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Distribution and natural infestation of *Bulinus globosus* and *Biomphalaria pfeifferi*, intermediate host snails of human schistosomes, in three municipalities in southern Benin

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Abstract
Schistosomiasis is a human parasitic infection caused by trematodes of the genus Schistosoma, whose life cycle necessarily involves a freshwater gastropod as an intermediate host. The aim of this study was to determine the distribution, abundance and natural infestation rate of two snail intermediate host species, Bulinus globosus and Biomphalaria pfeifferi, in three endemic municipalities of southern Benin: Aguégués, Dangbo and Sô-Ava. Snail sampling was carried out monthly from january to september 2025 at twelve sites distributed across rice fields, ponds, and agro-aquaculture pond. Collected snails were examined in the laboratory for natural schistosome infections. A total of 1,818 snails were collected, of which 75.5% were B. globosus and 24.5% were B. pfeifferi, with a significant difference between the two species ($p < 0.001$). A significant variation in the abundance of B. globosus was observed according to municipality ($p < 0.001$) and sampling site ($p < 0.001$), with the highest densities found in Dangbo and Aguégués. Abundance also varied significantly according to habitat type ($p < 0.001$), with the highest abundance in rice fields for B. globosus and in agro-aquaculture ponds for B. pfeifferi. A slight variation was observed between abundances according to month, with the highest abundances during the rainy and flood seasons. Only B. globosus was naturally infested with Schistosoma haematobium cercariae, with an overall infestation rate of 17.04%, which varied according to municipality and habitat type ($p < 0.001$). The highest infection rates were recorded in rice fields and during the rainy and flood seasons. These findings highlight the ecological dominance of B. globosus and the seasonality of S. haematobium transmission in the study municipalities.
Keywords: *Schistosomiasis, Abundance, Bulinus globosus, Biomphalaria pfeifferi, natural infestation, Benin.*

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I. Introduction

Schistosomiasis, also known as bilharzia, is a human parasitic disease whose transmission has been confirmed in 78 countries (OMS, 2022). It ranks second after malaria in terms of socio-economic and health impact in tropical and subtropical regions of the world (Inobaya et al., 2014). In 2023, approximately 254 million people worldwide needed treatment for schistosomiasis, of whom 91.13% lived in Africa and 53.16% were school-aged children (5–14 years old) (WHO, 2024). The pathogens responsible for this parasitic disease, which is mainly transmitted in areas with poor access to safe water and sanitation (OMS, 2022), are trematodes of the genus *Schistosoma* (McManus et al., 2018). According to Kokaliaris et al., (2022), the two main *Schistosoma* species responsible for schistosomiasis in Africa are *Schistosoma haematobium*, which causes urogenital schistosomiasis, and *Schistosoma mansoni*, which causes intestinal schistosomiasis. The groups of people most at risk of schistosomiasis are: preschool and school-aged children, women of reproductive age and pregnant women, fishermen, livestock breeders, and farmers practicing irrigation techniques (Molyneux et al., 2005). In a study conducted on schoolchildren in all municipalities of Benin by Onzo-Aboki et al., (2019), urogenital schistosomiasis caused by *S. haematobium* is widespread and detected in 76 municipalities with a national average prevalence of 17.56%, while intestinal schistosomiasis caused by *S. mansoni* was detected in 28 municipalities with a national average prevalence of 2.45%. The combined national average prevalence of the two forms of schistosomiasis found simultaneously or not in the subjects studied was 19.78%. The biological cycle of *Schistosoma*, the causative agent of Schistosomiasis, necessarily involves a freshwater gastropod as an intermediate host (Hailegebriel et al., 2020). In Benin, these gastropods are found from the Atlantic coast to the Niger river, with *Bulinus globosus* and *Biomphalaria pfeifferi* as the major intermediate hosts of *S. haematobium* and *S. mansoni*, respectively (Ibikounlé, 2006). To eradicate schistosomiasis, the World Health Organization has recommended several control strategies including periodic mass treatment to at-risk populations with praziquantel (OMS, 2008; WHO, 2024), and the use of molluscicides as part of integrated control programs against the disease (WHO, 2020). The implementation of these strategies requires knowledge of the population dynamics of the intermediate host snails and the dynamics of schistosome transmission (Onzo-Aboki et al., 2018). This study, which took place in the municipalities of Aguégués, Dangbo and Sô-Ava, three endemic municipalities for schistosomiasis in southern Benin (Onzo-Aboki et al., 2019), aimed to analyse the distribution, abundance and natural infestation rate of *B. globosus* and *B. pfeifferi* schistosomes in order to better understand the transmission dynamics of schistosomiasis in these municipalities.

