

## PRELIMINARY REPORT OF A PARASITOID WASP ON *Achaea serva* IN COTO ISLAND, QUANG NINH PROVINCE

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### ABSTRACT

*Achaea serva* is a serious insect pest of *Pouteria obovata* trees in CoTo island, Quang Ninh province, Vietnam. Its caterpillars feed on the host foliage and sometimes heavy damage results in complete defoliation and tree mortality. Biological control is an effective approach to suppress the population of *A. serva*. The present study provides information on a parasitoid wasp, which was found in *A. serva* larvae and pupae. Based on the morphological characteristics, our study preliminarily concluded that this parasitoid wasp belongs to the genus *Glyptapanteles*. The parasitism was more frequently observed in pupae than larvae, and the parasitism rate was highest in Mom Quan Y, followed by Hong Hai and Nam Dong. This finding would be helpful in the biological control programs of *A. serva* in CoTo island and other coastal provinces of Vietnam.

**Từ khóa:** *Achaea serva*,  
CoTo, insect pest,  
morphology, parasitoid  
wasp

### Bước đầu ghi nhận ong ký sinh *Glyptapanteles* sp. (Hymenoptera: Braconidae) trên sâu ăn lá Chối tại Cô Tô, Quảng Ninh

Sâu ăn lá (*Achaea serva*) là sinh vật gây hại nguy hiểm cho cây Chối ở đảo Cô Tô, tỉnh Quảng Ninh. Sâu non thường ăn trụi tán lá và đôi khi làm chết cây. Nghiên cứu này nhằm xác định loài ong ký sinh trên sâu non và nhộng của sâu ăn lá Chối. Dựa trên đặc điểm hình thái, loài ong ký sinh này được xác định thuộc giống *Glyptapanteles* (Hymenoptera: Braconidae). Chúng ký sinh ở giai đoạn nhộng nhiều hơn so với sâu non và trong số ba địa điểm nghiên cứu, tỷ lệ ký sinh cao nhất lần lượt là Mom Quân Y, Hồng Hải và Nam Đông. Kết quả nghiên cứu này sẽ góp phần phát triển loài ong ký sinh *Glyptapanteles* sp. trong phòng trừ sâu ăn lá Chối ở Cô Tô và các vùng duyên hải tại Việt Nam.

**Keywords:** *Achaea serva*,  
Cô Tô, hình thái, ong ký  
sinh, sâu hại

## I. INTRODUCTION

*Pouteria obovata* (Sapotaceae) lives wildly in several types of forests and in mixtures of the woody species in natural forests. This plant species distributes along coastal areas of East, South and Southeast Asia (Hoang and Thao, 2015; Shimizu and Tabata, 1991; Suzuki *et al.*, 2005) where it well survives in adverse weather conditions (Hoang and Thao, 2015; Pesiu *et al.*, 2016). In Malaysia and Indonesia, due to its high adaptability to sandy soil, *P. obovata* are grown for the purposes of ecological services and environmental protection around cities (Pesiú *et al.*, 2022). In Vietnam, the plant plays essential roles in protecting sea dikes, preventing erosion, limiting the harmful effects of climate change, especially in the condition of global warming, and natural disasters. In recent years, *P. obovata* has become one of the target trees for the national programs in relation to the coastal forest protection and restoration (Hoang and Thao, 2015).

The total area of *P. obovata* forests in CoTo Island, Vietnam was estimated about 268 hectares, and it is also the largest primary *P. obovata* forest in the country (Hoang and Thao, 2015). Local peoples consider *P. obovata* as “a green wall” because of its great potential for risk reduction of wind break, waves, and sand. With the purpose of responding to climate changes over the years, the Forest Protection and Management Department in CoTo Island have made great efforts to manage and protect primary *P. obovata* forests, including the annual expansion of *P. obovata* area.

In 2014, *A. serva* occurred and attacked *P. obovata* trees in CoTo island, northern Vietnam, but heavy infestation was observed in 2021 (Hinh *et al.*, unpublished). This

caterpillar feeded on the foliage, from the outside to the main vein and from the apex of the leaf down to the petiole. Severe infestation sometimes led to tree mortality. *Mimusops elengii* trees in southern of the country were additional host of this insect pest.

