



## A new species of *Corematosetia* Kallies & Arita, 2001 (Lepidoptera: Sesiidae) from south-eastern China

Jia-Yuan LIANG<sup>1,2</sup>, Jun-Feng RUAN<sup>1,3</sup>, Mei-Xia CHEN<sup>1,3</sup>, Cheng-Kang ZHANG<sup>1,3</sup>, Nuo-Bin LIN<sup>4</sup>, Yu-Feng HSU<sup>5,\*</sup>

1. College of Life Science, Ningde Normal University, No. 98-1 Jiaocheng South Rd., Ningde 352100, Fujian, China. E-mail: sesiidae760402@gmail.com 2. Department of Biological Resources, National Chiayi University, No. 300 Syuefu Rd., Chiayi City 60004, Taiwan (R.O.C.). 3. Industry and University Research Cooperation Demonstration Base in Fujian Province, Ningde 352100, Fujian, China. E-mail: cmx\_101019@163.com. 4. School of Life Sciences, Fujian Normal University, No.8 Xuefu South Rd., Fuzhou 350117, Fujian, China. 5. Department of Life Science, National Taiwan Normal University, Taipei City 11677, Taiwan, (R.O.C.). \*Corresponding author's email: t43018@ntnu.edu.tw

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**ABSTRACT:** A new species of clearwing moth, *Corematosetia parvimaclulata* sp. nov., is described from south-eastern China in this article. Adults and genitalia of both sexes are illustrated, DNA barcodes are provided, and immature biology and potential damage to *Ardisia sieboldii* Miq. and *A. quinquegona* Blume (Primulaceae) are both discussed.

**KEY WORDS:** *Ardisia sieboldii*, clearwing moth, *Corematosetia parvimaclulata*, immature biology, Pennisetiini, taxonomy.

### INTRODUCTION

Clearwing moths (Sesiidae) are a family of small to medium-sized moths that are well-known for their striking mimicry of various Hymenoptera (Kristensen, 2003). Species classification frequently becomes confused mainly due to morphological homogeneity and the lack of diagnostic morphological characters (Heppner and Duckworth, 1981). In addition, difficulties in collecting adult specimens and larval host-specificity have probably contributed to the situation where this group has been either ignored by many lepidopterists or these kinds of moths are simply rarely encountered. Therefore, the family Sesiidae is one of the most interesting and difficult lepidoptera families to study taxonomically.

Pennisetiini Naumann, 1971 is the smallest tribe in the family Sesiidae, with less than 1% of the world fauna belonging to this tribe according to Pühringer and Kallies (2023). The main diversity of the tribe lies within the Oriental region (Kallies and Arita, 2006), comprised of merely two genera, *Pennisetia* Dehne, 1850 and *Corematosetia* Kallies & Arita, 2001, according to Pühringer and Kallies (2004). According to Kallies and Arita (2001, 2006), the genus *Corematosetia* was known only to be found in Vietnam. Its biology and ecology are unknown. We report a member of the genus from China for the first time herein.

Diagnoses of Pennisetiini: Forewing of the tribe is usually opaque and/or with small transparent areas; veins R4 and R5 of forewing sharing a long stalk or coincident; M2 and M3 fused; M2 of hindwing arising slightly anterior to medium of cross-vein; M3 and Cu1 sharing a long stalk. Valve with simple hairs; uncus large, hairy apically; tegumen simple. Ostium bursae anterior to 8th segment, unspecialized; antrum strongly sclerotized;

ductus bursae elongate, usually twisted spirally.

13 species in 2 genera are currently recognized according to Pühringer and Kallies (2022). Pennisetiini are distributed world-wide, but unknown in the Australian region and Ethiopian region.

The present article provides taxonomic treatment and documentation of host associations and immature biology for this species, including a hostplant family previously unknown to be utilized by clearwing moths and a chalcid wasp unknown to parasitize the moths.

### MATERIAL AND METHODS

#### Collecting and rearing procedures

Adult moths were reared from immatures collected from *Ardisia sieboldii* Miq. and *A. quinquegona* Blume in Fujian, China. Label data is presented in a standardized format, with months represented by Roman numbers.

