

INTRODUCTION AND SPREADING OF *BIOMPHALARIA STRAMINEA* (DUNKER, 1848) (MOLLUSCA: PULMONATA: PLANORBIDAE) IN GUADELOUPE, FRENCH WEST INDIES

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*The finding in 1985 of a well-established population of *Biomphalaria straminea* in a pond in Grande Terre of Guadeloupe constitutes a new species record for the freshwater molluscan fauna of that island. The following years a rapid extension of the species was documented on Grande Terre and Marie Galante. However, it was never found in the neighboring island of Basse Terre. The invasion of the whole hydrographic system of this island by *Melanoides tuberculata* during the last decade and the current presence of well-established and dense populations of this snail may explain the failure of the colonization by *B. straminea*.*

Key words: Mollusca Planorbidae – *Biomphalaria straminea* dispersal – French West Indies

The first description of *Planorbis stramineus* was given by Dunker (1848) and the species was figured some years later (Dunker, 1856). This conchological description is however insufficient to allow recognition of the species. The type locality was mentioned as South America, and in 1873 Martens restricted it to Venezuela (Lagunilla and Caracas). In December, 1956, Paraense collected in a creek at Hacienda Cura (near San Joaquín), Carabobo State, Venezuela, 59 specimens of a planorbid which answered, in some instances, to Martens' description of *P. stramineus*. Anatomical studies demonstrated that the Venezuelan snail showed the characteristics of *Australorbis centimetralis*, as described by Pinto & Deslandes (1955), now considered a synonym of *Biomphalaria straminea* (Paraense, 1963).

B. straminea is presently spreading out from its original area (Madsen & Frandsen, 1989). It was discovered in some streams of Hong Kong in 1973 (Meier-Brook, 1974), and it is currently invading the mainland of China (Tang, 1983; Dudgeon & Yipp, 1983; Yipp, 1990). The occurrence of *B. straminea* in Costa

Rica was demonstrated in 1976 (Paraense et al., 1981). At Sydney airport, Australia, it was found in 1977 in a shipment of freshwater aquaria fish from Hong Kong (Walker, 1978). In the Lesser Antilles, it was first reported from Martinique in 1966 (Grétilat, 1967) under the specific name of *havanensis*. However, its introduction into the island probably occurred some years before, but it was not listed in the malacological survey carried out by Dreyfuss in 1953. *B. straminea* was then discovered in Grenada in 1970 (Ferguson & Buckmire, 1974) and much more recently in Saint Lucia (Pointier, in press). Its discovery in Guadeloupe occurred in 1985, and a rapid colonization of the whole island was documented. This paper presents the results of this invasion.

MATERIAL AND METHODS

A malacological survey was carried out yearly on the whole hydrographic system of the Guadeloupe archipelago which includes the islands of Basse Terre, Grande Terre, Marie Galante and Saintes (Fig. 1). The snails were collected either with a sieve or manually according to the type of habitat, and brought to the laboratory. The collected specimens were allowed to relax overnight using menthol. They were then immersed for 40 sec in water heated

