# Managing the Spread of Invasive Apple Snails and Possible Utilization in Aquaculture: A Case in Myanmar

*Aung Ko Win, Htar Htar Naing,* and *Ravindra C. Joshi*

In literature, many *Pomacea* spp. have commonly been referred to as golden apple snails (GAS), often without clarifying specifically which species was involved or indeed simply assuming it to be *Pomacea canaliculata* (Cowie *et al*., 2017). For clarity, this article avoids this ambiguous common name designation, especially because at this time, it is very difficult to pinpoint the number of *Pomacea* spp. that have been introduced to Myanmar, unless preserved specimens are examined using molecular and morphological approaches (Hayes *et al*, 2008). Nonetheless, correct identification of the invasive species is the most fundamental prerequisites when attempting to control the spread of such species (Joshi *et al*., 2017).

Invasive apple snails (*Pomacea maculata* and perhaps, also *Pomacea canaliculata*) were first introduced to the Northern Shan State of Myanmar from the People's Republic of China in the early 1990s as food for humans, and later for the biological control of aquatic weeds in lakes. Aside from the deliberate introductions, the other pathways for invasive apple snails are river floods during the rainy season. A few years after such deliberate introductions, the non-native apple snails quickly spread to many parts of the country (**Figure 1**) through irrigation canals, irrigated fields, rivers, waterways, and waterlogged areas. As the result, the snails have become a major pest of the country's rice industry damaging rice nurseries, direct-seeded rice fields as well as the fields with newly transplanted rice (Khin *et al*., 2006; Win, 2017; Myint and Ye, 2017).

Species of *Pomacea* are listed as one of the world's 100 worst invasive species (GISD, 2018). When the snails invade and get established in rivers and wetlands, they pose high risk to the sustainability of the areas' native biodiversity and in particular, to the survival of endangered species such as the native aquatic plants, fish, amphibians, and birds. Occurrence of snails also reduce the macrophyte biomass through selective herbivory, seriously impacting the ecosystem services such as availability of fresh and good-quality water, thereby reducing the availability of plants and fish as food, and making recreation activities less attractive due to diminished bird and fish populations, and growth of algal bloom (Carlsson, 2017). The exact area infested by invasive apple snails in Myanmar is not known because of the lack of systematic field surveys.


**Figure 1.** Map of Myanmar showing the distribution of invasive apple snails (*Pomacea* spp.) as of 2017

*(Source: Win AK, 2017)*

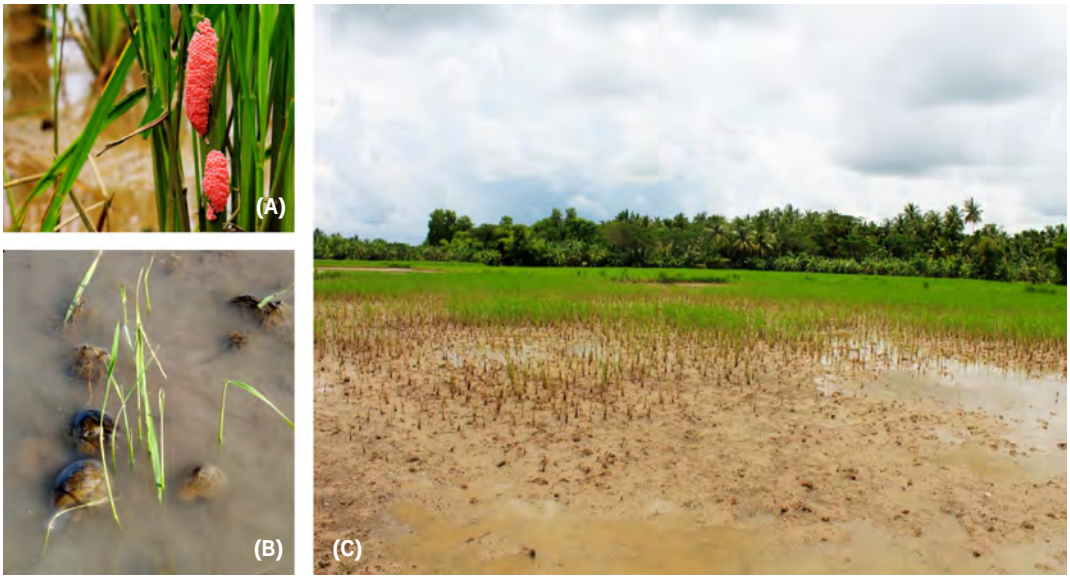


**Figure 2.** Invasive apple snails (*Pomacea* spp.) egg masses on rice plants **(A)**, and damages on transplanted rice **(B)** and direct-seeded rice field **(C)**, Dedaye Township, Ayeyarwaddy Region, Myanmar

*(Photos: Win AK)*

However, during the rainy season, 100 % damage to rice nurseries and young seedlings could be observed due to snail infestations (**Figure 2**). Thus, many farmers have become reluctant to grow rice.