#### Terminology for description

Terminology of genitalia follows Klots (1970) and Špatenka *et al.* (1999), and wing patterns and venation Špatenka *et al.* (1999).

#### Type depository

The holotype will be deposited in the Institute of Zoology, Academia Sinica, Beijing (IOZ). Additional type series or vouchers are deposited in the collections abbreviated in the text as follows: **IOZ**—Institute of Zoology, Academia Sinica, Beijing, China; **NDNU**—College of Life Science, Ningde Normal University, Fujian, China.

#### Molecular analysis

DNA was extracted from a leg muscle using a M5 HiPer



Universal DNA Mini Kit from Mei5bio (Mei5 Biotechnology Co., Ltd, Beijing, China). The COI gene (barcode) fragments were amplified with one set of two primers: Secox-J-1342 5'-TCWACAAATCATAAAGATAT-3' and Secox-N-2097 5'-GTTTCYTTTTTCTCTTTCTTG-3' (Liang *et al.*, 2022) following standard conditions for the reaction. The PCR product was checked using a 1% agarose gel and sequenced at BioSune Biotechnology (Shanghai, China). The sequences were checked and assembled into contiguous arrays using Sequencher 4.10.1 (GeneCode, Boston, USA). Sequences were submitted to GenBank under the accession number OQ559116, OQ559117.

## TAXONOMIC TREATMENT

*Corematosetia* Kallies & Arita, 2001:226.

**Type species:** *Corematosetia naumanni* Kallies & Arita 2001, original designation, by monotypy.

The genus *Corematosetia* represents the sister-group of the genus *Pennisetia* in Pennisetiini, with the two genera forming a monophyletic group characterized by the setaceous formation of the dorsal wall of the juxta, which is not found in other tribes of Tinthiinae (Kallies and Arita, 2001). Species of *Corematosetia* are characterized by the following characters: Forewing is usually opaque and/or has small transparent areas; aedeagus is long and narrow; uncus is relatively large, and has a pair of hairy socii apically; tegumen is small, and laterally it has numerous long and narrow scales; saccus is small and broad; juxta is large, and its apical part is tubular, with numerous short setae ventrally and dorsally.

*Corematosetia parvamaculata* Liang & Hsu, *sp. nov.*

小紋毛刷透翅蛾 Figs. 1–2

<http://zoobank.org/B3F32FB0-4298-4A3A-892A-A17B67F4EA27>

**Type:** **Holotype:** ♂, CHINA, Fujian Prov., Ningde, Nanjishan Mountain, 150m, 1. Sep. 2022, reared from *Ardisia sieboldii*, emg. 8. Sep. 2022, JYL lot no. 22J1, J.Y. Liang Coll. (IOZ). **Paratypes:** 1♂, 1♀, same locality and date as holotype, emg. 2–8 Sep. 2022, J.Y. Liang Coll. (1♂ Gen. Prep. JYL-1504, DNA. lot no. JY-0202) (1♀ Gen. Prep. JYL-1053) (NDNU); 1♀, same locality as holotype, 12. Mar. 2022, reared from *A. quinquegona*, emg. 10. Jul. 2022, JYL lot no. 22C3, J.Y. Liang Coll. (Gen. Prep. JYL-1502, DNA. lot no. JY-0201) (NDNU); 1♀, same locality as holotype, 200m, 23. Jun. 2022, reared from *A. sieboldii*, emg. 22. Jul. 2022, JYL lot no. 22F6, J.Y. Liang Coll. (NDNU); 1♀, same locality as holotype, 200m, 7. Jul. 2022, reared from *A. sieboldii*, emg. 16. Aug. 2022, JYL lot no. 22G3, J.Y. Liang Coll. (NDNU).

