

A new species of *Poropoea* (Trichogrammatidae) oviposites by entering through the oviposition hole of attelabid beetle

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ABSTRACT A new species of trichogrammatid wasp, *Poropoea cunabulintrans* n.sp., is described from Kyoto, Japan. The species is an egg parasitoid of an attelabid beetle species, *Cycnotrachelus roelofsi*, which is associated with *Styrax japonica*. Exceptionally for the genus, the female wasp has a short ovipositor. To oviposit in the host beetle egg, the female wasp enters incomplete leaf-rolls through the oviposition hole of the host beetle immediately after oviposition by the beetle.

KEY WORDS *Poropoea* / Trichogrammatidae / Attelabidae / oviposition behavior / leaf-roll

Introduction

The trichogrammatid genus *Poropoea* is a small group comprising 14 species (Subba Rao 1969, Lin 1994, Luo and Liao 1994), which are distributed from Europe to South and East Asia. These species are characterized by their association with the leaf-rolls of attelabid beetles (Silvestri 1916); the females of most species have long ovipositors with which to lay their eggs inside the leaf-rolls. For example, female *P. morimotoi* wasps repeatedly insert their ovipositors into the leaf-rolls of *Paracentroeorynus nigricollis* on *Pourthiaea villosa* (Rosaceae); this oviposition behavior continues for longer than one hour if the wasp is not disturbed (Hirose 1968).

Among the 14 described *Poropoea* species, however, one species, *P. brevituba*, has a very short ovipositor (Lin 1994). This species was reported to have emerged from the eggs of unidentified attelabid beetles in China. It was unknown how the host eggs inside a leaf-roll were parasitized by a wasp with a short ovipositor.

Cycnotrachelus roelofsi is a common attelabid beetle that rolls the leaves of *Styrax japonica*. In Kyoto, Japan, this beetle sustained high mortality in the egg stage as a result of parasitism by two trichogrammatid wasp species (Kobayashi and Kato in press). One wasp was *P. morimotoi*, which inserts its long ovipositor deep into the host leaf-rolls to oviposit. The other was a *Poropoea* species that had a very short ovipositor and was observed entering the host leaf-roll through the oviposition hole made by the beetle. A morphological survey suggested that this species was an undescribed species clearly discriminated from *P. brevituba*. Thus, we describe this wasp species and discuss the adaptive significance of the unique morphological and behavioral characteristics.

Materials and Methods

Observations and collections of parasitoid wasps of *C. roelofsi* were made on *Styrax japonica* trees in a deciduous oak forest at Iwakura, Kyoto, Japan (35.5°N, 135.47°E) from April to June in 2003 and 2004. Leaf-rolls made by *C. roelofsi* were collected and incubated separately in moisture-controlled plastic cases until host beetles or parasitoid wasps emerged. We observed morphology of emerged wasps and parasitized host eggs under a binocular (Nikon SHZ-10). Detailed surface structure of the emerged wasps was observed under a Real-Surface-View Microscope (Keyence VE-7800).

Description

Family Trichogrammatidae

Subfamily Trichogrammatinae

Genus *Poropoea* Förster

Poropoea cunabulintrans sp. nov.

(Japanese name: Yurikagosinobi-tamagokobachi)

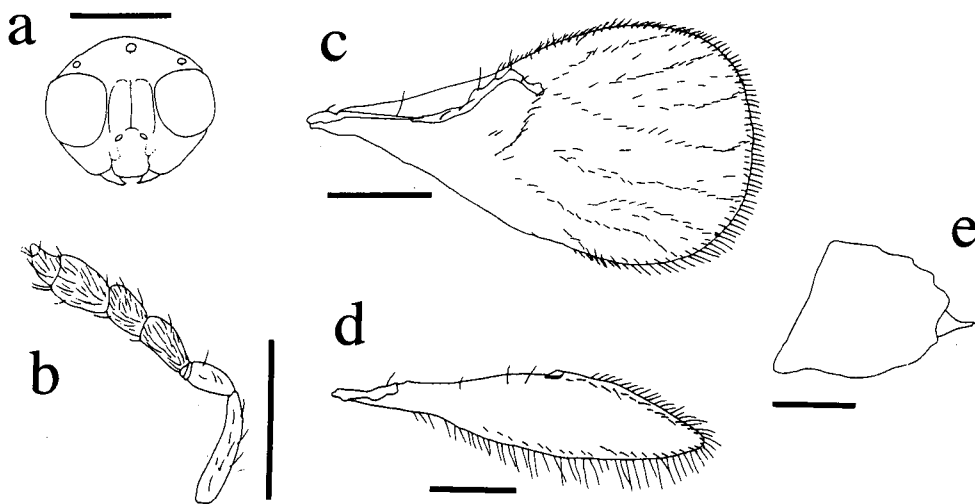


Fig. 1. *Poropoea cunabulintrans* sp. nov. female: a, frontal view of head; b, antenna; c, upper surface of right fore wing; d, upper surface of right hind wing; e, lateral view of abdomen. Scales: a, b, e = 0.1 mm; c, d = 0.2 mm.