II. Materials and Methods

Study area

The collection of schistosome intermediate host snails was carried out in the three southern municipalities of Benin with the highest schistosomiasis prevalence rates, namely Aguégués (65.60%), Sô-Ava (59.60%), and Dangbo (57.20%) (Onzo-Aboki et al., 2019). Four (04) sampling sites were selected in each municipality, namely: Goussa, Djèkpè, Akpadon and Bè-Mbè Akpa in the municipality of Aguégués; Tovè, Houédomè, Hêtin-Sota and Kodonou in the municipality of Dangbo; and Vekky, Ahomey-Lokpo, Ahomey-Gblon and Sô-Ava Centre in the municipality of Sô-Ava (Figure 1). The choice of 12 sites (03 rice fields, 07 ponds and 02 agro-aquaculture ponds) was guided by their use by humans (farming, fishing, swimming, etc.) and animals (watering of cattle around ponds) and their proximity to schools.

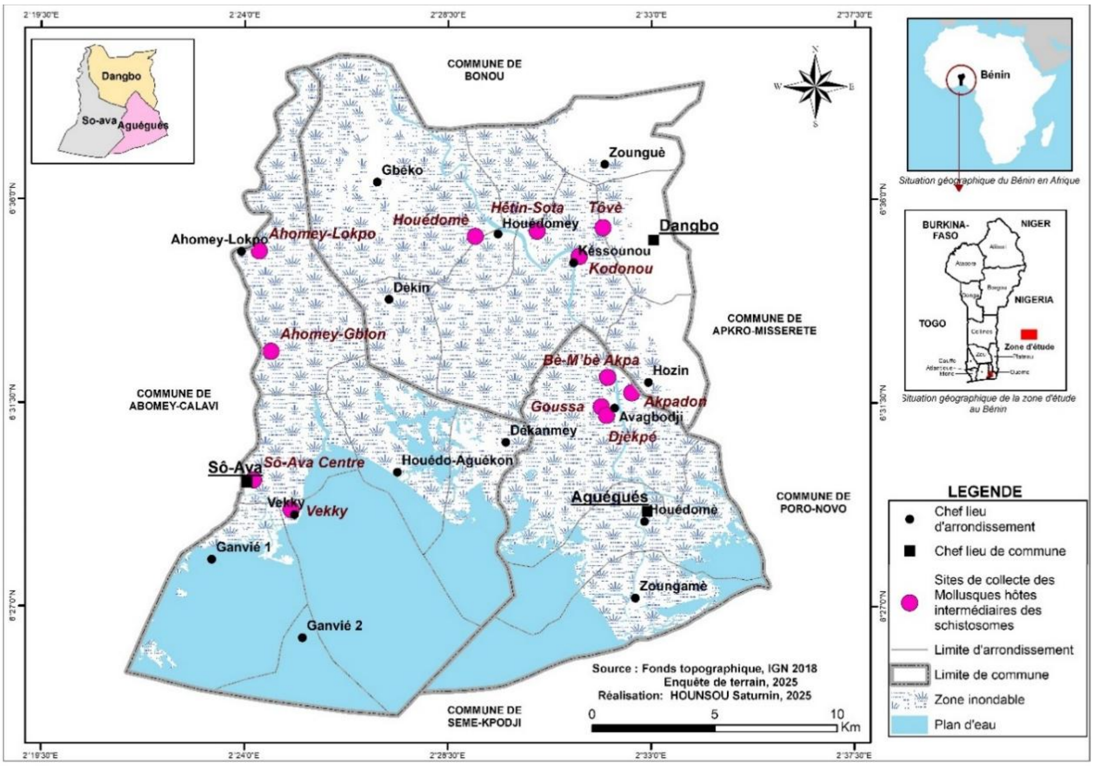

Figure 1: Map showing the location of the sampling collection sites

Collection and identification of snails

At each site, snails were collected monthly for nine months (January to September 2025) using a fine-mesh metal landing net by the same person. Each sampling session lasted 30 minutes. Snails were collected by immersing landing net under floating vegetation and gently shaking it, so that the snails previously attached to the leaves detached and fell to the bottom of the landing net. Sometimes snails were searched by directly examining supports: aquatic plants, dead leaves and branches, pebbles, and any other solid objects submerged in the water. They were also found in vases, thanks to the transparency of the water. When collecting snails, gloves and boots must be worn to protect against the potential risk of infection. The collected snails were identified according to species, counted, and subjected to parasitological testing. Snail identification was carried out using the identification key of Brown & Kristensen, (1993).

Parasitological testing of snails

The molluscs brought back to the laboratory were each placed in dishes (containing 24 wells), which were filled with Possotomè mineral water to undergo natural infestation control for schistosomes under natural light. After 24 hours, the water contained in each well was collected and observed under a microscope to note the presence or absence of any cercariae. The complete methodology is illustrated in Figures a–d.