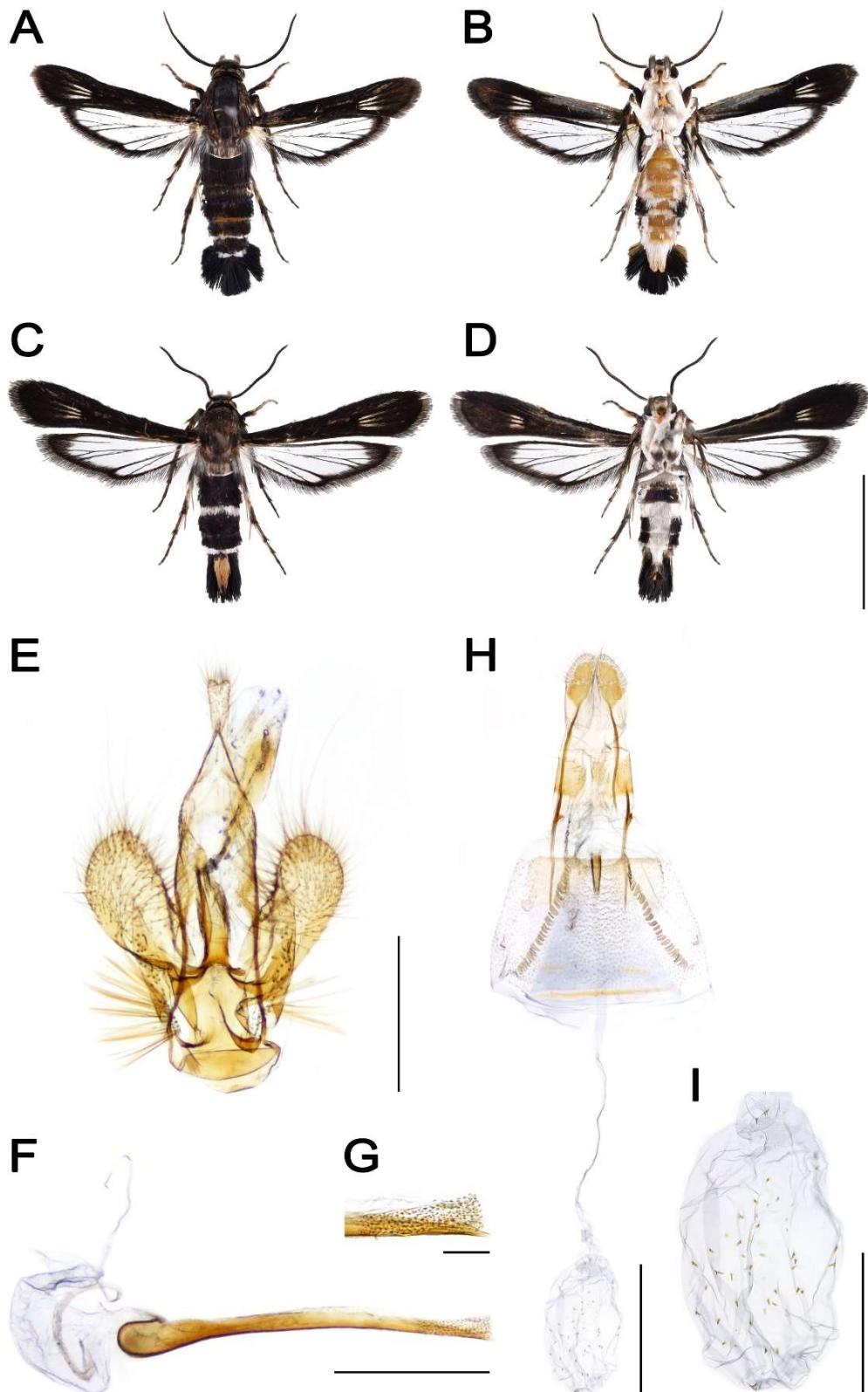
**Diagnosis.** *Corematosetia parvamaculata* sp. nov. is distinct from all known species of the genus *Corematosetia* by its abdomen not being constricted at segments 3–5. The male genitalia of *C. parvamaculata* is

similar to that of *C. minuta* Kallies & Arita 2006 from Vietnam, but can be distinguished from the latter by its vesica bearing numerous small cornuti, in contrast to the absence of cornutus on vesica in *C. minuta*.