## Management Measures

Majority of the rice farmers in Myanmar have resorted to hand picking of the snails and egg masses. Molluscicides application had also been used followed by duck herding and adopting some cultural control measures (**Figure 3**). Two kinds of synthetic molluscicides active ingredients are registered in Myanmar (**Table**).

The cost for molluscicides, hand pickings, and replanting ranged from Kyats 15,814 to 79,488 per acre (**Figure 4**). More international, regional collaboration efforts are needed to develop sustainable, easy to-do, cost-efficient, and environment-friendly management techniques to reduce crop losses from apple snail invasions in the midst of the changing climate.

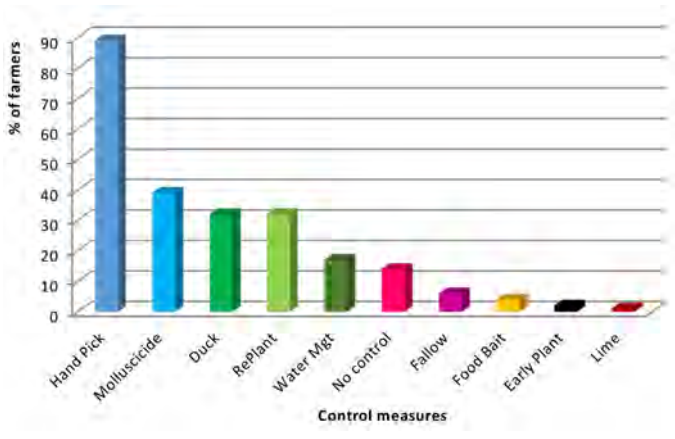


**Figure 3.** Practices adopted by Myanmar rice farmers to control the invasive apple snails (*Pomacea* spp.) in the surveyed areas

*(Source: Win AK, 2017)*

**Table.** Molluscicides registered in Myanmar as of 2016

| Trade Name | Active Ingredient | Distributor |
|---|---|---|
| Bayluscide 70WP | Niclosamide 70 % w/w | Bayer AG, Germany |
| Rainlucide 70WP | Niclosamide 70 % WP | Close Friend Company Ltd. |
| Kensamide 250EC | Niclosamide 250 EC | Grand Agrocare Company Ltd. |
| Benride 700WP | Niclosamide 700g/ kg WP | Huynh Zaw Company Ltd. |
| Snailcide 70WP | Niclosamide 70 % WP | Myanma Awba Group Company Ltd. |
| UNIK | Niclosamide 70 % WP | Myanma Awba Group Company Ltd. |
| Khayu Sae 70WP | Niclosamide 70 % WP | Myanmar Arysta Life Science Company Ltd. |
| Agro-Kharu 70WP | Niclosamide 700g/ kg WP | Myanmar Asiatic Agricultural Company Ltd. |
| Snail Out | Niclosamide 70 % WP | Wah Agricultural Chemicals Trading Company Ltd. |
| Mercury | Metaldehyde 10 % G | Myanma Awba Group Company Ltd. |

*Source: Pesticides Registration Board, Plant Protection Division, Department of Agriculture, Myanmar*

## Way Forward

One novel way of controlling the further spread of the invasive apple snails throughout Myanmar could be to pursue research studies on the use of the snails in aquaculture activities.

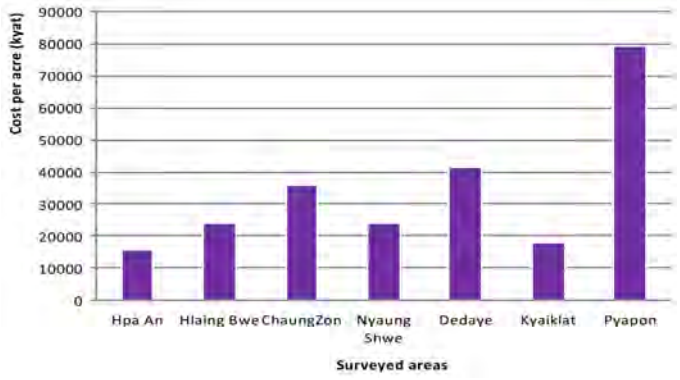


**Figure 4.** Comparison of average cost per acre to control invasive apple snails (*Pomacea* spp.) in the surveyed areas, Myanmar
*(Source: Win AK, 2017)*

As mentioned by Sathya Khay *et al*. (2018), a number of aquaculture research studies have shown that the invasive apple snails could be used as cheap alternative to fish meal in the preparation of feeds for the culture of various aquatic species, lowering aquaculture production costs and increasing the incomes of fish farmers. Considering that Myanmar is also engaged in rice-prawn farming (Khin Ko Lay, 2007), the use of the snails as protein supplement in the preparation of feeds for the giant freshwater prawn should be specifically explored to improve production of prawns from the rice-prawn culture system. Moreover, based on the experiences of many countries (Sathya Khay *et al*., 2018), the invasive apple snails have also been successfully used as feeds in the culture of other freshwater as well as marine aquatic species, *e.g.* common carps (*Cyprinus carpio*), black tiger prawn (*Penaeus monodon*), siganids (*Siganus guttatus*).