Photos: (a) Snail collection, (b) Snails placed in well dishes and exposed to natural light, (c) Observation of schistosomes under a ×40 microscope, and (d) *Schistosoma* observed.

Statistical Analysis

Data were entered into Excel 2016. For each species, the mean snail abundances collected per month, site, habitat type, and municipality were compared using ANOVA. The chi-square test was used to compare natural infestation rates of snails according to month, site, site type, and municipality. All comparisons were performed at the 5% significance level. SPSS Statistics 21 was used to conduct the analyses.

III. Results

Abundance of B. globosus and B. pfeifferi collected

At the end of the malacological survey, a total of 1,818 snails were collected, including 1,373 (75.5%) *B. globosus* and 445 (24.5%) *B. pfeifferi*. A significant difference ($P<0.001$) was observed between the proportion of *B. globosus* and *B. pfeifferi* collected.

According to the municipality

The mean abundance of *B. globosus* collected varied significantly according to the municipality (P<0.001). The highest mean abundance was found in the municipality of Dangbo (19.75±13.01), followed by Aguégués (15.25±11.54) and Sô-Ava (3.83±4.13). For *B. pfeifferi*, no significant difference was observed between the mean abundances according to municipality (P=0.110). The highest mean abundance of *B. pfeifferi* was recorded in the municipality of Aguégués (5.94 ± 8.37), while the lowest was observed in Dangbo (2.42 ± 4.91) (Table 1).

Table 1: Abundance of *B. globosus* and *B. pfeifferi* collected according to the municipality

Municipality	*B. globosus* collected		*B. pfeifferi* collected	
	Number (N= 1373)	Mean ± SD (95% CI)	Number (N= 445)	Mean ± SD (95% CI)
Aguégués	524	14.56±8.00 [11.85-17.26]	214	5.94±8.37 [3.11-8.78]
Dangbo	711	19.75±13.01 [15.35-24.15]	87	2.42±4.91 [0.75-4.08]
Sô-Ava	138	3.83±4.13 [2.44-5.23]	144	4.00±7.44 [1.48-6.52]
		P<0.001		P=0.110

According to the sampling site

The mean abundance of *B. globosus* collected varied significantly according to the site (p<0.001). The sites of Houédomè (31.22±16.23), Tôvè (22.22±6.83), and Bè-Mbè Akpa (18.89±8.74) showed the highest abundances. The lowest abundance was observed at Ahomey-Lokpo (1.33±2.4). Overall, the sites located in Sô-Ava displayed the lowest abundances.