Biological control plays an increasing important role in integrated pest management (IPM) programs (Waage and Greathead, 1988). The use of natural enemies comprising parasitoids, predators and entomopathogens are the most effective, environemntally sound and cost-effective approach to control insect pests (Ballal and Verghese, 2015). Parasitoids (wasps, bees, flies, and ants) are the natural enemies most used around the world (Flint and Dreistadt, 1998). Several previously identified species of parasitic wasps have shown to significantly suppress the larval population of different orders associated with Coleoptera, Lepidoptera, Diptera, Neuroptera, Strepsiptera, Trichoptera, and Hymenoptera (Gates *et al.*, 2012). *Glyptapanteles* wasps (Hymenoptera: Braconidae) are among the most abundant species parasitizing a broad range of important pests such as *G. liparidis*, *G. fulvipes* and *G. porthetriae* in *Lymantria dispar*, *G. hypermnestrae* in *Elymnias hypermnestra* (Gupta and Pereira, 2012).

The primary objective of this study was to provide preliminary information on the presence of parasitoid wasp species (*Glyptapanteles* sp.). Due to status of severe damage by *A. serva* in *P. obovata*, the present study is expected to assisst in developing a biological control measure of *A. serva*.

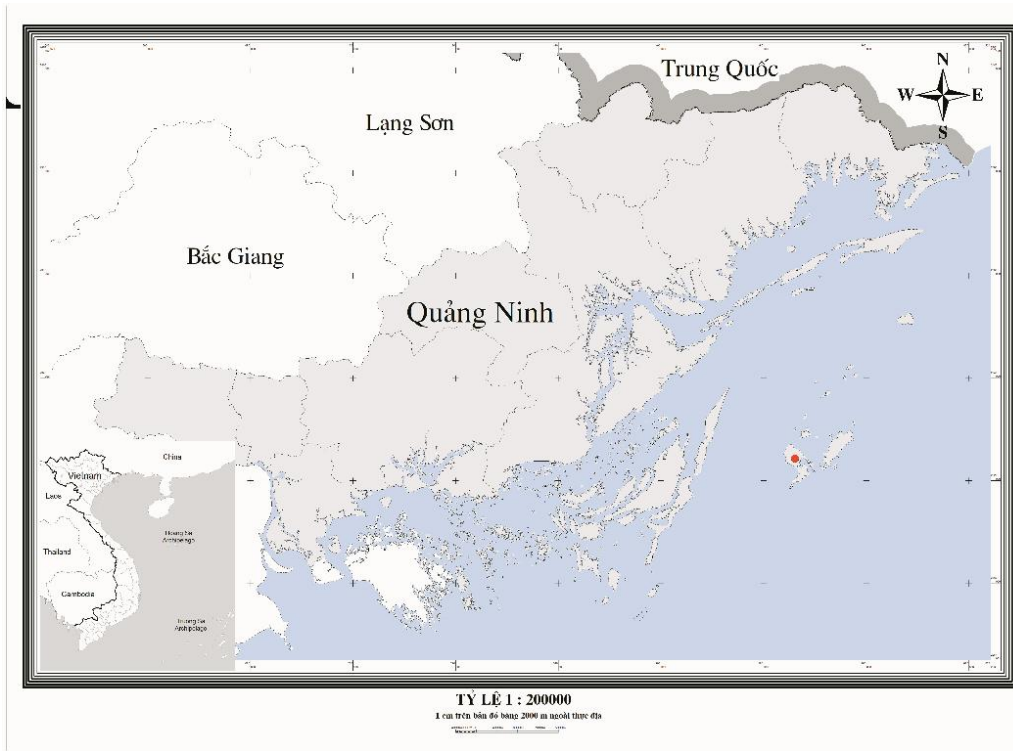
## II. MATERIALS AND METHODS

### 2.1. Sampling

In September and October 2021, one hundred and fifty final larval instars and one

hundred and fifty pupae of *A. serva* were collected on infested *P. obovata* trees in Nam Dong (21°01'286"N; 107°74'731"E), Mon Quan Y (21°01'182"N; 107°75'501"E) and Hong Hai (21°00'248"N; 107°76'166"E),

a natural coastal forest in CoTo island, Quang Ninh province (Figure 1). The detailed numbers of individuals at two developmental stages of insects from three sites were shown in Table 1.



**Figure 1.** Location where parasitoid wasps were collected. Red dot is CoTo island in Quang Ninh province

The site had an altitude of 6 - 30m above sea level and were 20 - 100 m from the beach. The collected larvae and pupae were transported to the laboratory of the Forest Protection Research Centre (FPRC), Vietnamese Academy of Forest Sciences (VAFS) in Hanoi (21°04'19"N; 105°46'36"E), where they were reared

individually in net cages on their host fresh leaves until emergence of adult moths. Average temperature and relative humidity in the laboratory room were 25°C and 70%, respectively. Parasitized insects were transferred into each 50 mL glass vial with the top covered by cotton mesh to allow air exchange.