Through such research activities, the extent of snail infestation in rice fields could be reduced. In such cases, the invasive apple snails would no longer be considered as pests but rather as an economic resource for the aquaculture industry. In line with the suggestions of Sathya Khay *et al*. (2018), in pursuing such endeavors, international and regional concerted efforts should be pooled for the development of ecologically sustainable invasive apple snail management approaches for the Southeast Asian region.

## References


Carlsson, N.O L. (2017). Invasive Apple Snails are Threatening Natural Ecosystems in Southeast Asia, Europe and North America. ***In***: Joshi RC, Cowie RH, and Sebastian LS. (eds). *Biology and management of invasive apple snails*. Philippine Rice Research Institute (PhilRice), Maligaya, Science City of Muñoz, Nueva Ecija 3119, Philippines; pp 45-61

Cowie, R.H., K.A. Hayes, E.E. Strong, S.C. Thiengo. (2017). Non-native Apple Snails: Systematics, Distribution, Invasion History and Reasons for Introduction. ***In***: Joshi RC, Cowie RH, and Sebastian LS. (eds). *Biology and management of invasive apple snails*. Philippine Rice Research Institute (PhilRice), Maligaya, Science City of Muñoz, Nueva Ecija 3119, Philippines; pp 3-32

GISD (Global Invasive Species Database). (2018). Species Profile: *Pomacea canaliculata*. [*http://www.iucngisd.org/gisd/species.php?sc=135*]. Accessed 02 October 2018

Hayes, K.A., R.C. Joshi, S.C. Thiengo, R.H. Cowie. (2008). Out of South America: Multiple Origins of Non-native Apple Snails in Asia. *Diversity and Distributions*, 14: 701-712

Joshi RC, Cowie RH, and Sebastian LS. (eds). (2017). Biology and Management of Invasive Apple Snails. Philippine Rice Research Institute (PhilRice), Maligaya, Science City of Muñoz, Nueva Ecija 3119, Philippines; 406 p

Khin Ko Lay and Thin Thin Oo. (2007). Rice-Prawn Culture: Experience of Myanmar. ***In***: Fish for the People Volume 5 No. 2 (2007). Southeast Asian Fisheries Development Center, Bangkok, Thailand; pp 33-36

Khin, O., O.O.Thein, M. Thwin, N.N. Yin. (2006). Efficacy of Selected Insecticides against the Golden Apple Snail, *Pomacea canaliculata* (Lamarck) in Rice in Myanmar. ***In***: Joshi RC, and Sebastian LS. (eds). *Biology and management of invasive apple snails*. Philippine Rice Research Institute (PhilRice), Maligaya, Science City of Muñoz, Nueva Ecija 3119, Philippines; pp 315-317

Myint, K.K.M. and K.N. Ye. (2017). Apple Snails (*Pomacea* spp.) in Myanmar: Current Status and Integrated Management Activities. ***In***: Joshi RC, Cowie RH, and Sebastian LS. (eds). *Biology and management of invasive apple snails*. Philippine Rice Research Institute (PhilRice), Maligaya, Science City of Muñoz, Nueva Ecija 3119, Philippines; pp 209-211

Sathya Khay, Ravindra C. Joshi, and Soetikno S. Sastroutomo. (2018). Invasive Apple Snails (*Pomacea* spp.): Current Status and Integrated Management in Lowland Rice Fields of Cambodia. ***In***: Fish for the People, Volume 16 No. 3 (2018). Southeast Asian Fisheries Development Center, Bangkok, Thailand; pp 34-37

Win, A.K. (2017). Distribution, Population Fluctuation, Pest Status and Fertilizer Induced Mortality of Golden Apple Snail *Pomacea canaliculata* (Lamarck) (Gastropoda: Ampullariidae) in Selected Rice Growing Areas of Myanmar. Yezin, Myanmar: Yezin Agricultural University, MSc thesis, 85pp


## About the Authors


**Mr. Aung Ko Win** is Extension Communication Specialist of the International Fertilizer Development Center, Myanmar.

**Dr. Htar Htar Naing** is Associate Professor of the Department of Entomology, Yezin Agricultural University, Myanmar.

**Dr. Ravindra C. Joshi** is Associate of CABI-SEA, Malaysia; Technical Advisor on Invasive Apple Snails to DELTAMED (Asociación de Deltas del Mediterráneo), Amposta, Spain; Senior Adviser on Invasive Apple Snails, NEURICE Project-Funded by European Commission, Spain; Pacific Coordinator, Tropical Agriculture Association (UK); SAFE-Network Pacific Islands Coordinator; and Visiting Adjunct Professor at the University of the South Pacific, Fiji. E-mail: *rcjoshi4@gmail.com*, *ravindra.joshi@usp.ac.fj*