**Description.** Male (Fig. 1A–B): Antennal length 2.8–3.1 mm (n=2); forewing length 6.1–6.4 mm (n=2); body length 8.4–8.8 mm (n=2). Head: antenna black, biciliate; labial gray, white at ventral side; vertex black, long and smooth, covering half of the frons, anteriorly with some brown scales, white ventrally. Thorax: patagia and tegula black with violet sheen; a patch of white scales ventro-laterally; metathorax black, dorso-laterally with some gray hair-like scales. Legs: neck plate white; fore coxa and femur white; fore tibia dark brown to black; fore tarsus brown, with a few black scales dorsally; mid coxa white, with some gray scales apically; mid femur white, dark brown distally; mid tibia and tarsus brown ventrally, dark brown dorsally, with black spine-like scales at each segment apically; spurs brown; hind leg similar color. Abdomen: dorsal black; tergite 1 muddy brown, with a narrow white posterior margin; tergites 6 and 7 with white posterior margin; sternite white; abdominal tuft black, lateral margins with some brown scales. Forewings: dark brown to black, with admixture of brown scales; exterior transparent area small divided into three cells, between common stem of R<sub>4</sub>/R<sub>5</sub> to M<sub>3</sub>; cilia dark brown. Hindwing: transparent; veins and outer margin dark brown to black; cilia dark brown, gray anally. Female (Fig. 1C–D). Antennal length 3.1–3.2 mm (n=4); forewing length 7.2–7.6 mm (n=4); body length 7.8–8.4 mm (n=4). Abdomen tergites 4 and 7 white; middle of abdominal tuft orange. Other characteristics identical to those of males.

