptidae from Cuba and Hispaniola. – Brevoir. Proc. Victoria Inst. Trinidad, **2:** 72-77.

CROSSE, H. (1891): Faune malacologique terrestre et fluviatile de l´ile de Saint Domingue. – Journal de Conch., **39:** 69-211.

EVANS, S. (1999) The Green Republic: A Conservation History of Costa Rica. – University of Texas Press, Austin, Texas, 335 pp., 9 b&w illus., 3 line drawings, 6 maps, 4 tables.

GOMEZ, J. D., VARGAS, M. & MALEK (1986): Freshwater Mollusks of the Dominican Republic. – The Nautilus, **100(4):** 130-134.

HAAS, F. (1960): Caribbean Land Molluscs: Vertiginidae. – Stud. Fauna Cur., **10:** 1-17.

HAAS, F. (1962): Caribbean Land Molluscs: Subulinidae and Oleacinidae. – Ibid., **13:** 49-60.

HERBERT, D., KILBURN, D. (2004): Field Guide to the Land Snails and Slugs of Eastern South Africa. – Natal Museum, 336 pages, 600 col photos, 87 line illus, 279 dist maps.

KAY, A.,(1995): The IUCN Species Survival Commission; The Conservation Biology of Molluscs, Gland, Switzerland, p.71.

MALTZAN, H. Von (1888): Diagnosen neuer Landschnecken von Haiti, gesammelt von Hernann Rolle 1887-88. – Nachrichstblatt der Deutschen Malakozoologischen Gesellschaft, **20:** 177-182.

PARKINSON B., HEMMEN J. and GROH, K. (1989): Tropical landshells of the world. – Verlag Christa Hemmen, Wiesbaden, Germany.

PFEIFFER, L. (1866): Bescheibung neuer Landschnecken. – Malakozoologische Blätter, **13:** 76-91.

PILSBRY, H. A. (1889): Manual of Concology, sér.II, vol V, Helicidae vol.III. – Academy of Natural Sciences, Philadelphia, p.16, pl. XIX, fig. 48-50.

PILSBRY, H. A. (1906): Manual of Conchology (sér II). Vol XVIII. Achatinidae: Stenogyrinae and Coeliaxinae. – Academy of Natural Sciences, Philadelphia, xii+ 1-357 + 51 pls.At 10:42 AM 7/26/2006.

PILSBRY, H. A. (1933): Santo Domingan land mollusks collected by Daniel C.Pease, 1932, and by A.A.Olsson, 1916. – Proceedings of the Academy of Natural Sciences of Philadelphia, **85:** 121-162+ plates.

PILSBRY, H. A. (1933): *Polydontes obliteratus* (Férussac). – The Nautilus, **53(2):** 42-43.

PILSBRY, H. A. & VANATTA, E. G. (1928): Land Shells of Tortuga Island, Haiti, and a new Haitian Oleacina. – Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. **LXXX**: 475.

REHDER, H. A. (1939): A new *Nenia* from Haiti and some notes on this genus. – J. Washington Academy Sci., **29(4):** 171-173.

SCHILEYKO, A. A. (1999): Treatise on Recent Terrestrial Pulmonate Molluscs Vol.4., Ruthenica suppl. 2., Draparnaudiidae, Caryodidae, Macrocyclidae, Acavidae, Calvatoridae, Dorcasiidae, Sculptariidae, Corillidae, Plectopylidae, Megalobulimidae, Strophocheilidae, Cerionidae, Achatinidae, Subulinidae, Glessulidae, Micrarctaeonidae, Ferussaciidae. – Moscow.

THOMPSON, F. G. (1977): The polygyrid genus McLeania in Hispaniola. – The Nautilus, **91(2):** 77-80.

THOMPSON, F. G. (1978): A new genus of operculate land snails from Hispaniola with comments on the status of family Annulariidae. – The Nautilus, **92(1):** 41-54.

THOMPSON, F. G. (1987): A review of the land snails of Mona Island, West Indies. – Bull. of the Florida State Museum, Biological Sciences, **31(2):** 69-106.

THOMPSON, F. G. (1989): Clausliid land snails from Hispaniola and their relationsips to other New World genera. – Arch. Molluskenkunde, **127(1/2):** 33-41.

TORRE, C., BARTSCH, P. & .MORRISON, J. P. E. (1942): The Cyclophorid operculate land mollusks of Ame rica. – Smithsonian Inst., Bulletin, **181:** 1-306.

TRYON, G. W. (1885): Manual of Conchology sérII, vol. I, Testacellidae, Oleacinidae, Streptaxidae, Helicoidea, Vitrinidae, Limacidae, Arionidae. – Academy of Natural Sciences, Philadelphia, p.22, pl. IV, fig 39, p. 27, pl. XI, fig. 99.

TRYON, G. W. (1886): Manual of Conchology sérII, vol. II, Zonitidae. – Academy of Natural Sciences, Philadelphia p.163, pl. LI, fig. 30-32.

TRYON, G. W. (1887): Manual of Conchology sérII, vol. III, Helicidae vol. I. – Academy of Natural Sciences, Philadelphia, p.96, pl. XXII, fig. 51-53, p.98, pl. XIX, fig. 25-28.

WATTERS, G. T. (2006): The Caribbean land snail family Annulariidae: a revision of the higher taxa and a catalog of the species. – Backhuys, Leiden: 1-557.

WATTERS, G. T. (2013): New taxa and distributional notes on Abbottella and related taxa. (Gastropoda: Littorinoidea: Annulariidae) Zootaxa, **3646(1):** 1-22.

WATTERS, G. T., DUFFY, K. (2010): New taxa of Annulariidae from Dominican republic (Gastropoda: Littorinoidea). – Visaya, **3(1):** 16-20.

WATTERS, G. T., GREGO J., ŠTEFFEK J. (2013): Rediscovery of *Choanopoma*? *smithianum* Pfeiffer, 1866 (Annulariidae) from Haiti and designation of a neotype, with the description of two new species of Weinlandipoma Bartsch, 1946. – The Nautilus, **127(2):** 78–84.

WEINLAND, F. & MARTENS, E. (1859): Neue Landsnecken aus Haiti. – Malakozoologishce Blätter, **6:** 53-59.

WEINLAND, F. (1862): Diagnosen einiger neuen westindischen Lanschnecken. – Malakozoologishce Blätter, **9:** 86-91.

WEINLAND, F. (1876):, Diagnoses Moluscorum Haitensium. – Malakozoologishce Blätter, **23:** 170-174.

WEINLAND, F. (1880): Zur Moluskenfauna von Haiti. – Jahrbucher der Deutschen Malakozoologischen Gesellschaft., **7:** 356-364.