

## The Never Spoken Poignant Connection Between Cuban Tree Snails and Carpentry/Crafts/Art: the case of *Polymita* and *Liguus*

Adrián González-Guillén<sup>1</sup>, David P. Berschauer<sup>2</sup>, Roberto Pérez-Rivero<sup>3</sup>, and Abelardo A. Méndez-Hernández<sup>4</sup>

<sup>1</sup> 132 1st ST E, apt 105, Tierra Verde, FL 33715-1746 [adrian.polymita@gmail.com](mailto:adrian.polymita@gmail.com)

<sup>2</sup> 25461 Barents Street, Laguna Hills, CA 92653 [shellcollection@hotmail.com](mailto:shellcollection@hotmail.com)

<sup>3</sup> Foundation for Nature and Humanity (FANJ), Havana, Cuba. 11600 [ropernicus2002@yahoo.es](mailto:ropernicus2002@yahoo.es)

<sup>4</sup> Eastern Center of Ecosystems and Biodiversity (BIOECO), Santiago de Cuba, Cuba. 90100 [allan.biomail@gmail.com](mailto:allan.biomail@gmail.com)

**ABSTRACT** The extinction of endemic Cuban tree snail colonies are shown to be directly caused by habitat fragmentation due to deforestation. Hardwood extraction and exploitation started in the 16<sup>th</sup> century and has steadily increased throughout the Cuban archipelago. This article is the first investigation into the connection between overexploitation of natural resources by local communities and the extinction of Cuban tree snail colonies. The authors have compiled a list of 345 hardwood trees species, many of which have been clear cut and over used by Cuban farmers, carpenters, artists and crafts people. Of those hardwood tree species, 84 species are known to be host plants for endemic Cuban *Liguus* and *Polymita* tree snails. Since the late 1960s, there has been an accelerated demand for hardwood for traditional craftworks. That demand became more aggressive after the opening of the country to international tourism in the 1990s. This desire for exotic hardwoods has endangered both the precious hardwood tree species and the endemic tree snail species that inhabit them. It is our hope that with the development of field guides on endemic Cuban hardwood tree species that educators can raise awareness of this issue while discouraging unmanaged or uncontrolled harvesting of these hardwoods in Cuba. Encouraging artists and crafts people to create miniature wood sculptures could be an alternative sustainable solution.

**KEY WORDS** Cuban tree snails, *Polymita*, *Liguus*, traditional craftworks, ethnobotany, woodworks, carvings

### INTRODUCTION

The Cuban archipelago contains one of the most diverse and remarkable molluscan land snail fauna in the world (González-Guillén, A., 2008). Currently, more than 1,400 species of land snails have been described from this region (González-Guillén, 2019). Of those, approximately 230 species of closely related land snails are co-dependent on primary and secondary hardwood forests (Mesa, 1986; González-Guillén, 2014; González-Guillén, 2018). Among these strict arboreal species, the genera *Liguus* (Montfort, 1810) and *Polymita* (Beck, 1837) stand out because of their beauty,

color, and polymorphism. Many people in the scientific community contend that this is the reason for their over-collecting resulting in their population declines; this is only partially true. Our research indicates that a major reason for the extinction of many of these populations is forest fragmentation and habitat loss due to overexploitation of hardwood tree species.

The flora of the Cuban archipelago has more than 7,000 species of plants, of which 52.4% are endemic. Over millennia, Cuban herbivorous tree snails evolved rapidly to fill specialized niches among a broad assortment of plants, corticolous lichens and fungi, leading to

specialization between endemic snails and plant host species. Some Cuban tree snail species adapted to environments near sea level (e.g., genera *Coryda*, *Liguus*, *Polymita*, *Helicina*), and others adjusted to environments at higher elevations (e.g., *Cysticopsis lessavillei*). Nevertheless, despite this incredible adaptive radiation, virtually all Cuban arboreal land snail species are now at risk of extinction due to threats to their habitats. Since the 16<sup>th</sup> century, when Cuba was almost entirely covered by exuberant primary forests, deforestation and exploitation of endemic hardwood species have now reduced these forests to less than 15% (Risco, 1995).

