

Occurrence of *Haedus vicarius* (Drake) (Hemiptera: Tingidae) in Malaysia as Potential Biological Control of *Urena lobata* L. (Malvaceae)

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Introduction

Urena lobata L. is an annual weed of the Malvaceae family. Although the original distribution region of *U. lobata* is unknown, it is most likely Asiatic (i.e., China and Southeast Asia). According to Austin (1999), some authors consider Asia as the native region, while others claim that the true origin is unclear. This plant has a pan-tropical distribution, growing in moist tropical and subtropical locations around the world, including Asia, tropical Africa, Australia, North, Central, and South America, the West Indies, and Pacific islands (PIER, 2012; USDA-ARS, 2012). This species is also a fast-spreading weed that can quickly colonise new environments, creating dense patches and monospecific stands in suitable locations (Austin, 1999).

The weed is very common in Malaysia as it invades on roadsides, open areas, pastures, and abandoned gardens. Neither farmer nor public ever complaint on its existence. In India and China, *U. lobata* was traditionally used as a traditional medicinal plant (Gao et al., 2015). Traditional herbalists used extracts of the leaves and root to cure a variety of diseases, including malaria, gonorrhoea, leucorrhoea, hema-temesis, carbuncle, trauma, bleeding, cold, fever, discomfort, numbness induced by rheumatism, wounds, toothache, and inflammation. In comparison to New Zealand, *U. lobata* has caused a significant problem, especially in the livestock industry (Barth et al., 1994; Diaz, 2011). The invasive weeds have destroyed the surrounding ecosystem and became one of the big obstacles to farmers. They compete for nutrients with other crops and eventually reducing the crop yield (Korav et al., 2018; Maru et al., 2018). Herbicide spraying is a common method of weed control. This is because the results are rapid and easy to implement as well as highly available on the market. However, long-term usage of herbicides, may have negative impact on the environment and ecology (Buhler, 2002; Baki, 2004; Manalil, et al., 2011). Hence, it is crucial to find the alternative for the problem such as biological control agent to help in controlling extensive spread of the weed. It is seen to be as the promising feasible long term option solution.

Drake and Ruhoff (1965) reported that there are 18 species of Tingidae in Federation of Malaya that play an essential role in weed control, including *Haedus vicarius* (Drake). The larvae and adults feed on the sap from the leaves and are found in large enough numbers to be considered virulent. As a result, this study was carried out to validate the occurrence of *H. vicarius* in Malaysia as a potential *U. lobata* biocontrol agent. Data gathered from this study might be useful in the future biocontrol program not only in Malaysia but in other country as well.

Materials and Methods

Sampling was conducted along the roadside of Paya Indah Wetlands in Dengkil, Selangor, where it was discovered that the area was abundant with *U. lobata*. The leaves with symptom of infestation were collected and brought back to the laboratory. For identification purposes, 10 individuals from each stage

were taken for microphotography and measurements using a Dino-Lite Digital Microscope with DinoCapture 2.0 software (Figure 1). Total body length was measured along the longitudinal mid-line from the head apex to the posterior end of the abdomen or wings, excluding the ovipositor and antennae. Width was measured at the widest point of the thorax.