The abundance of *B. pfeifferi* also varied significantly according to the collection site (p<0.001), with the highest abundance recorded at Sô-Ava Centre (15.78±5.78), followed by Bè-Mbè Akpa (11.89±4.01), Hêtin-Sota (8.33±6.82), and Goussa (8.11±13.62). No *B. pfeifferi* was observed at Vèkky, Ahomey-Gblon, and Houédomè (Table 2).

These marked differences indicate distinct ecological foci and suggest that the sites of Dangbo and Aguégués provide favourable habitats for *B. globosus*.

Table 2: Abundance of *B. globosus* and *B. pfeifferi* collected according to the collection site

Sites	*B. globosus* collected		*B. pfeifferi* collected	
	Number (N= 1373)	Mean ± SD (95% CI)	Number (N= 445)	Mean ± SD (95% CI)
Vekky	40	4.44±2.7 [2.37-6.52]	0	0.00±0.00 [0.00-0.00]
Sô-Ava Centre	37	4.11±4.11 [0.95-7.27]	142	15.78±5.78 [11.33-20.22]
Ahomey-Lokpo	12	1.33±2.4 [0.00-3.18]	2	0.22±6.67 [0.00-0.73]
Ahomey-Gblon	49	5.44±5.86 [0.94-9.94]	0	0.00±0.00 [0.00-0.00]
Tovè,	200	22.22±6.83 [16.97-27.47]	1	0.11±0.33 [0.00-0.37]
Hêtin-Sota	150	16.67±9.07 [9.70-23.64]	75	8.33±6.82 [3.09-13.57]
Houédomè	281	31.22±16.23 [18.75-43.70]	0	0.00±0.00 [0.00-0.00]
Kodonou	80	8.89±7.06 [3.46-14.32]	11	1.22±2.33 [0.00-3.02]
Goussa	113	12.56±6.52 [7.54-17.57]	73	8.11±13.62 [0.00-18.58]
Djèkpè,	92	10.22±4.84 [6.50-13.94]	20	2.22±3.03 [0.00-4.55]
Bè-Mbè Akpa	170	18.89±8.74 [12.17-25.61]	107	11.89±4.01 [8.80-14.97]
Akpadon	149	16.56±9.29 [9.42-23.70]	14	1.56±3.68 [0.00-4.38]
		P<0.001		P<0.001

According to the type of habitat

A highly significant variation was observed between the mean abundances of *B. globosus* (P<0.001) according the type of collection site, as well as between those of *B. pfeifferi* (P<0.001). *B. globosus* was more abundant in rice fields (23.33±12.64) than in agro-aquaculture ponds (11.50 ± 10.08) and ponds (8.51 ± 7.44). Regarding *B. pfeifferi*, the highest abundance was found in agro-aquaculture ponds (13.83 ± 5.23), whereas the lowest abundance was observed in rice fields (0.56 ± 2.17) (Table 3).

Table 3. Abundance of *B. globosus* and *B. pfeifferi* collected according to habitat type

Type of sites	*B. globosus* collected		*B. pfeifferi* collected	
	Number (N= 1373)	Mean ± SD (95% CI)	Number (N= 445)	Mean ± SD (95% CI)
Rice fields	630	23.33±12.64 [18.33-28.33]	15	0.56±2.17 [0.00-1.41]
Ponds	536	8.51±7.44 [6.63-10.38]	181	2.87±6.64 [1.20-4.55]
Agro-aquaculture ponds	207	11.50±10.08 [6.49-16.51]	249	13.83±5.23 [11.23-16.43]
		P<0.001		P<0.001

According to the month

The monthly analysis indicated that there was no significant difference between the mean abundances of *B. globosus* (P=0.521). A slight variation was observed between the mean abundances. The highest abundances were recorded in August (16.42 ± 8.31), September (15 ± 8.68), and June (14.83 ± 17.84), while the lowest were observed in July (9.58 ± 11.23), March (10 ± 7.98), and January (10.17 ± 8.76). Similarly, there was no significant difference Between mean abundances of *B. pfeifferi* according to the month (P = 0.611). A slight variation was also observed between the mean abundances, with the highest abundances in March (8.00±13.33) and September (5.58±7.48) and the lowest in June (2.25±4.94) and January (2.33±3.26) (Table 4). These results suggest moderate seasonal fluctuations in mollusc populations, with increases during the rainy season and during flooding