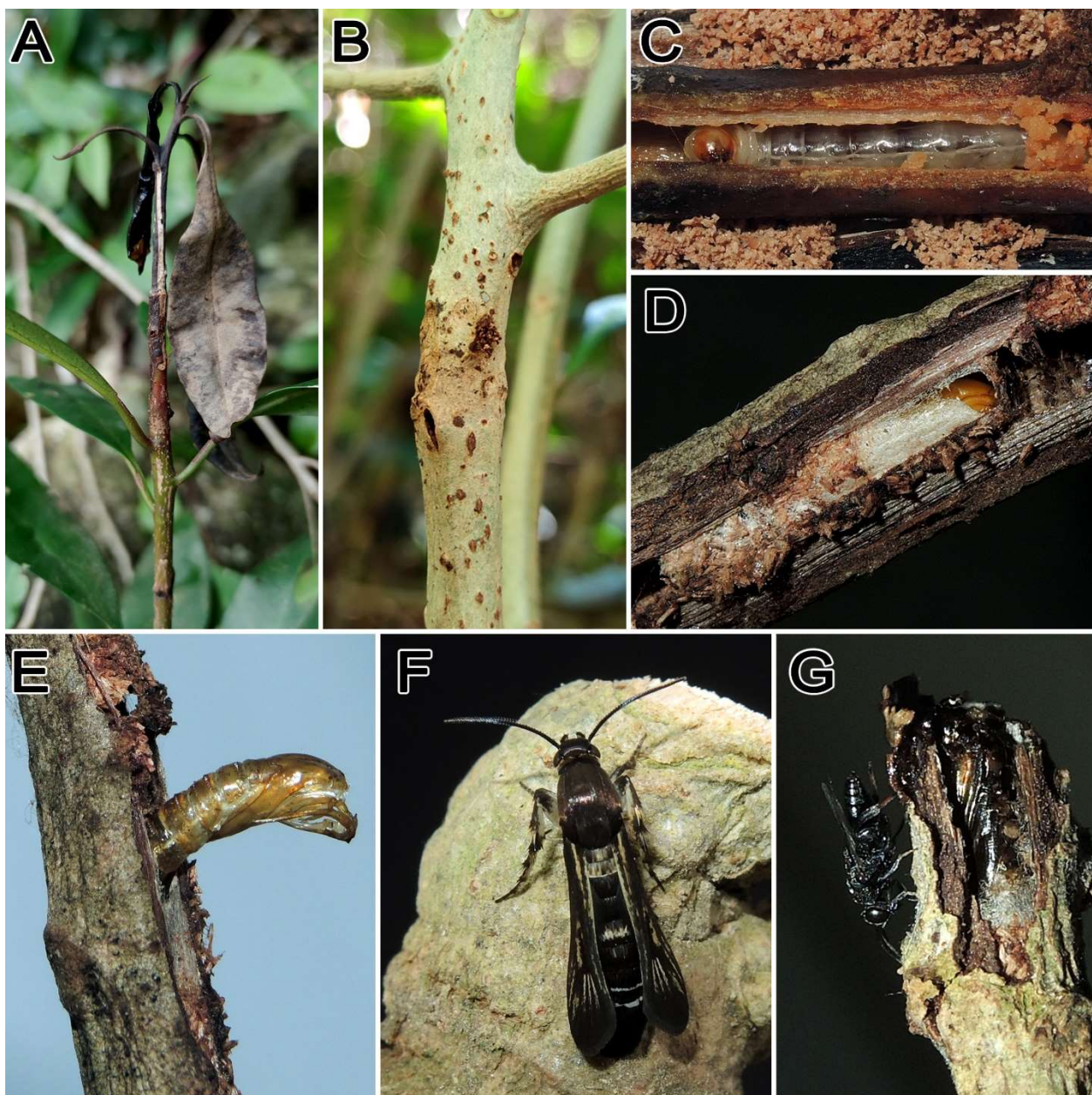
Male genitalia (Gen. Prep. JYL-1504, NDNU, Fig. 1E–G): Tegumen-uncus weakly developed and sclerotized, uncus covered in short hairs, with a pair of hairy socii apically; tegumen laterally with androconial scales (coremata); juxta forming a simple tube, covered with short setae; valva simple, covered with hair-like setae on the inner surface and long prominent hair-like setae at the margins and near the edges of the outer surface; with two fields of long and short androconial scales, respectively, near the base; saccus simple, bag-like; aedeagus long, about 2X length of valva, pointed terminally; vesica with numerous small cornuti.

Female genitalia (Gen. Prep. JYL-1503, NDNU, Fig. 1H–I): 8th tergite relatively broad, with a few long setae at distal margin; apophysis posterior about as long as apophysis anterior; anterior apophysis near 1/3 basally with a small spine; ostium bursae opening at posterior margin of sternite 7, small, membranous; antrum narrow, well-sclerotized, shorter than 1/3 of anterior apophysis in length; ductus bursae membranous, relatively thin, long, about 7 times longer than sclerotized part of antrum, twisted into loop twice at corpus bursa; corpus bursae membranous, ovoid; signum as broad patch of sparsely scattered small spines.



**Fig. 1.** Adults and genitalic structures of *Corematoseitia parvimaclata* sp. nov., **A–B.** Male, holotype, CHINA, Fujian Prov., Ningde (IOZ). **C–D.** Female, paratype, CHINA, Fujian Prov., Ningde (NDNU). **E.** Caudal view of tegumen-uncus and valvae. **F.** Lateral view of phallus. **G.** Distal part of phallus. **H.** Female genitalia. **I.** corpus bursae and signum. Scale bar A–D. = 5 mm. E–F, I. = 0.5 mm; G. = 0.1mm; H. = 1mm.





**Fig. 2.** Biology of *Corematosetia parvimaculata* sp. nov. **A–B** Infection of *C. parvimaculata* sp. nov. immature on stem of *Ardisia sieboldii*. **C.** Mature larva of *C. parvimaculata* sp. nov. in stem of *A. sieboldii*. **D.** Pupal and cocoon of *C. parvimaculata* sp. nov. in stem of *A. sieboldii*. **E.** Pupal exuviae protruding from trunk of *A. sieboldii*. **F.** Freshly emerged male adult. **G.** *Haltichella* sp. adult that emerged from *Corematosetia parvimaculata* pupa.