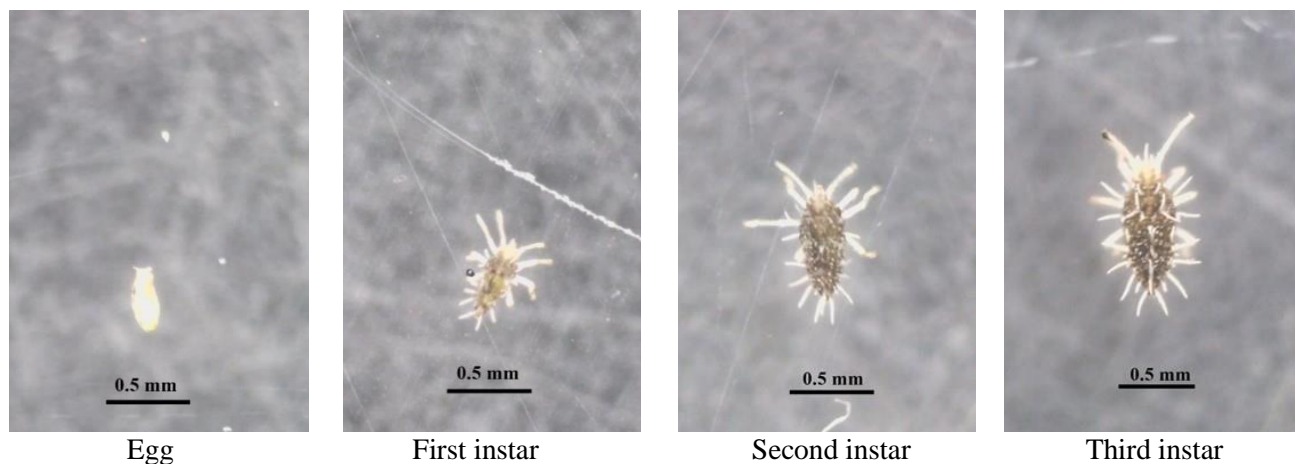
Results and Discussion

Based on the morphological identification it is confirmed that insects that were collected were *H. vicarius*. Another physical characteristic of the adult that can be seen as described by Tigvattnanont (1991) was narrow-elongated, greyish to dark brown when age, and the region outside of the wings is a black band clear, and the flattened areas behind the head are gauze-like or lace-like. The length and width for male and female adult were measured at 3.047 ± 0.108 mm and 0.7653 ± 0.033 mm, 3.147 ± 0.111 mm, and 0.7937 ± 0.035 mm, respectively. Males have a rounded convex genital capsule at the end of the sternite, whilst females have a smooth genital capsule with a visible ovipositor (Figure 2).

Haedus vicarius is a hemimetabolous insect that goes through an incomplete metamorphosis life cycle, egg, nymph and adult stage. Eggs are small, elongated ovules with a rounded cap (operculum). The cap is brownish in colour and has a slight taper near the top. Eggs were implanted in the vegetative tissue solitary; newly placed eggs are white and turn pale yellow as they age. When hatching, the colour of the eggs turns dark brown. The mean egg size is 0.363 ± 0.03 mm length and 0.155 ± 0.018 mm width. Tigvattnanont, (1991) reported each female oviposition stage lasts 8.49-9.53 days (average 8.94), and 133-265 eggs can be deposited (average 178.93 ± 0.47 days). The nymph of this insect consists of five instars stage. Each stage is similar in that each tentacle has four segments. The first two segments are shorter than the last, while the third segment is the longest. The mean first instar size is 0.451 ± 0.027 mm length and 0.186 ± 0.011 mm width. The mean second instar size has been measured at 0.621 ± 0.055 mm length and 0.275 ± 0.092 mm width. While mean size of third instar is 0.890 ± 0.031 mm length and 0.381 ± 0.013 mm width. The fourth instar size is 1.238 ± 0.032 mm length and 0.522 ± 0.021 mm width. The fifth instar size is 1.759 ± 0.079 mm length and 0.709 ± 0.050 mm width (Table 1).

Symptoms on *Urena lobata*

Nymphs and adults of *H. vicarius* fed on the cell protoplast of leaf parenchyma and consequently left chlorotic spots on the surface of leaves. The damage can reduce the plant's photosynthesis, which leads to early leaf drop. In more severe infestations, complete defoliation may occur. Leaves that have been extensively injured by this insect are white at first, then become yellow, and eventually fall off (Tigvattnanont, 1991) (Figure 3).

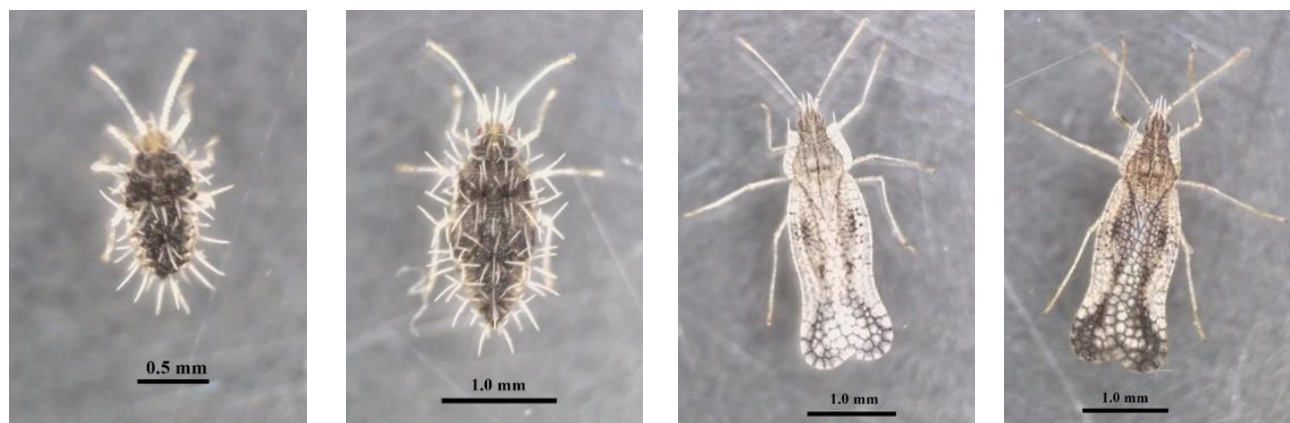


Egg

First instar

Second instar

Third instar



Fourth instar

Fifth instar

Adults

Adults

Figure 1: The life cycle of *Haedus vicarius* was taken by using a Dino-Lite Digital Microscope with DinoCapture 2.0 software.