Many studies have been published regarding the history of the Cuban forests (e.g. Zanetti & García, 1976; Risco, 1995; Monzote, 2005, 2007, 2008). Obviously some ecosystems, more than others, were cleared or modified for human purposes such as livestock breeding, sugarcane production, coal mining, railroad construction, infrastructure, agriculture (e.g., exotic vegetables, fruits, roots, grains, tobacco, coconut, cocoa, and coffee), as well as rural expansion and development. In 1994, zoologist Gilberto Silva Taboada wrote about the reduction of forested areas on the island stating that “the modification of the Cuban landscape has been tripled since 1959 by human causes.”

A large number of trees from coastal xerophytic shrubland, semideciduous forests, evergreen forests, moist forests, gallery forests and mountain rainforests were cut down for their precious woods. Colonial houses, palaces and country estates were built and decorated utilizing these precious Cuban hardwoods. They were also used to decorate famous buildings like the Empire State Building in New York and El Escorial Palace in Madrid (the later utilized ebony from the Baracoa forests).

*Liguus* and *Polymita* have been studied since the 19<sup>th</sup> century. The first reports identifying specific host plants for these genera appeared in the 1930's (J. Natenson letters to C. de la Torre), and the first extinction concerns were raised in the 1940's [letters to C. de la Torre (March 7<sup>th</sup> and May 14<sup>th</sup>, 1942); Jaume, 1943; M. L. Jaume handwriting from Minutes between 1942-1954; Lippincott, 1954]. Increased attention to extinction risks faced by *Liguus* and *Polymita* began in the 1980s and continues to this day (Milera & Martínez, 1979, 1984, 1987; Milera, 1997, 1999; Fernández-Velázquez & Navarro, 1998; Reyes-Tur & González-Rodríguez, 2003; González-Guillén, 1998, 2014, 2018; Fernández-Velázquez, A. et al. 2001; Almaguer, et al., 2002; Esteva-Morales, 2012.). Because of this, the association between the host plant hardwood tree species and their endemic *Liguus* and *Polymita* species has been well documented.

Other Cuban Cepolidae genera like *Hemitrochus*, Swainson, 1840, *Eurycampta*, Von Martens, 1860, *Jeanneretia*, L. Pfeiffer, 1877 and *Coryda*, Albers, 1850, which seem to use an impressive wide variety of host plants, and *Cysticopsis* Mörch 1852, require more research on their host plant relationships. The same studies are needed for other families of Cuban arboreal land snails.

Very few papers have addressed precious Cuban hardwoods and their use in crafts and sculptures (Martínez *et al.*, 1987; Martínez, 2006). Only one study has been published on Cuban tree snails and their feeding habits on lichens and fungi on specific hardwood tree species (Reyes-Tur *et al.*, 2020).

## MATERIAL AND METHODS

We reviewed all of the literature related to *Liguus* and *Polymita* host plant species and cross-referenced it with our research on

hardwood tree species which have been exploited in Cuba since the 16<sup>th</sup> century. We assembled all of the collected data from these sources including our own, Roig's Botanical Dictionary (2014 edition), which provided additional crucial information, other literature that supplied relevant facts about foreign or local precious hardwood species used centuries ago in cabinet making and sculpture as well as fieldwork experience of craft people known to the first author, who is also a sculptor from the Cuban Association of Artisans and Artists (ACAA), into a database and updated the host-plant species names and their synonymy using Greuter & Rankin (2016).

## DISCUSSION

As far as we know, no prior publication has assessed the impact of the exploitation of precious hardwood species by the carpentry industry, commercial craftsman and sculptors in relation to the impact on Cuban endemic tree snail populations. After an exhaustive analysis we grouped 345 trees species that have been exploited in Cuba; several of these tree species are critically endangered or surviving as relicts in areas where they were once widespread.