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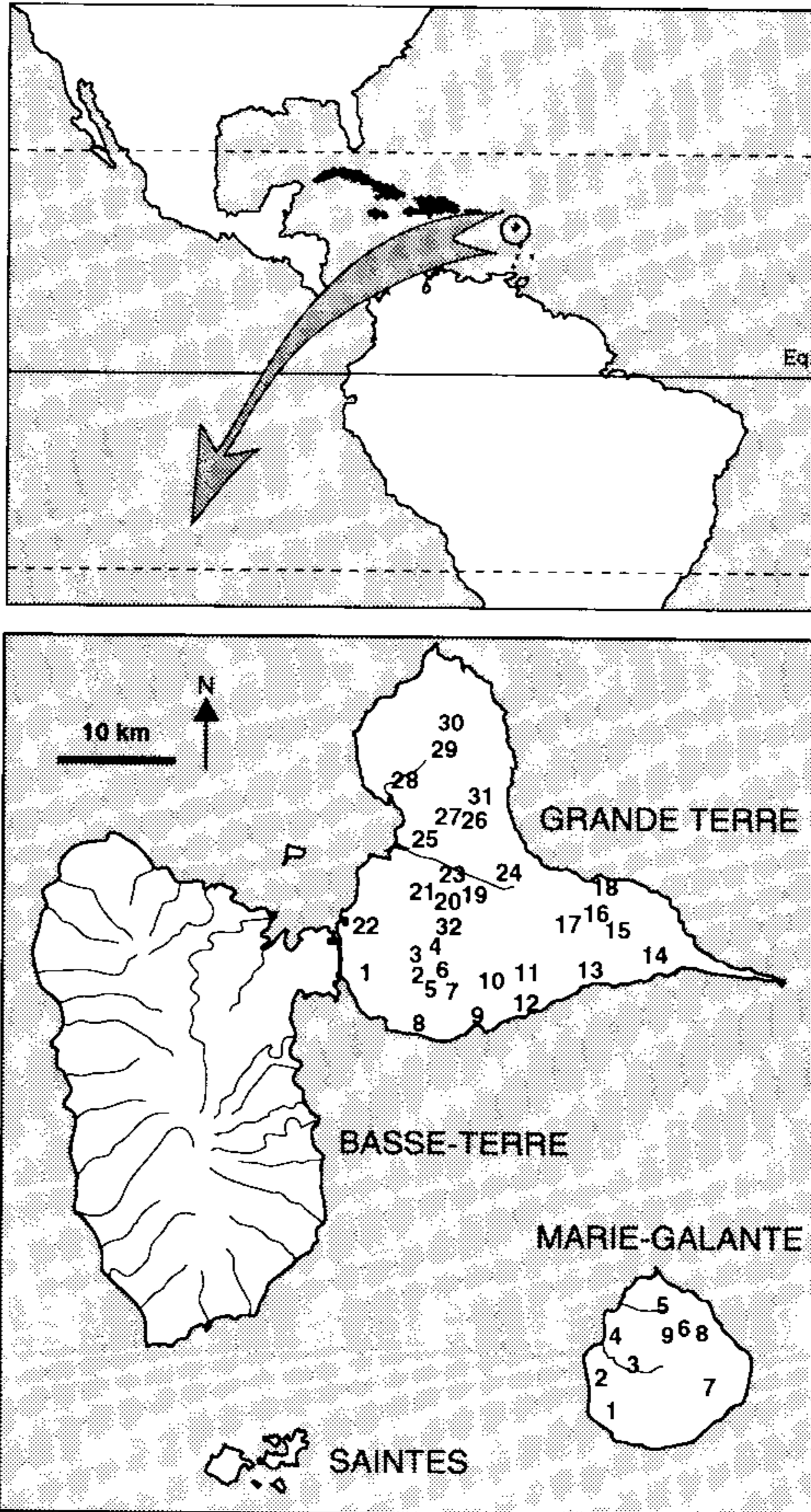


Fig. 1: sites colonized by *Biomphalaria straminea* in the Guadeloupean archipelago and time of appearance. Grande Terre: 1 = Duthau pond (1987), 2 = Caraque pond (1991), 3 = Descareaux pond (1990), 4 = Céligny pond (1985), 5 = Leroux I pond (1991), 6 = Leroux II pond (1990), 7 = Tombeau pond (1987), 8 = Grande ravine stream (1987), 9 = Saint-Félix pond (1987), 10 = Jacotière pond (1988), 11 = Fouché pond (1988), 12 = Favreau pond (1991), 13 = Grandmaison pond (1988), 14 = Carrière marsh (1991), 15 = Celcourt pond (1988), 16 = Bel Étang pond (1988), 17 = Mam'mé pond (1988), 18 = Moule pond (1988), 19 = Dubisquet pond (1987), 20 = Fidélin pond (1990), 21 = Jabrun pond (1992), 22 = Jacquot marsh (1986), 23 = David pond (1992), 24 = Acomat pond (1988), 25 = Pico pond (1987), 26 = Bazin pond (1991), 27 = Balin pond (1988), 28 = Gaschet stream (1987), 29 = Gaschet reservoir (1990), 30 = L'Ermitage pond (1988), 31 = Besnard pond (1992), 32 = Carlan pond (1992). Marie Galante: 1 = Roussel pond (1986), 2 = Mare de l'Usine pond (1989), 3 = Saint Louis river (Les Sources) (1986), 4 = Desmarais pond (1989), 5 = Vieux Fort river (1989), 6 = Bambou pond (1989), 7 = Desmond pond (1992), 8 = Massacre pond (1992), 9 = L'Ermitage pond (1992).