Table 4: Abundance of *B. globosus* and *B. pfeifferi* collected according to the month

Month	*B. globosus* collected		*B. pfeifferi* collected	
	Number (N= 1373)	Mean ± SD (95% CI)	Number (N= 445)	Mean ± SD (95% CI)
January	122	10.17±8.76 [4.60-15.73]	28	2.33±3.26 [0.26-4.4]
February	146	12.17±10.04 [5.79-18.55]	44	3.67±4.79 [0.62-6.71]
March	120	10.00±7.98 [4.93-15.07]	96	8.00±13.33 [0.00-16.47]
April	155	12.92±13.11 [4.59-21.25]	61	5.08±7.01 [0.63-9.54]
May	160	13.33±13.19 [4.96-21.71]	35	2.92±5.28 [0.00-6.27]
June	178	14.83±17.84 [3.5-26.17]	27	2.25±4.94 [0.00-5.39]
July	115	9.58±11.23 [2.45-16.72]	38	3.17±6.42 [0.00-7.25]
August	197	16.42±8.31 [11.14-21.69]	49	4.08±7.53 [0.00-8.86]
September	180	15.00±8.68 [9.49-20.51]	67	5.58±7.48 [0.83-10.33]
		P=0.521		P=0.611

Natural infection rates of collected snails

The natural infestation rate of *B. globosus* with schistosomes across all sites was 17.04%. This rate varied significantly according to municipality, site, habitat type, and month. No *B. pfeifferi* tested positive for schistosomes during the nine (9) months of the study.

According to municipality

The analysis revealed a significant difference between schistosomes infestation rates of *B. globosus* according to the municipality (P<0.001). The municipality of Aguégués had the highest infestation rate (20.04%±3.41), while the municipality of Sô-Ava had the lowest (9.42%±4.88) (Table 5).

These results illustrate a variable spatial transmission of *Schistosoma haematobium*.

Table 5: *B. globosus* infestation rate by municipality

Municipality	Number of parasitised *B. globosus*	Total number of *B. globosus*	Infestation rate (%) ± 95% CI	P-value
Aguégués	105	524	20.04±3.41	P<0.001
Dangbo	116	711	16.32±2.71	
Sô-Ava	13	138	9.42±4.88	
Total	234	1373	17.04±2.00	

According to site

The natural infection rate of *B. globosus* with schistosomes varied significantly according to the site (P < 0.001). The site of Akpadon had the highest rate (34.2%±7.62), followed by Tôvè (25%±6), and Djèkpé (20.7%±8.27). The Sô-Ava-centre site had the lowest rate of infected *B. globosus* (2.70%±5.23) (Table 6).

Table 6: *B. globosus* infestation rate according to site

Sites	Number of parasitised *B. globosus*	Total number of *B. globosus*	Infestation rate (%) ± 95% CI	P-value
Vekky,	6	40	15.00±11.07	P<0.001
Sô-Ava Centre	1	37	2.70±5.23	
Ahomey-Lokpo	1	12	8.30±15.60	
Ahomey-Gblon	5	49	10.20±8.48	
Tovè,	50	200	25.00±6.00	
Hêtin-Sota	15	150	10.00±4.80	
Houédomè,	39	281	13.90±4.04	
Kodonou	12	80	15.00±7.82	
Goussa	19	113	16.80±6.90	
Djèkpè,	19	92	20.70±8.27	
Bè-Mbè Akpa	16	170	9.40±4.39	
Akpadon	51	149	34.20±7.62	
Total	234	1373	17.04±2.00	

According to habitat type

Analysis according to habitat type revealed a significant variation in the infection rates of *B. globosus* (P < 0.001). snails collected from rice field were more heavily infested with schistosomes (22.2%±3.3) than those from ponds (14.4%±3) and agro-aquaculture ponds (8.2%±3.7) (Table 7).