Approximately 84 of those 345 tree species are recorded as specific or occasional host plants for *Liguus* and *Polymita* tree snails: *Ampelocera cubensis* (ULMACEAE); *Amyris balsamifera* (RUPPIACEAE); *Bourreria succulenta*, *Cordia alliodora*, *C. sebestena*, *Ehretia tinifolia* (BORAGINACEAE); *Brya ebenus*\*, *Caesalpinia bahamensis*, *Dichrostachys cinerea* (= *D. glomerata*), *Gliricidia sepium* (= *Lonchocarpus sepium*), *Haematoxylum campechianum*, *Lysiloma latisiqua*, *L. sabicu*, *Piscidia piscipula* (= *Ichthyomethia piscipula*) (FABACEAE); *Bucida buceras* (COMBRETACEAE); *Calycophyllum candidissimum*, *Exostema caribaeum*,

*Guettarda calyprata*\*, *G. longiflora* (RUBIACEAE); *Canella winterana* (= *Canella alba*) (CANELLACEAE); *Casearia aculeata* (SAMYPDACEAE); *Cedrela cubensis*, *C. odorata* (= *C. mexicana*) (MELIACEAE); *Celtis trinervia* (CANNABACEAE); *Chrysobalanus icaco*, *Chrysophyllum oliviforme*, *Ch. cainito* (CHRYSOBALANACEAE); *Coccoloba caesia*\*, *C. diversifolia* (= *C. laurifolia*), *C. praecox*\*, *C. reflexa*\*, *C. retusa*\*, *C. uvifera* (POLYGONACEAE); *Colubrina arborescens* (= *C. ferruginosa*) (RESEDACEAE); *Conocarpus erectus* (CNEORACEAE); *Diospyros crassinervis* subsp. *kubal*\*, *D. grisebachii*\* (EBENACEAE); *Sideroxylon salicifolium* (= *Dipholis salicifolia*), *Manilkara zapota* (= *M. grisebachii*), *Pouteria aristata*\*, *Sideroxylum americanum*, *S. cubense* (= *Dipholis cubensis*), *S. foetidissimum* subsp. *foetidissimum* (= *Mastichodendron foetidissimum*), *S. horridum*, *S. salicifolium* (*Dipholis salicifolia*) (SAPOTACEAE); *Drypetes alba* (= *D. incurva*); *D. lateriflora*, *D. mucronata* (PUTRANJIVACEAE); *Erythroxyllum areolatum*, *E. confusum*, *E. rotundifolium* (= *E. suave*, = *E. spinescens*), *E. rufum*, *E. havanense* (ERYTHROXYLACEAE); *Eugenia axillaris*, *E. galalonensis*, *E. glabrata*, *E. heterophylla*\*, *E. monticola* (= *E. buxifolia*, *E. foetida* var. *parvifolia*), *E. rhombea* (= *E. foetida* var. *rhombea*), *Psidium guajaba* (MYRTACEAE); *Guaiacum officinale*, *G. sanctum* (ZYGOPHYLLACEAE); *Guapira obtusata* (= *Torrubia obtusata*) (NYCTAGINACEAE); *Guazuma ulmifolia* (= *G. tomentosa*) (BYTTNERIACEAE); *Gymnanthes lucida* (EUPHORBIACEAE), *Hypelate trifoliata* (SAPINDACEAE); *Jacquinia keyensis*, *J. aculeata* (THEOPHRASTACEAE); *Krugiodendron ferreum* (RHAMNACEAE); *Chionanthus domingensis* (= *Linociera domingensis*, = *Mayepea domingensis*), *Ch. ligustrinus* (= *Linociera ligustrina*) (OLEACEAE); *Maytenus*

*buxifolia* (CELASTRACEAE); *Metopium toxiferum* (ANACARDIACEAE); *Oxandra lanceolata* (ANNONACEAE); *Phyllanthus epiphyllantus* subsp. *epiphyllantus*\*, *Savia sessiliflora* (PHYLANTACEAE); *Phyllostylon rhamnoides* (= *Ph. Brasiliensis*) (ULMACEAE); *Rhizophora mangle* (RHIZOPHORACEAE); *Talipariti elatum* (= *Hibiscus elatus*) (MALVACEAE); *Terminalia diptera*\* (COMBRETACEAE); *Zanthoxylum coriaceum*, *Z. flavum* (RUTACEAE). We expect that this list will grow as research on these two genera continues. In addition, these species may also be hosts to other arboreal tree snails, which are not the focus of this paper.

