

Draft risk assessment report addressing Terms of Reference

Species : *Oncomelania hupensis quadrasi*

1. Taxonomy of the species

Phylum Mollusca

Class Gastropoda

Family Pomatiopsidae

Oncomelania hupensis quadrasi also known as *Oncomelania quadrasi* is a subspecies of *Oncomelania hupensis* – wild type strains only.

Another subspecies (*Oncomelania hupensis hupensis*) is already on the Live Import List.

2. Status of species under CITES

This species is prevalent in large numbers in several regions of the Philippines [1-4]. The species is not listed in CITES. The snails to be imported are derived from laboratory stocks maintained in the Philippines and/or the USA. The laboratory strain has been obtained from wild populations in the Philippines and has not been genetically modified. Occasionally, it may be necessary to source infected snails from wild populations to ensure the lab stocks do not become less pathogenic than endemic isolates.

3. Ecology of the species

Oncomelania quadrasi is a tropical, freshwater snail that is operculated, amphibious and dioecious [1,2,4]. It feeds on green algae, diatoms and decaying vegetative matter. The snail lives in wet environments such as flood plain forests, swamps and sluggish streams, ones usually clogged with vegetation [1,2,4]. The species is susceptible to desiccation in the absence of moisture for prolonged periods [1,2,4].

Life Span: The snail can live for about 4-6 months in the wild, though it can live substantially longer in laboratory conditions. Those snails used to maintain the *Schistosoma japonicum* parasite life cycle in the laboratory will be crushed to harvest the parasite after 3 months post infection [1].

Size and Weight Range / Identification: The snails are small, dextral and generally dark brown in colour with the adult no bigger than 4-6mm in length with 4-6 whorls or spirals in the shell. Except for fine axial lines of growth the shell is rather thin and smooth (see illustration). Males are smaller than females [1,2].

Natural Geographic Range: *Oncomelania quadrasi* is known to occur over most of Mindanao Philippines except in oriental Misamis, in most of Samar, in northeastern Leyte, around Lake Naujan in Mindoro, in Sorsogon in Luzon, and on the island of Siargao northeast of Mindanao [1-4]. These areas have no distinct dry season. Within the endemic islands the distribution is related to topography, usually flat.

Habitat: These are varied and include flood plain forests, swamps, ponds, water logged grasslands and small sluggish streams. They must be freshwater, definitely not brackish. Most often found at sea level elevation, they can occur at higher altitudes. The most noted characteristic of the snail inhabited areas is their flatness which promotes the retention of water. The snail is not migratory, remaining within its established habitat. It has been observed that adult *Oncomelania hupensis quadrasi* can withstand desiccation for about 3 months and there is evidence to suggest that the snail is able to hibernate as a survival mechanism during adverse weather/habitat conditions but, if these are prolonged, it eventually dies [1].

Habitat Requirements: Includes vegetation which provides shade and shelter from sunlight. Defined level of water with sloping banks or water edge which provides breeding or egg laying sites and relative clarity of water. It is believed that well oxygenated water is essential, levels of 3.8 – 9.85ppm of dissolved oxygen. They do not like stagnant and foul water. They appear to prefer a relative neutral pH of soil and water. *Oncomelania quadrasi* is a tropical, fresh water snail so warmer, humid conditions are best. Humidity of around 70-80% and temperatures between 20-30 degrees celsius with optimum being 26 degrees celsius. Mortality increases significantly at much lower temperatures [1].

Social Groupings: The species does not form social groups but do tend to be found in colony clusters.

Harm to Humans: The species in itself does not harm humans however, it is the intermediate host and therefore, if infected, a carrier of the parasite, *Schistosoma japonicum*, which causes the disease Schistosomiasis in humans [3].

Diet: Green algae, diatoms, decaying vegetative matter.

4. Reproductive Biology

Oncomelania quadrasi is dioecious with separate male and female individuals. Reproduction therefore requires copulation between sexes. However, studies have shown that continuous presence of males is not necessary as females, once fertilised, can continue to lay fertile eggs for several months. Sexual maturity is reached at 10-16 weeks or approximately 3.5mm in size. Copulation occurs both day and night. Eggs are laid singly on solid objects in the water surface and at inter-phase between water and soil on sloping banks. A fertilised female can lay 2 eggs every 5 days. Hatching occurs 10-15 days after oviposition. There is no evidence to indicate that the snails are able to hybridise with other snail species [1,2,4].

5. Feral Populations

There is no record of feral populations of this species in Australia or in other parts of the world.