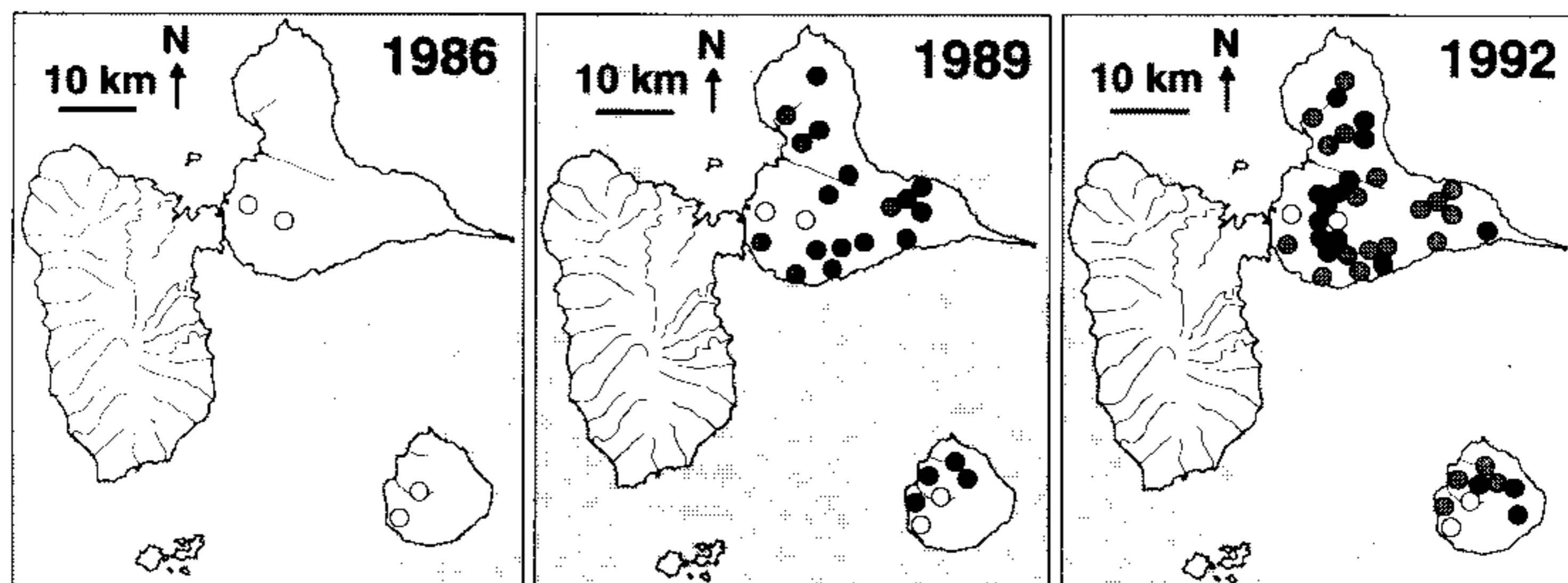


Fig. 2: Colonization of the Guadeloupean archipelago by *Biomphalaria straminea*. White circles = sites colonized in 1986, grey circles = sites colonized between 1986 and 1989, black circles = sites colonized between 1989 and 1992.

to 70 °C, from which they were transferred to water at room temperature. The soft parts were drawn from the shell with a small forceps and fixed in slightly modified Railliet-Henry's fluid (distilled water 930 ml, sodium chloride 6 g, formalin 50 ml, glacial acetic acid 20 ml). Voucher specimens were deposited at the Museum National d'Histoire Naturelle de Paris (Laboratoire de Biologie des Invertébrés Marins) and at École Pratique des Hautes Études (Laboratoire de Biologie Marine et Malacologie).

