

Biodiversity Record: Freshwater clams in Jurong Lake

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Subjects: Ingalls' unionid clam, *Ensidens ingallsianus* (Mollusca: Bivalvia: Unionidae);
Wood's unionid clam, *Sinanodonta woodiana* (Mollusca: Bivalvia: Unionidae);
Slender unionid clam, *Pilsbryconcha exilis* (Mollusca: Bivalvia: Unionidae);
Tweedie's corbiculid clam, *Corbicula tweediei* (Mollusca: Bivalvia: Cyrenidae).

Subjects identified by: Chan Sow-Yan and Lau Wing Lup.

Location, date and time: Singapore Island, Jurong Lake; 13 March 2022; around 1330 hrs.

Habitat: Freshwater. Artificial lake in urban parkland with shallow limnic water and clay banks lined with granite rocks (Fig. 1).



Fig. 1. Habitat where the four clam species were found. Fig. 2. A live *Ensidens ingallsianus* in-situ with its foot emerging. (Photographs by: Lau Wing Lup)

Observer: Lau Wing Lup.

Observations: Many *Ensidens ingallsianus* of various shell lengths ranging from 30 to 93 mm (Figs. 2–5) were found along the lake bank, including at least 15 live specimens (Fig. 2) and around 20 pairs of articulate valves of dead examples (Figs. 3–5). Algae growths were observed on the posterior outer shell of most individuals. When devoid of blackish stains on the exterior, shells tend to be golden yellow with greenish or brownish lines. Many examples were found with aberrant characters on the shells such as spots on the shell exterior (Fig. 4), inner shell discolouration (Fig. 5), deformed posterior lips (Fig. 6), keloid-like irregular calcification (Fig. 5), and pustule-like blister formation (Fig. 7).

About 16 *Sinanodonta woodiana*, 10 live examples and six dead articulate shells were found sympatrically with *Ensidens ingallsianus* in mud and rock crevices (Fig. 8). The greenish radiating lines on the shell tend to be more obvious on juvenile specimens (Fig. 9). Some of the shells were also observed to have aberrant characters on the inner surfaces such as discolouration, keloid-like irregular calcification and pustule-like blister formation (Fig. 11). One shell has a partially detached and deformed 'double' beak covering another one on the same valve (Fig. 10).

Only one valve of a *Pilsbryconcha exilis* was found (Fig. 12). No live examples were detected despite an extensive search around the water's edge. Four live *Corbicula tweediei* of about 33 mm shell length (Fig. 13) were found in shallow water, and about 20 freshly dead articulate valves of various growth stages were scattered on the strandline. Two of the live samples were noted to have pustule-like growth on their periostracum (Fig. 13).



Figs. 3–7. *Ensidens ingallsianus* shells. Fig. 3. Four examples with periostracum showing variation in shape, colour and pattern. Fig. 4. Shell with spots. Fig. 5. Interior surfaces of valves showing discolouration, keloid-like irregular calcification, and pustule-like blister formation. With a length of 93 mm, this particular shell is apparently the largest on record. Fig. 6. Example with deformed posterior lips. Fig. 7. Close-up of pustule-like blister formation on the inner shell. (Photographs by: Lau Wing Lup)



Figs. 8–11. *Sinanodonta woodiana*. Fig. 8. Ventral view of a live example with its mantle edge exposed, in-situ between rock crevices at the edge of the lake edge. Fig. 9. Shell showing green radiating lines. Fig. 10. An aberrant shell with a partially detached and deformed 'double' beak covering another existing one on the same valve. Fig. 11. Interior surface of a valve with discolouration, keloid-like irregular calcification, and pustule-like blister formation. (Photographs by: Lau Wing Lup)

Remarks: Jurong Lake used to be part of a freshwater swamp forest (Sin et al., 2015). All four bivalve species herein featured are most likely introduced, possibly via the aquarium trade (see Tan & Woo, 2010; Tan et al., 2012; Tan et al., 2013; Ng et al., 2016). The populations of *Ensisidens ingallsianus* and *Sinanodonta woodiana* seem to be well-established and thriving.

This appears to be the first record of a thriving population of *Ensisidens ingallsianus* in Singapore. The species was previously known in the country from individuals encountered in the vicinity of aquaculture (fish and frog) farms in the Lim Chu Kang area in the north-western corner of Singapore Island (Chan, 2008; Tan et al., 2012). One shell with a length of 93 mm seems to be the largest of the species on record (Fig. 5) for an exhaustive search online by the authors did not produce any specimens attaining that size. Interestingly, *Ensisidens ingallsianus* is listed as critically endangered in Malaysia as it has not been found there in the wild for the past forty years despite fairly extensive surveys (Zieritz & Lopes-Lima, 2018).

Sinanodonta woodiana is a well-known invasive species that is widely spread in many parts of the world together with its alien fish hosts. Recent molecular studies reveal that it is a complex of several closely related species with at least seven deeply divergent mtDNA lineages (Vikhrev et al., 2017).

Aberrant shell characters are present on many examples of *Ensisidens ingallsianus*, *Sinanodonta woodiana* and *Corbicula tweediei*. Like the abnormalities found in the stout razor clam, *Tagelus plebeius* by Lomovasky et al. (2005), the development of aberrant characters such as deformed posterior lips, inner shell discolouration, keloid-like irregular calcification and pustule-like blister formation, may have resulted from dysfunctional or compensatory healing process in response to vagaries of the elements, predatory attacks and infection by the metacercariae of gymnophallid parasites.



Fig. 12. Valve of a *Pilsbryconcha exilis*. Fig. 13. Live *Corbicula tweediei* samples with pustule-like growths on the periostracum. Space between black bars is 1 mm. (Photographs by: Lau Wing Lup)

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