**Table 1.** The number of larval and pupal individuals collected in Nam Dong, Mom Quan Y and Hong Hai communes were reared in the laboratory

Sampling site	Parasitized stage	
	Larvae	Pupae
Nam Dong	40	50
Mon Quan Y	45	52
Hong Hai	65	48

## 2.2. Morphological characterization

Initial identification of wasps was done based on the external morphological characteristics of 10 *Glyptapanteles* adults using the keys to genera given by Arias-Penna (2019). The voucher specimens were stored in the insect collection of the Forest Protection Research Centre, Vietnamese Academy of Forest Sciences.

Morphological measurements of slide mounted specimens were taken to describe the species using a micrometer mounted in a compound microscope Leica M165C stereozoom microscope (Leica Microsystem, Wetzlar, 54 Germany) with a micrometric scale. The parasitoid images were captured by using a Nikon DS-63 Fi2 camera (Nikon Corporation, Hanoi, Vietnam) mounted on a Leica M165C microscope (Leica 64 Microsystems, Wetzlar, Germany). The images were further processed using Adobe Photoshop.

## 2.3. Data analysis

From the parasitized data of larvae and pupae, the parasitized rate was calculated as follows:

$$P\% = (n/N) \times 100$$

where:

*n* is the number of parasitized larvae or pupae;

*N* is total number of larvae or pupae assessed.

Data were analyzed using R for Windows, version 4.2.2 (R Core Team, 2023).

## III. RESULTS

### 3.1. Morphological description of adults

Body length were as 2.40 - 2.67mm. Fore and mid legs light yellow, coxae and tarsal claws brownish. Forewing with second r-m vein absent, small areolet is open distally. Fore and

mid coxa with a yellow infuscation at apical end. Propodeum coarsely sculptured with medial carina rather than medial areola, or nothing medially. Hind coxa blackish brown except a yellow infuscation apically, hind trochanter and hind femur except at extreme apical end- light brown, light yellow, hind tibia yellow with brown infuscation on anterior and tarsal segments, tarsal claws dark brown. Metasoma light yellow, tergum median part dorsally, posterior one third of metasoma brown. Antenna brownish yellow, palpi testaceous, labrum and tegula are light yellow, ovipositor dark brown. Scape yellow, except apical edge brownish black, pedicel e3'4798 with brownish yellow and remainder of antenna brownish yellow; ocelli yellowish; tarsal claws brownish black. Compound eye. Wings hyaline, fore wing veins translucent except dark brown pterostigma; hind wing veins translucent. First metasomal tergite narrowing posteriorly, second metasomal tergite broadening posteriorly and often nearly triangular (Figure 2).

Clypeus with punctulate sculpture denser medially; face with dense fine punctate sculpture, frons laterally with fine punctate sculpture and dense near the scrobes, vertex with dense punctulate sculpture. with dense punctate sculpture that almost reaches the scutellar groove; Scuto-scutellar groove distinctly crenulate with nine deep costulae; scutellum medial area essentially nitid, scutellum lateral area with costulate sculpture which become narrower and elongated towards posterior edge; metanotum subrectangular; propodeum with lateral longitudinal carinae inclined medially, areola absent; spiracles large and round. Ovipositor and sheaths short and barely exerted (Figure 2).

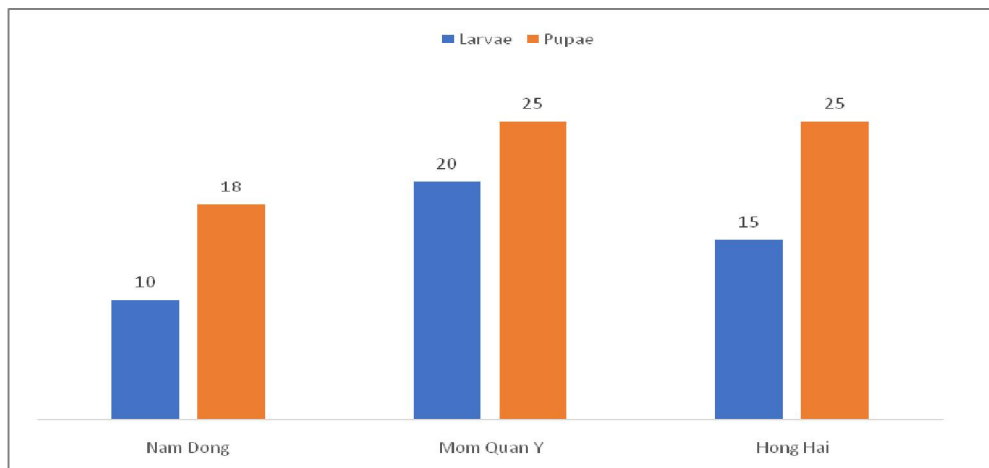


**Figure 2.** Morphological characteristics of *Glyptapanteles* sp. adults; a. Dorsal view; b. Lateral view; c. Forewing; d. Head; e. Abdomen; f. Mesosoma.