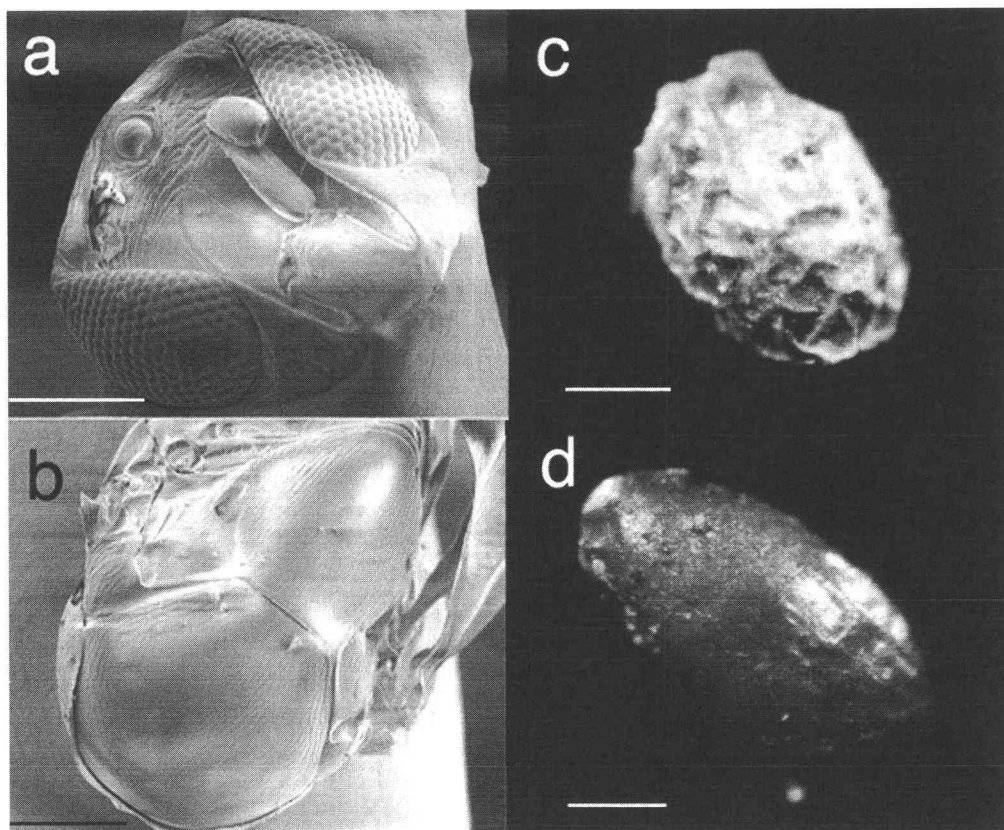


Fig. 2. a, frontal view of head of a *Poropoea cunabulintrans* female; b, dorsal view of thorax of a *P. cunabulintrans* female; c, egg of *Cynotrachelus roelofsi* parasitized by *P. cunabulintrans*; d, egg of *C. roelofsi* parasitized by *P. morimotoi*. Scales: a, b = 0.1 mm; c, d = 0.5 mm.

Female: Body length 0.9 mm. Head, including vertex, brown. Antennae yellowish-brown, except for scape and pedicel, which are dark brown. Thorax glossy black. Ovipositor sheaths dark brown, although very short. All tarsi and the apex of hind and midtibiae yellow. Other parts of legs brown. Wings hyaline.

Head viewed frontally wider than it is long (Fig. 1a, 2a). Three grooves in the fronto-clypeal area. Ocelli in a very broad obtuse triangle. Antennae inserted slightly above the lower level of eyes; scape long, almost reaching median ocellus; pedicel one-third of the scape; one ring segment visible between pedicel and the first funiculus segment (Fig. 1b). Antennae appear as two funiculus segments and three club segments; third club segment obscure; first two funicular almost equal in length; segments 3–5 together equal in length to 1–2.

Upper side of thorax very smooth with no grooves (Fig. 2b). Mesonotum with two pairs of setae. Fore wings almost 1.5 times as long as broad (Fig. 1c); upper side bearing

nine longitudinal rows of discal cilia. The discal cilia are dense. An arc-shaped row of discal cilia basad of pterostigma. The veins with seven bristles. The marginal fringe long, densely spaced. Hind wing bearing two rows of cilia on upper side (Fig. 1d).