Pest Status: *This species is not considered a pest in its natural range. Much of the potential risk relates to the ability of the snail to carry disease causing parasites infective to humans.*

6. Environmental Risk Assessment

It is possible that *Oncomelania quadrasi* could adapt well to the conditions of the tropical north of eastern Australia if released and potential for the species to compete with other snails in the fresh water environment. It is also possible that prolonged periods of drought would have the potential to decimate any colonies. The snail's role as a potential pest is primarily due to its ability to carry human disease causing parasites. This risk potential is considerably reduced through factors of better sanitation conditions in Australia and the lack of a present reservoir of infected mammals. However, this species will only be imported for scientific research purposes and will be maintained in Biosecurity approved quarantine premises under strict regulatory controls. The laboratory at QIMR Berghofer has maintained the *Oncomelania quadrasi* snails for 25 years. Last imported in 1999. Strict and diligent controls on the snails and the parasites have ensured that there has been no release of live snails or viable tissue from this laboratory.

7. Likelihood that the species could establish a breeding population in Australia.

Oncomelania quadrasi could potentially establish a breeding colony if released from human control in a suitable fresh water habitat in a tropical region of adequate rainfall and humidity such as the tropical north east area of Queensland. However, there are several factors that may limit the snails ability to thrive and spread here in Australia. The snail is susceptible to desiccation in prolonged dry periods where the shallow

waters which it inhabits dry up [1]. The young snails, upon hatching, are primarily aquatic for the first two weeks becoming amphibious later [1,2,4]. It is at this stage that the snails are most vulnerable to dry conditions, though the adults have the ability to survive longer as they are able to aestivate in dry conditions. It does not thrive at colder temperatures, the optimum being around 26 degrees celsius and mortality increases significantly when temperatures drop below 10 degrees [1].

It does not tolerate stagnant, foul water, requiring well oxygenated water of relative clarity. The snails are not compatible with fast currents, requiring slow, sluggish water movement [1].

Unlike a number of snail species which are hermaphrodite and thus capable of self fertilisation, the *Oncomelania quadrasi* is dioecious with separate male and female individuals requiring copulation between sexes to breed. This can be a major limiting factor.

8. Potential impact of the species should it become established in Australia

The species feeds on green algae, diatoms and decaying vegetative matter in freshwater locations. In such a habitat it could compete with other small aquatic snails. The species is unlikely to affect agriculture or contribute to land degradation.

The risk to humans from this species lie in its capacity as an intermediate host to the pathogenic blood fluke *Schistosoma japonicum* which causes the disease Schistosomiasis. These parasites infect humans by penetration of the skin in freshwater environments. Though very host specific with regard to the snail host it is not limited to humans as the primary mammalian host, being infective to several mammalian species including cows, pigs, dogs, goats, rats and mice, rabbits and hares. It is possible that it may also be infective to several native species. Maintenance of the life cycle of *Schistosoma japonicum* in natural environments in Australia is highly unlikely as it would require

1. An established colony of *Oncomelania quadrasi*
2. Infected human or animal to defecate into the body of water where the snail host occurs.
3. Frequent visits of potential mammalian hosts to that water body.

While it is likely that humans in Australia carry the disease, the prevalence is quite low (limited to travellers or immigrants from the endemic areas of the Philippines) and too low to sustain a viable risk. It is extremely unlikely that there are any infected animals present in Australia outside the strict controls of Biosecurity containment facilities at research institutes.

9. Restrictions

This species should only be imported for the purposes of research where strict Biosecurity controls are enforced. The parasites will be sourced from laboratory maintained stocks that have not been genetically modified. It may be necessary on occasion to refresh these stocks with wild sourced infected snails to ensure that the life cycles that the research is being conducted on do not become less pathogenic than that occurring in the natural environment.

The snails should be transported by approved couriers or accredited Biosecurity approved persons in approved biological containers which meet IATA standards. The snails to be imported may be uninfected or infected with *Schistosoma japonicum* parasite (*Schistosoma japonicum* is on the Live Import List already). After entry into Australia, the snails will be held in Biosecurity approved Bio-secure quarantine premises approved for the containment of snails. Currently, *Oncomelania hupensis hupensis*, *Biomphalaria glabrata*, *Bulinus truncates* and *Oncomelania hupensis quadrasi*, all snail hosts to various strains of Schistosome parasites, are held in such

facilities at QIMR Berghofer Medical Research Institute. The parasites derived from these snails are used for medical research at this Institute.