**3.2. Parasitism rate**

In general, the percentage of pupae parasitized was from 5 - 10% higher than those of larvae depends on sites. This trend was consistent in Nam Dong, Mom Quan Y and Hong Hai.

Among the three sites, the parasitized percentage of larvae and pupae was highest in Mom Quan Y, reached to 20 and 25% (equally) and followed by Hong Hai and Nam Dong (Figure 3).



**Figure 3.** Parasitized percentage of larvae and pupae collected in Nam Dong, Mom Quan Y and Hong Hai communes in CoTo island.

#### IV. DISCUSSION

*Glyptapanteles* are small size parasitoid wasps that occur in all faunal regions. Approximately 1.000 or more species have been estimated for the tropics (Mason, 1981), and almost species have been described and authored by Arias-Penna. Many studies have suggested that the *Glyptapanteles* genus is among the three most diverse within *Microgastrinae*, which is among the most frequently collected groups and one of the two most species-rich subfamilies of Braconidae (Jones *et al.*, 2009). Different species of the genus *Glyptapanteles* have been recorded in Australia (Austin and Dangerfield, 1992), Ecuador (Whitfield *et al.*, 2002), China (Lu *et al.*, 2020), Greece (Papp, 2007), Croatia, Bosnia, and Macedonia (Papp 2009), India (Gupta and Pereira 2012). In Vietnam, 257 braconid species from 21 subfamilies were recorded. We found that the external morphological characteristics of *Glyptapanteles* sp. in this study was different from those of *G. nawaii* described previously by Long and Belokobylskij, 2003.

Many families of the order Lepidoptera have been reported as the hosts for the genus *Glyptapanteles* (Whitfield *et al.*, 2009; Arias-Penna, 2011) such as *G. militaris* in *P. unipuncta* (Calkins and Sutter, 1976; Steinkraus *et al.*, 1993), *G. porthetriae* and *G. liparidis* in *Lymantria dispar*, *G. hypermnestrae* in *Elymnias hypermnestra* (Gupta & Pereira, 2012). The present study is the first that report on the parasitism of *Glyptapanteles* in *A. serva* in Vietnam. Previous studies showed that *Glyptapanteles* adults are free-living wasps that feed primarily on nectar, pollen, or secretions from scales and aphids while larvae develop inside caterpillars (Arias-Penna *et al.*, 2019).

*Glyptapanteles* is taxonomically challenging because almost species in the genus are morphologically homogeneous and highly speciose (Arias-Penna, 2013). High incidence of morphological convergence and lack of obvious discrete morphological variation virtually preclude straight forward morphological identification of specimens (Shaw and Huddleston, 1991). In addition, its previously mentioned astonishing diversity, total lack of striking coloration, and the minute body size of its specimens. The poor understanding of *Glyptapanteles* diversity in the tropics could also be a consequence of other factors such as specialized ecological niches, relatively small population sizes, and the concealed parasitoid life history (Stireman *et al.*, 2009). In this study, we were not able to exactly determine the species level of *Glyptapanteles* specimens in CoTo island. Therefore, further study is needed to clarify this point.

Chemical insecticides have been only deployed to control *A. serva* caterpillars in some urban areas when high population of the insect pest under CoTo Department of Resource and Environment (Duc, 2021). Other primary *P. obovata* forests situate along the beach in the CoTo island, and it attracts many young people to climb up enjoy the natural scenery and get a panoramic view of the whole island. The finding of *Glyptapanteles* in this study promise its future potentials in the biological control of *A. serva* in CoTo island and other coastal provinces of Vietnam. Further studies are required to focus on identification, biology, and rearing of this *Glyptapanteles* parasitic wasp.

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**Ngày nhận bài:** 09/03/2023

**Ngày phản biện đánh giá và sửa chữa:** 10/04/2023

**Ngày duyệt đăng:** 27/04/2023