Abdomen vertically flat. Ovipositor sheaths very short (Fig. 1e), almost invisible; ovipositor almost completely housed within the body.

Male: No specimen.

Type material

Three female specimens were collected in a *Quercus serrata*-dominated secondary deciduous forest at Iwakura, Sakyo-ku, Kyoto, Japan, and deposited in the Kyoto University Museum (KUM). Holotype: one female collected on a leaf-roll of *C. roelofsi* on 28 May 2003. Paratype: one female collected on a leaf-roll of the beetle on 28 May 2003; one female that emerged on 15 April 2004 from a host leaf-roll, collected on 5 June 2003.

Etymology

From the Latin *cunabula* (cradle, i.e., leaf-roll) and *intrare* (enter), suggestive of the female wasps entering the leaf-rolls of the host beetle to oviposit.

Distribution

Known only from the type locality in Kyoto, Japan.

Host

Cynotrachelus roelofsi (Coleoptera: Attelabidae) associated with *Styrax japonica*.

Biology

Oviposition was observed from late April to late June at Iwakura, Kyoto (35.5°N, 135.47°E). The species has one generation a year: adults emerged from parasitized leaf-rolls the following spring.

When a *C. roelofsi* female started to incise a leaf of *Styrax japonica* for oviposition, *P. cunabulintrans* females flew to the leaf and waited there until the beetle started oviposition. One to five female *P. cunabulintrans* were observed on the leaf while the beetle incised it. After incising, the beetle rolled up the apex of the leaf, made a hole using its mandibles, and inserted her egg into the leaf-roll. After oviposition, the beetle turned around and began rolling up the remainder of the leaf. Just after the beetle oviposited, a *P. cunabulintrans* wasp entered the leaf-roll through the beetle's oviposition hole, laid her egg into the beetle's egg, and left the leaf-roll through the hole before the beetle began rolling the remainder of the leaf.

The shell of a host egg parasitised is wrinkled, thick, and resistant, turning dark brown after oviposition (Fig. 2c). Eggs parasitised by *P. cunabulintrans* can be easily distinguished from beetle eggs parasitized by *P. morimotoi*, which have soft, smooth, pale brown egg shells (Fig. 2d). A minute pupa was found inside the beetle egg parasitized by *P. cunabulintrans*; it was much smaller than the pupae of *P. morimotoi*.

Remarks

This species resembles *P. brevituba* in having a very short ovipositor, but can be discriminated using the following key:

Key to the Females:

1. Ovipositor very long and clearly protruded from the top of abdomen.
 *P. defilippii*, *P. duplicata*, *P. longicornis*, *P. minkiewiczii*, *P. morimotoi*,
 P. morimotoi, *P. indica*, *P. orientalis*, *P. reticulata*, *P. stollwerkii*, *P. tomapoderus*
- 1'. Ovipositor very short and housed in abdomen.
 2. Body length 1.35 mm. Arc-shaped row of discal cilia basad of pterostigma with 7 cilia.....*P. brevituba*
 - 2'. Body length 0.9 mm. Arc-shaped row of discal cilia basad of pterostigma with 9 cilia. Hind wing with two rows of cilia along the edge on upper surface
 *P. cunabulintrans* sp. nov.

**P. bohémica* and *P. attalaborum* were excluded from this key (See Subba Rao 1969).

Discussion

Other species of *Poropoea*, with the exception of *P. brevituba*, have long ovipositor and oviposit into host beetle eggs in leaf-rolls by repeatedly piercing the leaf-rolls from the outside with their ovipositors. However, this new species has a very short ovipositor and oviposits by entering the leaf-rolls through the oviposition holes of the host beetle, *Cycnotrachelus roelofsi*.

It was reported that *P. brevituba* also has a very short ovipositor (Lin 1994), but it is unknown whether the *P. brevituba* female also enters the leaf-roll to oviposit during the construction of the leaf-roll. The results of our observation of *P. cunabulintrans* suggests that the *Poropoea* species with short ovipositors might enter the leaf-roll to oviposit into host beetle eggs.

For a *P. cunabulintrans* female, the time during which she can complete oviposition is very restricted, i.e., the interval from immediately after the host beetle oviposits until it begins to roll up the remainder of the leaf. It is remarkable that such a minute wasp can detect and exploit the precise timing of oviposition without being discovered by the leaf-rolling beetle. In the type locality in Kyoto, *P. cunabulintrans* wasps found on leaf-rolls of host beetles are not rare. Most likely, this new species has not been previously found and described by entomologists because it is difficult to rear a wasp that has only one generation a year. The parasitism rate at the type locality ranged from 0 to 22 % during April to June (Kobayashi and Kato, in press). These results suggest that *Poropoea* species with short ovipositors may cause considerable mortality in eggs of various attelabid beetles.

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