RESULTS

B. straminea was first reported in 1985 in Céligny pond and in subsequent years in other ponds of Grande Terre island. It was also found on the small island of Marie Galante (Fig. 1). Malacological surveys carried out each year after 1985 showed the rapid invasion of the Guadeloupean archipelago by this snail. In 1986 the species had colonized four sites, in 1989, 25 sites, and in 1992, 41 sites (Fig. 2). The invaded habitats were mainly standing water bodies such as permanent or temporary ponds, reservoirs and marshes. It was also found in several small streams on Grande Terre and Marie Galante (Fig. 2). In spite of careful searches, it was never found on Basse Terre island.

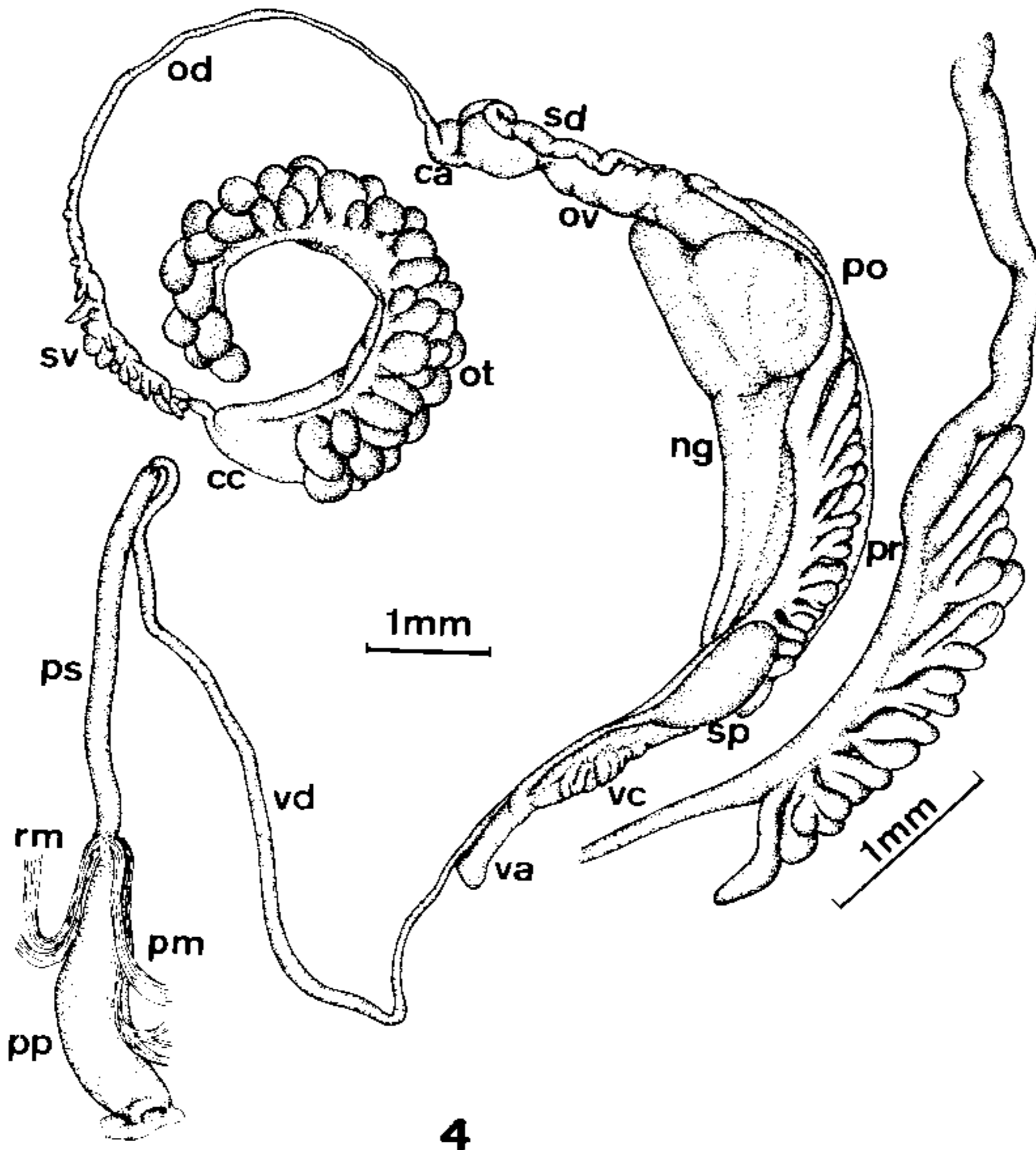
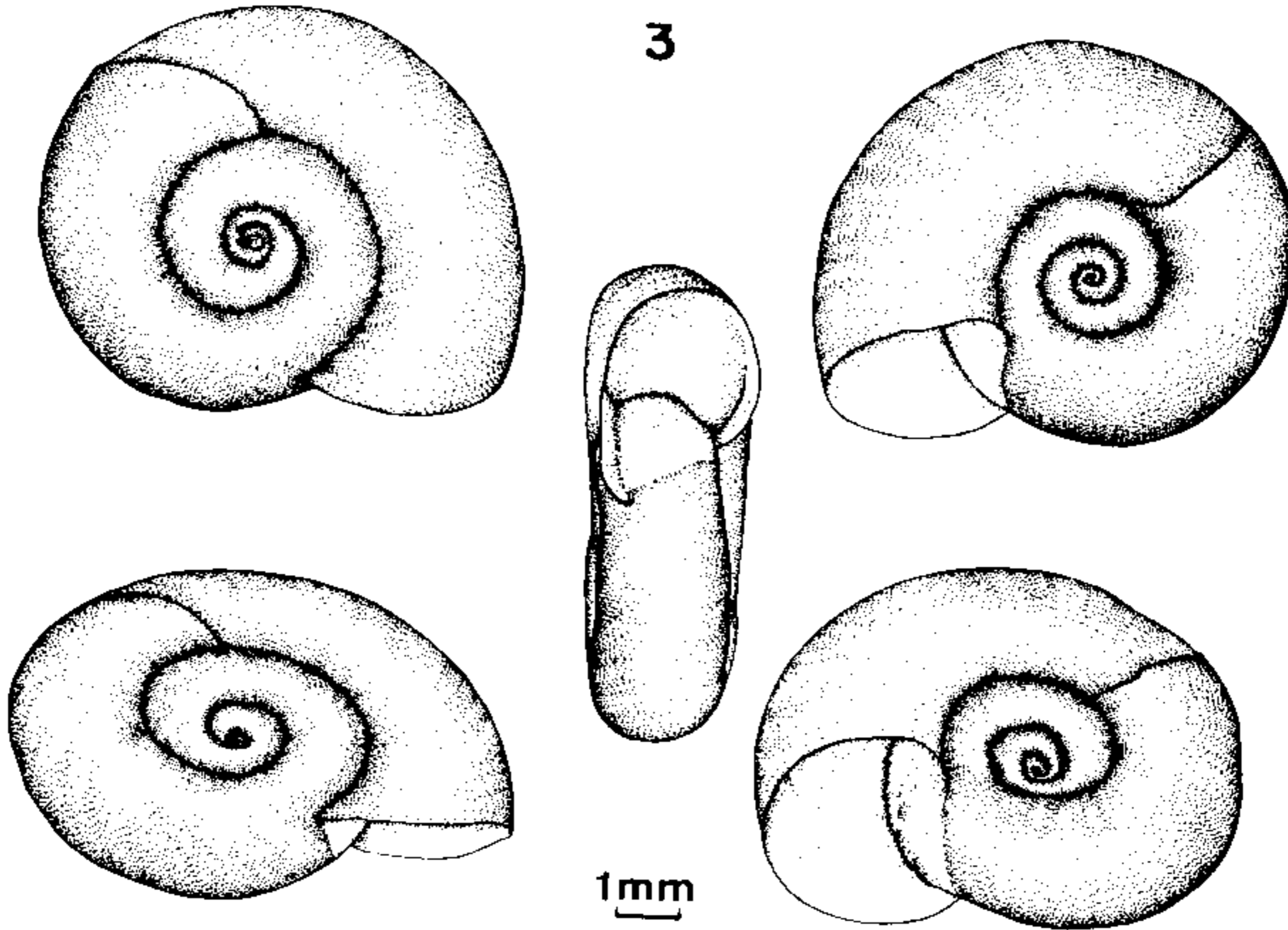
All the collected specimens fit well, in shell and anatomic characteristics, with the description given by Paraense & Deslandes (1955). The mean shell size of full-grown snails range between 4.5 and 7.9 mm according to the population. The reproductive system includes several reliable characteristics: penis sheath as long

as or longer than the prepuce and much narrower; vagina short with a series of lateral corrugations above the attachment of the spermatheca; ovotestis diverticula relatively few, short and stout, usually simple; prostate diverticula ranging between seven and ten (Figs 3 to 6).