It appears that these land snail genera prefer plant species with smooth barks where corticolous lichens develop (e.g., *Eugenia*, *Lysiloma*, *Savia* and *Senna*). Other *Liguus* and *Polymita* host tree genera that have been among the most frequently exploited hardwood species since the 19<sup>th</sup> century (e.g., *Manilkara*, *Diospyros*, *Cedrela*, *Mastichodendron*, *Guaiacum*, *Cordia*, *Brya*, *Lysiloma*, *Gymnanthes*, *Bucida*, *Conocarpus* and *Erythroxylum*) are used in cabinetry, furniture, marquetry, crafts and sculpture. Hardwood tree genera such as *Swietenia* (MELIACEAE), *Pera* (PERACEAE), *Tabebuia* (BIGNONIACEAE) and *Pinus* (PINACEAE) that have also been exploited are excluded from this analysis because they are not considered host plants for *Liguus* and *Polymita*.

In Spanish colonial furniture we were able to identify more than 25 endemic hardwood species (Carreras-Rivery, 1998, 2008, 2010). It seems that the most frequently employed Cuban hardwoods by the Spanish and other European furniture and cabinet makers since the 18<sup>th</sup> century were *Swietenia mahagoni* (Caoba del país, Caoba amarilla, Caoba), *Manilkara zapota* (Ácana), *Manilkara jaimiqui* subsp.

*wrightiana*\* (Jaimiquí, Almiquí, Carne de Doncella), *Diospyros caribaea* (Ébano), *Diospyros crassinervis* (Ébano Carbonero, Chicharrón de cuabal), *Diospyros grisebachii* (Ébano negro), *Brya ebenus* (Granadillo, Espino de Sabana, Espino Negro, Romperopa, Ojo de Perdiz), *Guaiacum officinale* (Guayacán, Guayacán negro, Palo santo), *Guibourtia hymenaefolia*\* (Quiebra hacha, Algarrobo de las Antillas, Curbaril, Caguairán, Coronel, Guaney, Caney), *Lysiloma sabicu* (Sabicú), *Tectona grandis* (Teca), *Gymnanthes lucida* (Yaití, Aité, Aité caracolillo, Aité veteado, Aceitero, Aceitillo), *Tabebuia angustata* (Roble blanco, Roble yugo), *Pera bumeliifolia* (Jiquí, Jiquí de ley, Jequí), *Calophyllum antillanum* (Ocuje, Ocuje colorado, Ocuje hembra), *Bonetia cubensis* (Manglecillo), *Bucida buceras* (Júcaro común, Júcaro de costa, Júcaro amarillo, Júcaro negro), *Conocarpus erectus* (Yana, Mangle botón), *Erythroxylum sp.*, *Zanthoxylum flavum* (Cerillo, Aceitillo, Ayúa Varía, Satín), and *Juglans aff. jamaicensis* (Nogal). At least 8 of these 20 Cuban hardwoods come from trees known to be *Liguus* or *Polymita* host tree species.

Upon review of the Diario de la Marina (Navy's Newspaper) from 1865 to 1875 (A Havana tabloid with a section for Trade & Arts), we determined that in the second half of the 19<sup>th</sup> century, most of the wood furniture and musical instruments manufactured in Cuba were exported to Europe and the United States. Apparently, the Louis XV style was in vogue at that time and rosewood (also is known in Spanish as palisandro (*Dalbergia* spp.)), maple and pine (Pino Tea) were popular in the United States. We also found that some local businesses offered furniture and musical instruments restoration. However, the constant mention of local oak, cedar and mahogany in such advertisements does not mean that other Cuban precious woods were not also exploited

or shipped overseas; this merely means that those trees were more often utilized for fine carpentry work.