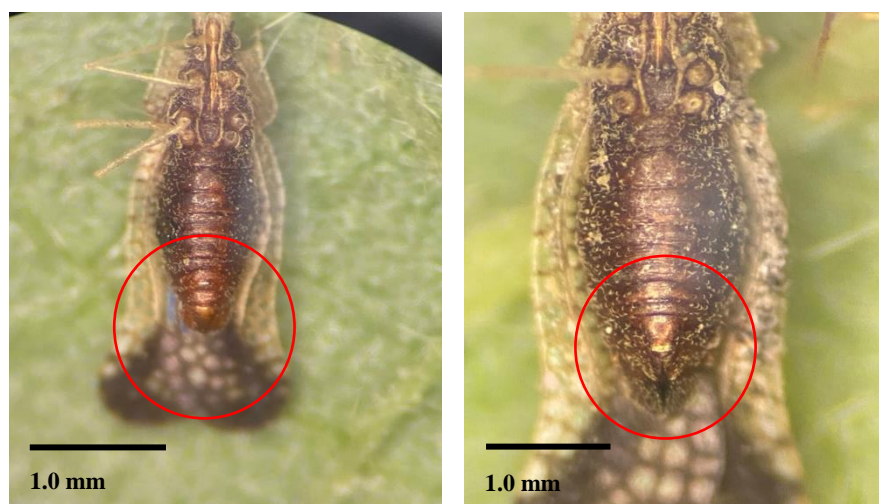


Figure 2: Different between male (left) and female (right) on their genital capsule.

Table 1: Body measurements (mean±standard deviation), given in millimetres (mm).

Stage	n=10	Total Length (mm)		Total Width (mm)	
		Mean	Range	Mean	Range
Egg		0.363±0.031	0.340-0.442	0.155±0.018	0.135-0.154
Nymphal instar	1	0.451±0.027	0.412-0.485	0.186±0.011	0.178-0.205
	2	0.621±0.055	0.541-0.718	0.275±0.092	0.261-0.290
	3	0.890±0.031	0.827-0.925	0.381±0.013	0.366-0.408
	4	1.238±0.032	1.173-1.278	0.522±0.021	0.493-0.550
	5	1.759±0.079	1.644-1.815	0.709±0.050	0.613-0.763
Adult Male		3.047±0.108	2.878-3.203	0.7650±0.033	0.725-0.830
Adult Female		3.143±0.111	2.875-3.300	0.7937±0.035	0.723-0.847

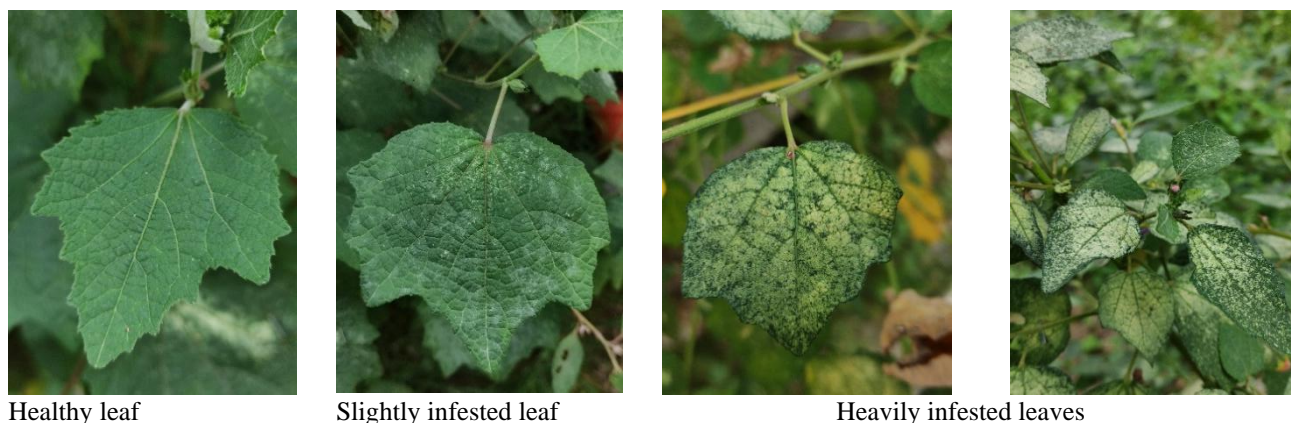


Figure 3: Symptoms on *U. lobata* before and after being infested by *H. vicarius*.

Conclusions

The study has confirmed the presence of *H. vicarius* in Malaysia based on the key morphological identification. This revealed a prospect for biological control agent of *U. lobata* in Malaysia. However, more research on abundance, distribution, and host specificity tests are needed to verify it as a promising biological control agent for *U. lobata*.

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