Table 7: Infestation rates of *B. globosus* according to habitat type

Type of sites	Number of parasitised *B. globosus*	Total number of *B. globosus*	Infestation rate (%) ± 95% CI	P-value
Rice fields	140	630	22.20±3.30	P<0.001
Ponds	77	536	14.40±3.00	
Agro-aquaculture ponds	17	207	8.20±3.70	
Total	234	1373	17.04±2.00	

According to month

A significant variation in the schistosomes infestation rate of *B. globosus* was also observed according to the month (p<0.001). The highest infestation rate was obtained in June (27.53%±6.57) and the lowest in January (5.74%±4.12). The highest rates were obtained during the rainy season and the flood season (August and September) (Table 8).

Tableau 8 : Taux d'infestation de *B. globosus* en fonction du mois

Month	Number of parasitised *B. globosus*	Total number of *B. globosus*	Infestation rate (%) ± 95% CI	P-value
January	7	122	5.74±4.12	P<0,001
February	21	146	14.40±5.70	
March	16	120	13.33±6.08	
April	25	155	16.10±5.80	
May	23	160	14.38±5.43	
June	49	178	27.53±6.57	
July	24	115	20.90±7.43	
August	38	197	19.30±5.51	
September	31	180	17.20±5.51	
Total	234	1373	17.04±2.00	

IV. Discussion

The results obtained through this study highlight, on the one hand, the spatial and temporal distribution of the snails *B. globosus* and *B. pfeifferi*, two intermediate hosts of schistosomes, and, on the other hand, the dynamics of schistosome transmission responsible for schistosomiasis in three endemic municipalities in southern Benin (Aguégués, Dangbo and Sô-Ava).

The species *B. globosus* proved to be largely dominant (75.5% of individuals collected). This dominance of *B. globosus* over *B. pfeifferi* has previously been reported by Ibikounlé, (2006) and Ibikounlé et al., (2009) in Benin, as well as by Nwoko et al., (2023) in the KwaZulu-Natal province in South Africa. Similar results have been reported in several other studies conducted in Africa. Indeed, Olkeba et al., (2020) concluded after a study conducted in six localities in the Ethiopian Rift Valley, targeting intermediate host molluscs of schistosomes, that *Bulinus globosus* was the most abundant (31.7%), confirming its strong dominance over *B. pfeifferi* (14.6%). Magero et al., (2025) in a study conducted in Tanzania, Uganda and Kenya revealed that *B. pfeifferi* was found at only 23 of the 172 sites surveyed (≈13.4%), across various types of aquatic habitats. This supports the idea that *B. pfeifferi* has a restricted distribution.

B. globosus was present at all study sites, with particularly high abundances at Dangbo and Aguégués, and lower abundances at Sô-Ava. In contrast, *B. pfeifferi* was found at nine of the twelve sites, with higher abundances in the municipalities of Aguégués and Sô-Ava, and lower abundance at Dangbo. This wide distribution of *B. globosus* was reported by Manyangadze et al., (2021) in the KwaZulu-Natal province in South Africa. The heterogeneous spatial distribution of the two species can be attributed to various ecological and environmental factors. According to Olkeba et al., (2020), *B. globosus* has a greater tolerance to variations in the physicochemical parameters of its habitat, which favours its presence in a variety of habitats such as ponds, irrigation canals, rice fields and agro-aquaculture ponds. *B. pfeifferi*, being more demanding ecologically, remains confined to more fragmented and scarce stable microhabitats (Nkolokosa et al., 2025). According to Olkeba et al., (2020), water temperature, turbidity, dissolved oxygen, alkalinity, depth and vegetation cover influence the differential distribution of *B. globosus* and *B. pfeifferi*.

The rice fields hosted the highest abundances of *B. globosus*, followed by ponds and agro-aquaculture ponds. Recent works conducted in Senegal by Sack et al., (2025) reported the presence of *B. globosus* releasing human schistosomes both in rice fields and adjacent canals during the growing and non-growing seasons, thereby establishing a professional exposure risk for rice farmers. The work of Patz et al., (2000) also revealed that the different rice-field developments carried out can considerably influence the malacological fauna through the abundance, specific diversity and density of the main vector species.