E. Martínez (2006) mentions some tree species used in woodcrafts and sculptures in Santiago de Cuba municipality (e.g., *Cedrela odorata*, *Diospyros grisebachii*, *Guaiacum officinale*, *Talipariti elatum*, *Brya ebenus*, *Gerascanthus gerascanthoides* (= *Cordia gerascanthus*), *Hymenaea courbaril* (= *Guibourtia hymenaeifolia*), *Manilkara valenzuelana*, *Citrus x aurantium* (= *C. x sinensis*), *Pinus sp.*). Except for a very few, almost all of these species are reported as *Liguus* or *Polymita* host species. It was not noted that several of these hardwood species used in making those commercial products came from other provinces, mostly from adjacent Guantánamo province.

Among the most expensive hardwoods today are the species from genera *Guaiacum*, *Diospyros*, *Cordia*, *Dalbergia*, *Guibourtia* and *Brosimum*. In Cuba, the over-exploitation of some of these valued hardwoods for carpentry, wood crafts and sculptures and their relation with the decline of these endemic tree snail populations is not well understood or recognized. Throughout the country these hardwoods can be found in every crafts trade fair, tourists store and art gallery. The problem is that removing host trees as well as other hardwood species that may be used by these endemic tree snails, from the forests causes habitat fragmentation and reduces a population's chance for survival.

*Polymita* and *Coryda* species are more resilient than *Liguus* species, which have longer life cycles and are therefore more susceptible to drastic changes in habitat conditions. Arboreal tree snails are less adaptable than terrestrial land snail species. It is possible that in some ecosystems the growth rate of tree species can

be fast enough to allow them to recover in only a few years after being cleared. Unfortunately, the growth rate of hardwood trees in coastal forests is very slow (e.g., *Guaiacum* can reach 30 centimeters in trunk diameter in about 100 years). Consequently, at the current rate of deforestation, the remaining hardwood tree species and their closely linked endemic tree snail populations are in grave danger of extinction unless there is an immediate and conscious effort to protect these habitats for future generations.

In Cuba, there are no tree worshiping traditions except for the species *Ceiba pentandra* (it's said because of its similarity with the African Baobab tree) and Royal palm *Roystonea regia*. There is a religion in Cuba known as 'Palo' or 'Palo Monte' that is divided into multiple traditions including Kimbisa, Mayombe and Briyumba branches. Palo contains a close bond and awareness of certain plants and trees. Some of these species are hardwoods used in crafts (e.g., *Abarema obovale* (= *Pithecellobium obovale*), *Capparis cynophallophora*, *Capparis ferruginea*, *Senna bicapsularis* (= *Cassia emarginata*), *Exothea paniculata*, *Trophis racemosa*, *Casearia sylvestris*, *Byrsonima sp.*) but very few of these species are *Liguus* and *Polymita* hosts (*Canella winterana*). There's also a religion named 'Santería' of African origin that uses hardwoods in some of its religious items.

There has been a gradual development through the centuries of carving African related images in hardwoods. This has been used to justify an "identity of customary carving", when in fact, it is a market that grew slowly from the late 1960s to the present. Before that time, wood, bronze and stone sculpture was more allied to the art *per se* (Veigas, 2005), and wood was the less utilized medium by the Academy artists, with few exceptions. African related wood crafts in

the 19<sup>th</sup> and first half of the 20<sup>th</sup> century were made mostly for their religious demand, mainly by African descendants. Requests for precious hardwoods were mostly related, as always, to the cabinet making industry and urban or township construction.

In 1978 the Cuban government created the *Fondo Cubano de Bienes Culturales* (Cuban Fund of Cultural Assets, "FCBC") in order to commercialize crafts on a large scale. In the 1990s, this institution launched a network of galleries and stores throughout the archipelago. It must be kept in mind that large-scale commercialization and over-collecting of *Polymita* shells for crafts, with government approval, occurred from the mid-1960s to the early 1990s. Accordingly, during those decades the deadly combination of increasing demand for precious hardwoods, legal over-collecting of shells, and other forest loss caused by the sugarcane industry, agriculture, grazing, mining and infrastructure expansion, led to the significant decline of *Polymita* species. These forces combined to reduce *Polymita* populations more than what had occurred during the first half of the 20<sup>th</sup> century.