**Etymology.** The name "*parvimaculata*" comes from the Latin *parva* (= small) and *maculae* (= spot), which is referring to the three small, transparent cells present in the exterior area of the new species.

**Distribution.** Currently, the new species is only known to be from China (Fujian Prov.). However, its hostplant, *Ardisia sieboldii*, is widely distributed in subtropical Asia, so the moth may be found elsewhere.

**Biology.** The larva bored into the stem of *Ardisia sieboldii* Miq. (Primulaceae) about 0.5–1.5 cm and

*Ardisia quinquegona* Blume (Primulaceae) 0.4–0.8 cm in diameter, often causing terminal buds to wither (Fig. 2A–C). Pupation took place in a tough cocoon of silk intermingled with frass and debris (Fig. 2D). Before the adult moth emerged, the pupa wriggled so that it was projected from the entrance hole, leaving a hole of exuviae on the stem of the hostplant (Fig. 2E–F). Some pupae were parasitized by *Haltichella* sp. (Fig. 2G), which emerged out of the pupal head, with one pupa producing just one individual of the chalcid wasp.



**Parasitism.** The following Chalcididae have been found parasitizing immatures of *Corematosetia parvimaculata* sp. nov.: *Haltichella* sp. (JYL 22G3, JYL 22J1).

**Molecular data.** The barcode of *Corematosetia parvimaculata* sp. nov. (612 bp fragment of COI; accession number: OQ559116, OQ559117) was deposited in GenBank.

### Key to species of *Corematosetia*

1. abdomen not constricted at segments 3–5 ..... *Corematosetia parvimaculata*
- abdomen constricted at segments 3–5 ..... 2
2. Forewing with ETA marked only by sparse scaling in cell between M<sub>2</sub> to M<sub>3</sub>; 4th tergite with a broad orange anterior margin ..... *C. naumanni*
- Forewing with prominent ETA, consisting of 3 cells between common stem of R<sub>4</sub>/R<sub>5</sub> to M<sub>3</sub>. 4th tergite black, white laterally ..... *C. minuta*

## DISCUSSION

Clearwing moths are mostly univoltine or bivoltine, and their larvae are basically borers in plant tissue, making investigation of their life histories difficult to achieve (Špatenka *et al.*, 1999). Up to the present, only species of crop pests have had their life histories be comparatively well-documented. Although in some reports sesiid parasitism has been noted anecdotally in literature, such as in Engelhardt (1946), some known host-parasite associations are recorded in Purrington and Nielsen (1987), including 1 species of Pteromalidae, 2 species of Ichneumonidae and 1 species of Braconidae. According to Noyes (2011), the host range of the genus *Haltichella* Spinola, 1811 (Chalcididae) includes a few families of Lepidoptera (Bucculatricidae; Gelechiidae; Momphidae; Notodontidae; Oecophoridae; Pyralidae; Tortricidae) and Hymenoptera (Braconidae; Ichneumonidae). The present study represents the new primary relationship between the clearwing moth as hosts and parasitic wasps in the genus *Haltichella*. However, it remains unknown how the parasitic wasp manages to oviposit upon the larva of sesiid moth dwelling in the wood, so this is an intriguing issue to be studied in the future.

As the host plant *Ardisia sieboldii* and *A. quinquegona* are widely distributed in the urban landscape in southern China and commercially used in various applications, the damage potentially caused by *Corematosetia parvimaculata* sp. nov. to these plants deserves further attention.

## CONCLUSIONS

A new species of Sesiidae, *Corematosetia parvimaculata* sp. nov., is described and illustrated from south-eastern China in this article, with morphological description, immature biology, potential damage to the hostplant, and molecular information from the COI gene (barcode) provided.

The present study represents the first documentation of host association and immature biology for the genus *Corematosetia*; and the family Primulaceae has not previously been documented as larval hostplants by Sesiidae (Robinson *et al.*, 2023).

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