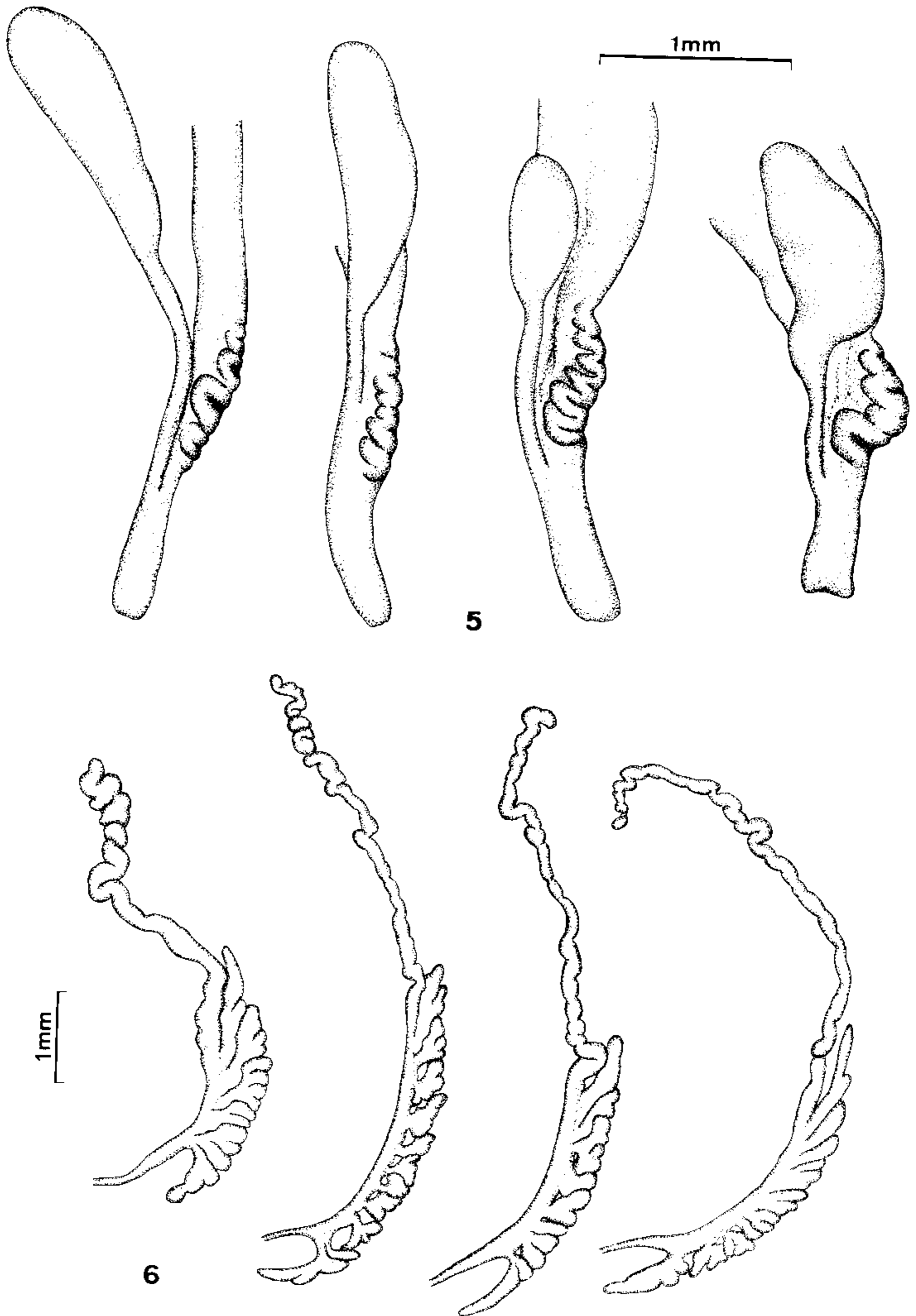
DISCUSSION

The time of introduction of *B. straminea* into Céligny pond, Guadeloupe, 1985, may be stated with reasonable certainty because this pond has been the subject of bimonthly samplings since 1974, when a biological control program using sterilizing trematodes and competitor snails was initiated (Nassi et al., 1979; Pointier et al., 1989; Pointier, 1989). In addition, a malacological supervision of the other water bodies has occurred during that period (Pointier, 1974, 1976). The origin of this introduction is not known, but aquatic birds have probably played a major role, as snails or snail eggs can be carried on feet or in plumage (Rees, 1965; Boag, 1986). The role of the aquatic plant trade should also be considered because of increasing demand all over the world (Madsen & Frandsen, 1989) and especially in the French West Indies where aquariophily has been strongly promoted in recent years.

The spread of *B. straminea* in Grande Terre island and Marie Galante was very rapid and, six years after the discovery of the first population, the species is now established in the majority of the water bodies which mainly include standing waters such as ponds and marshes. Its absence from the neighboring island, Basse Terre, raises a question. Basse Terre



Biomphalaria straminea from Grande Terre, Guadeloupe Fig. 3: shell. Fig. 4: reproductive system. ca = carrefour, cc = collecting canal of ovotestis, ng = nidamental gland, od = distal segment of ovispermiduct, ot = ovotestis, ov = oviduct, pm = protractor muscle of penial complex, po = pouch of oviduct, pp = prepuce, pr = prostate, ps = penial sheath, rm = retractor muscle of penial complex, sd = spermiduct, sp = spermatheca, sv = seminal vesicle, va = vagina, vd = vas deferens, vc = vaginal corrugation.



Biomphalaria straminea - Fig. 5: variation of vaginal corrugation; from left to right: specimens from Caraque pond, Grande Terre, Guadeloupe; Pères river, Martinique; Calicanto canal, Venezuela; São Luis (spring), Maranhão, Brazil. Fig. 6: variation of prostate; from left to right: specimens from São Luis (spring), Maranhão, Brazil; Calicanto canal, Venezuela; Pères river, Martinique; Caraque pond, Grande Terre, Guadeloupe.