In a country that no longer exports precious hardwoods, Cuban Forest Rangers play an important role in regulating and enforcing the laws that protect these woodland territories. However outside these territories, forest rangers have no jurisdiction. When smugglers are able to evade forest rangers and police, they will frequently sell the hardwoods to carpenters and artisans. This naturally leads to hardwood trafficking throughout the country with much of the wood reaching craft fairs as commercial products. This exploitation is more aggressive in some province than others. For example, *Guaiaacum officinale* trees are habitual hosts of *Polymita versicolor* in Guantánamo province

coastal and subcoastal range, and is one of the most desirable woods in that region.

Finally, international tourism development has led to even more aggressive exploitation of endemic hardwoods. Yet it is important to mention, that in the last decade, carving wood miniatures is becoming more popular and is now included as a contest category in sculpture events.

## CONCLUSIONS

After 1960, the increase in hardwood crafting was an ongoing trend that matured in the late 1970s and has continued to this day. It seems clear that a significant cause of *Liguus*, *Polymita* and other tree snails' genera populations decline in the last 70 years is due to hardwood demand by crafts people and artisans. Precious hardwoods were used mainly in carpentry and construction in the first half of 20<sup>th</sup> century. This resulted in significant deforestation and forest fragmentation. As a consequence, tree snail populations that utilize these trees as host plants are now threatened with extinction. In addition, the unending demand for selected hardwood species in the second half of the 20<sup>th</sup> century has further decreased their chances for survival.

## RECOMMENDATIONS

The lack of knowledge of endemic Cuban hardwoods species in the wild has become a liability. Forest rangers, crafts people and sculptors in Cuba must learn to identify them and understand that these trees are host plants for a variety of endemic Cuban land snails. A proper field guide of trees is urgently needed. If the artisans and sculptors want to save these precious hardwood species for future generations, they must start working commercially with smaller formats. For

example, instead of carving a single sculpture in a 50 cm block of black ebony, they can sculpt several pieces and even use the remaining splints and dust for inlays. In the end, they will obtain a better return from those several pieces rather than for just one. We understand that not everyone can become a skilled miniature carver and that bigger sizes are desirable as well, but the alternative solution of carving miniatures will help save Cuba's forests as well as the animals that rely on them.

### ACKNOWLEDGMENTS

We thank Luis Dickinson Felipe, Yadira Sánchez Serrano, Midalis González-Acevedo, Mónica Saura and Rolando Teruel.