No significant variation in abundance was observed according to the month, although peaks were recorded in June (rainy month) and in August and September (flood period) which are periods conducive to the reproduction and dispersal of snails. This finding is consistent with the observations of Moser et al., (2014), who highlighted the direct influence of the season on the dynamics of host snail populations.

Only the species *B. globosus* showed individuals naturally infested with schistosomes cercariae, with an overall infestation rate of 17.04%. This result confirms the major role of this species in the transmission of *S. haematobium* in Benin, as reported by Ibikounlé, (2006) and Onzo-Aboki et al., (2019).

Furthermore, the meta-analysis carried out by Hailegebriel et al., (2020) on the prevalence of *S. mansoni* and *S. haematobium* in intermediate host snails in Africa reported an average schistosome prevalence of 5.5% in intermediate host snails, with a rate of 12.3% for *B. globosus* and 5.1% for *B. pfeifferi*. This reinforces the idea that *B. globosus* is a major host in the transmission of schistosomes. In contrast, no *B. pfeifferi* individuals, the intermediate host of *S. mansoni*, were found to be infected, which suggests a low circulation of *S. mansoni* in the study area, without ruling out the presence of intestinal schistosomiasis cases in the human populations of the study area.

The infestation rates of *B. globosus* varied significantly between municipalities, sites and habitat types. The highest rates were observed in the municipality of Aguégués (20.04%) and at the Akpadon site (34.2%), while the lowest rates were recorded in the municipality of Sô-Ava (9.42%) and at the Sô-Ava Centre site (2.70%). Rice fields had the highest infestation rate (22.2%), followed by ponds (14.4%) and agro-aquaculture ponds (8.2%). These results confirm that rice-growing areas, due to stagnant water and human activities (irrigation, cultivation, bathing), constitute active transmission foci for *S. haematobium.* According to Boelee & Madsen, (2006), surface irrigation systems, particularly those with poor water management, stagnant areas and proliferation of aquatic plants, create favourable habitats to the reproduction of host snails, thereby facilitating the transmission of the parasite to humans.

The monthly variation of infestation rate was marked by a peak in June (27.53%) corresponding to the rainy season and also high rates from July to September corresponding to the flood period, when contact between humans and aquatic environments is most frequent. These observations are consistent with those of Chandiwana & Christensen, (1988), who showed that seasonal fluctuations in schistosome transmission are closely linked to hydrological cycles and human and animal activities (fishing, rice cultivation, livestock watering). The high rate observed at Akpadon and other active sites indicates persistent transmission of S. *haematobium* in these areas with high human and animal activities, joining the conclusions of Anto et al., (2013) and (Onzo-Aboki et al., 2019). In Burkina Faso, recent work by Zida et al., (2023) revealed that sites with high density of *B. globosus* maintain stable transmission despite mass chemotherapy campaigns, confirming the central role of ecological and behavioural factors in the persistence of schistosomiasis.

V. Conclusion

This study has provided a better understanding of the dynamics of schistosomiasis transmission in southern Benin through the analysis of the abundance, distribution and natural infestation of intermediate host molluscs. The results show a strong dominance of *B. globosus* over *B. pfeifferi* at most sites, confirming its major role in the transmission of *S. haematobium*. The variations observed according to municipalities, sites, and habitat types reveal pronounced spatial heterogeneity, linked to the nature of the biotopes and human activities. Rice fields, in particular, appear as major foci of parasite transmission, but so do ponds and agro-aquaculture ponds, due to stagnant water and high human and animal activities. The absence of infected *B. pfeifferi* suggests a low circulation of *S. mansoni*, but does not rule out the presence of intestinal schistosomiasis cases in the area. The variation in the natural infestation rate of *B. globosus* according the month confirms seasonal transmission of *S. haematobium* in the study area. These observations call for strengthened integrated schistosomiasis control strategies, combining mass treatment with praziquantel, ecological management of snail habitats, and health education on the risks associated with contact with aquatic environments. An analysis of the physicochemical parameters of the waters in the surveyed biotopes is necessary in order to understand their influence on the dynamics of snail population and the dynamics of schistosome transmission.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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