is a mountainous island and the majority of aquatic milieus are represented by streams and rivers which, a priori, do not constitute very favorable habitats for *B. straminea*. However, as has been shown in Martinique, this type of island may harbor a great number of *B. straminea* populations (Guyard & Pointier, 1979). During the last decade, the invasion of all the hydrographic system of Martinique by the prosobranch snail *Melanoides tuberculata* has been responsible for a strong decline of the planorbid snail which only persists in small refuges such as banana drains or rivulets (Pointier et al., 1989; Pointier & Guyard, 1992). The same invasion phenomenon by *M. tuberculata* also occurred in Basse Terre, and the current presence of dense populations of the thiarid snail may explain the failure of *B. straminea* to colonize this island.

B. straminea is an important intermediate host of *Schistosoma mansoni* in northeastern Brazil, in spite of its very low susceptibility to the parasite (Lucena, 1963; Barbosa & Coelho, 1956; Barbosa & Figueiredo, 1970). Its importance in the transmission of *S. mansoni* in the Lesser Antilles, especially in Martinique island, remains unclear in spite of numerous searches. In 1967, Paraense (unpublished) collected 257 *B. straminea* in Carbet river, Martinique, and one of them harbored larvae of *S. mansoni*. More recently a biological control program using *M. tuberculata* as competitor snail has strongly reduced the planorbid populations, so the risk of this species playing a role in the transmission of *S. mansoni* on this island is quite negligible (Pointier et al., 1989; Pointier & Guyard, 1992).

In Guadeloupe different surveys conducted in ponds and pools in Grande Terre island in 1980-1981 have demonstrated the absence of *S. mansoni* transmission in spite of apparently favorable ecological conditions and especially of the abundance of susceptible populations of *B. glabrata*. It was shown that only human behavior was responsible for the absence of transmission, man breaking the life cycle of the parasite by avoiding all fecal pollution and therefore all snail contamination (Théron & Pointier, 1985). The current presence of another potential intermediate host, *B. straminea*, does not constitute a great risk because this species is much less susceptible to infection by *S. mansoni* than *B. glabrata*. However, special attention will be paid to the malacological situation of Grande Terre island in the future.

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