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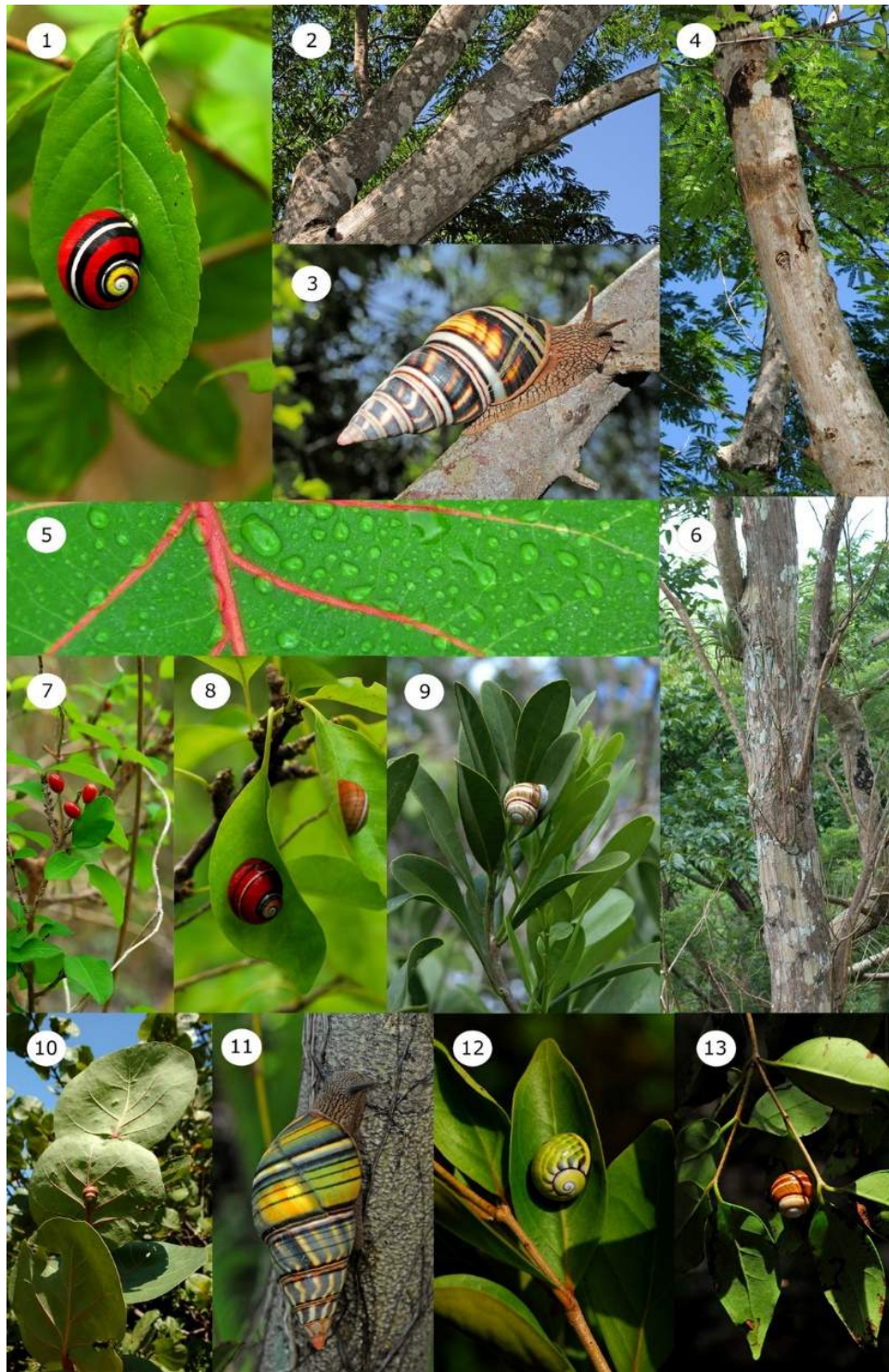
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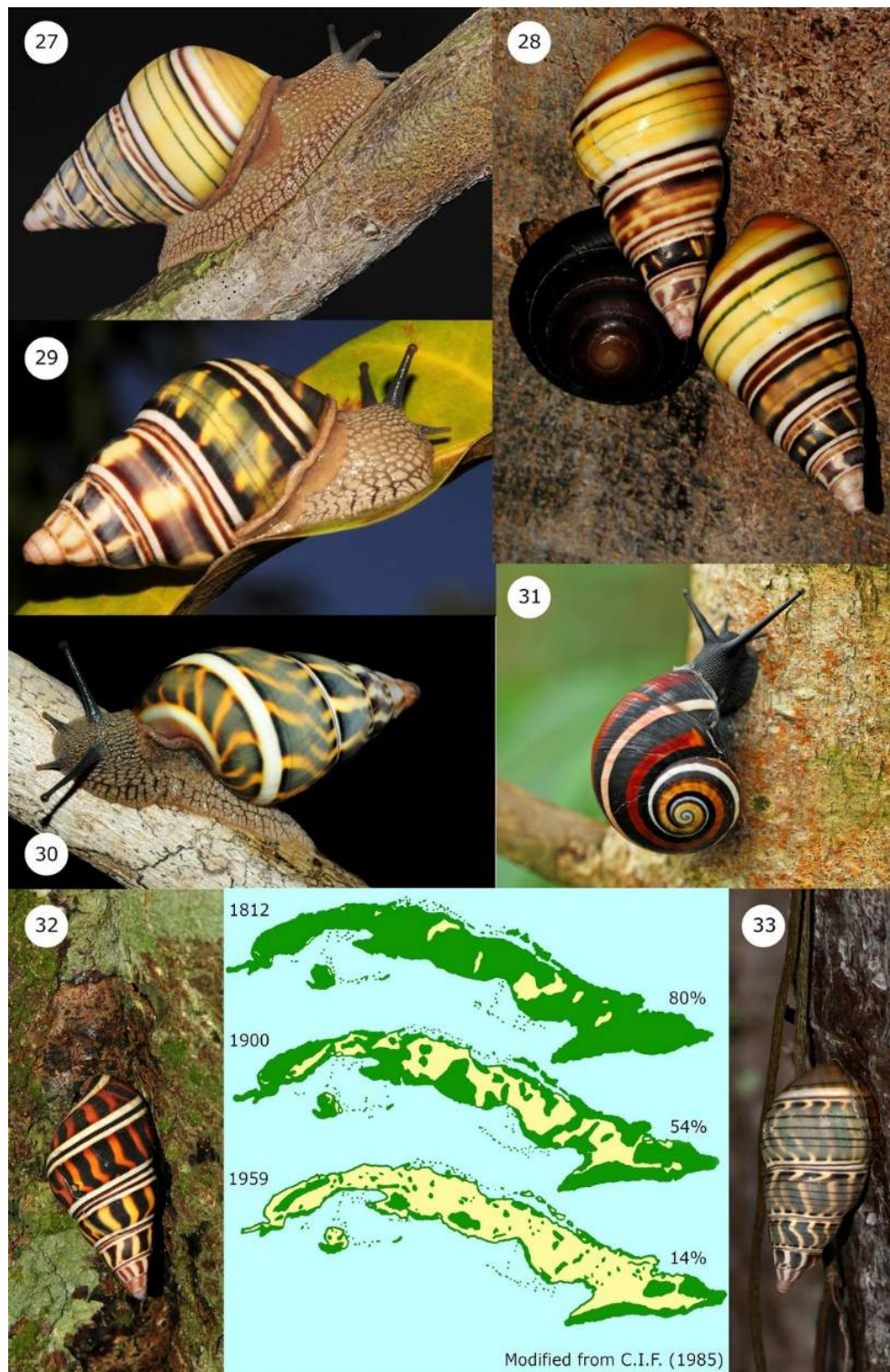
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**Plate 1. 1:** *Polymita picta iolimbata* over *Casearia aculeata*, **2:** *Lysiloma latisiliqua*, **3-4:** *Liguus fasciatus achatinus* over *L. latisiliqua*, **5:** *Cocoloba uvifera*, **6:** *P.p. roseolimbata* over *Gliricidia sepium*, **7:** *Erythroxyllum havanense*, **8:** *P.p. iolimbata* over *E. havanense*, **9:** *P. muscarum* over *Canella winterana*, **10:** *P. muscarum* over *Cocoloba uvifera*, **11:** *L.f. guitarti*, **12:** *P. sulphurosa* over *Eugenia* sp., **13:** *P. muscarum* over *Eugenia axillaris*.



**Plate 2.** 14: *Sideroxylum salicifolium*, 15-16: *P. sulphurosa* over *Diospyros crassinervis*, 17: *P. sulphurosa* over *Sideroxylum salicifolium*, 18, 21-22: *P. versicolor* over *Guaiaacum officinale*, 19, 26: *Guaiaacum officinale*, 20: *L.f. achatinus* over *Guaiaacum officinale*, 23: *P. sulphurosa* over *Calycophyllum candidissimum*, 25: *P. sulphurosa* over a hardwood tree trunk, 25: *L.f. caroli* over *Calycophyllum candidissimum*.



**Plate 3.** *Liguus* and *Polymita* over different trees types. **27-29:** *L.f. achatinus*, **30:** *L.m. fairchildi*, **31:** *P.p. iolimbata*, **32:** *L.b. pilsbryi*, **33:** *L.f. viridis* Simplified map showing the Cuban archipelago deforestation rate from 1812 to 1959 (Modified from a 1985 Forestry Research Centre map).