10. Summary of proposed activity.

Oncomelania quadrasi are used in conjunction with mice for the maintenance of the life cycle of the human parasite *Schistosoma japonicum*. Laboratories at QIMR Berghofer have been conducting research on the tropical disease Schistosomiasis and the disease causing parasite *Schistosoma japonicum* for 25 years. To enable this research it is necessary to maintain the parasite life cycle at the research facility. *Oncomelania quadrasi*, as the intermediate snail host to the Philippine strain of this parasite, is a vital part of that life cycle. We have successfully maintained both the snails and the parasite since 1999 when we last imported infected *Oncomelania quadrasi* snails from the Philippines. However, after so many years it has become apparent that our parasite life cycle is in need of a genetic rejuvenation. To do this we would need to import new infected snails to provide fresh parasites to booster the life cycle. This is critically important as this parasite is used in laboratory experiments to study pathogenesis of the parasite in animal models and to develop vaccines and new drugs to control the parasite. *Schistosoma japonicum* is highly host specific and the Philippine strain of the parasite can only be maintained in *Oncomelania quadrasi* snails [1]. The parasite cannot be cultivated in vitro and must be maintained through the snail and animal host [3]. The snails are kept in enclosed aquaria, fed on algae and decaying leaf matter. For harvesting of the parasite, infected snails will be crushed to release the infective parasitic larva, cercaria, which is then collected using bacterial loops. These are then used to infect laboratory mice for life cycle maintenance or various experiments.

At the completion of experimentation, all waste is sterilized by autoclaving. Collected samples such as animal tissue and parasites will remain under Biosecurity controls until treated via a Biosecurity approved inactivation method such a fixing with approved fixatives, DNA or RNA extraction, protein extraction etc. Thorough and complete records will be maintained on all activities and sample collections and treatments as per Biosecurity requirements. Regular shipments are unlikely to be necessary, possibly a shipment of 50-100 snails per year will be imported.

This research is critical and ongoing as Schistosomiasis continues to be a major tropical disease affecting millions of people.

11. Guidelines on how the species should be kept.

Imported snails will be transported under strict Biosecurity guidelines in secure approved biological shipping containers that meet IATA packing standards. The snails will be double enclosed in these containers. The containers will be opened only inside Biosecurity approved quarantine facilities and the snails placed into enclosed, aerated aquaria within the facility. These facilities are set up so as to prevent any liquid escaping with no floor drains present, bunding is in place to contain any water should there be an accidental spill. The only drainage point, at the water supply, is heavily filtered with extremely fine mesh in place to prevent any minute solids escaping and this is situated high off the floor and away from work surfaces. All waste generated within the facility, both liquid and solids, is autoclaved before disposal and there is no movement of equipment or glass and plastic ware from the facility without prior decontamination. The snail rooms are highly secure, with restricted key access to only a few Biosecurity approved, trained personnel who must wear appropriate PPE of water proof shoe covers, gloves and lab coats which must all be removed before exiting the containment rooms.

Animals that are infected with the parasite will be transported within Biosecurity approved containment to the animal holding facility which is also an approved Biosecurity quarantine facility. Parasite or animal samples

which are collected within the snail facility or animal facility will be transported in double sealed containment and be clearly identified as quarantine material to the laboratory tissue culture rooms, which are also Biosecurity approved quarantine facilities, where further analysis of the samples will take place. All quarantine waste from these facilities is autoclaved before disposal. All of these facilities are contained within the institute at the one site. All movement and treatments of quarantine material is recorded. No quarantine material is removed from quarantine without prior written approval from Biosecurity.

12. Commonwealth, state territory legislative controls.

The species is restricted by order of Biosecurity Australia and can only be kept in Biosecurity approved quarantine facilities. The Department of Agriculture Import Permits for this species will be similar to those currently covering *Oncomelania hupensis hupensis*, *Biomphalaria glabrata* and *Bulinus truncatus*. Conditions listed on the import permits will be abided and the species will be kept in a Biosecurity Approved Arrangement premises with access restricted to trained AA accredited persons as required under Biosecurity legislation.

References.

1. T. P. Pesigan, N. G. Hairston, J. J. Jauregui, E. G. Garcia, A. T. Santos, B. C. Santos, and A. A. Besa. Studies on *Schistosoma japonicum* infection in the Philippines 2. The molluscan host. *Bull World Health Organ.* 1958; 18(4): 481–578.
2. B. C. Dazo and R. G. Moreno Studies on the Food and Feeding Habits of *Oncomelania quadrasi*, the Snail Intermediate Host of *Schistosoma japonicum* in the Philippines. *Transactions of the American Microscopical Society* 1962; 81 (4), 341-347.
3. E. G. Garcia. Schistosomiasis japonica. Technical Report Series No. 3, 59 pages. Philippine Council for Health Research & Development, Dept of Science and Technology (1988).
4. B. L. Blas (ed). Handbook for the Control of Schistosomiasis japonica. Monograph on *Schistosoma japonicum* infection in the Philippines. Schistosomiasis Control Service, Department of Health, The Philippines. Chapter IV. The snail intermediate host, pp. 19-31.

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