

First Report of *Fergusonina* Gall Fly on *Eucalyptus urophylla* in Mt. Mutis, Timor Island

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ABSTRACT

The gall fly, *Fergusonina* sp. (Diptera: Fergusoninidae) is known as gall inducer on several species of *Melaleuca* and *Eucalyptus*. The gall fly is commonly found associated with nematodes. The first record of the gall fly *Fergusonina* sp. on the Timor mountain gum, *E. urophylla* was collected from Mt. Mutis, East Nusa Tenggara (NTT) Province. However, the association of the gall with nematodes has not been observed in this finding. The gall formation was mostly found on the buds and young leaves of eucalyptus, the gall size is 1-5 mm in diameter with a reddish or greenish color. The vertical distribution of the gall in Mt. Mutis was at the altitude of 1,450 to 2,400 m asl. The presence of the gall fly *Fergusonina* sp. in Mt. Mutis should be anticipated so as not to cause severe damages on eucalyptus. This finding also implies that special precaution is necessary for eucalyptus forest industries in other islands such as Java, Sumatra, and Kalimantan where the *Fergusonina* gall fly is still absent.

Keywords: *ampupu*, *gall fly*, *NTT*, *Timor mountain gum*

1. INTRODUCTION

The Fergusoninidae is a monogeneric family of true flies (Diptera) found mainly in Australia, although a few species are known from India, New Guinea and New Zealand [1]. Species of *Fergusonina* Malloch form unique associations with nematodes of the genus *Fergusobia currie* (Nematoda: Neotylenchidae), is the only known case of obligate mutualism between nematodes and insects [2]. Although many more species of *Fergusonina* have been collected, only 31 have been described [1, 3–6]. The only key to the genus *Fergusonina* from *Eucalyptus* includes 20 species separated mainly by adult colouration [5], and from *Melaleuca*, seven species separated by an adult and larval morphology [6]. *Fergusonina* flies follow the pattern of other gall-forming insects by choosing leaf meristematic tissue as the dominant plant tissue attacked [7]. The *Eucalyptus* (Myrtaceae) plant is an evergreen plant with new seasonal leaf production, providing a regular supply of new seasonal tissue for fly oviposition. Gall of flower-buds is also common, occurring during seasonal floral production [8, 9]. The level of damage to eucalyptus leaves caused by *Fergusonina* can reach 30-70% but the level of damage tends to occur seasonally. The level of leaf damage is associated with an increase in flower buds and flower production. The level of damage to *Eucalyptus* leaves caused by *Fergusonina* can reach 30-70% but the level of damage tends to occur seasonally. The level of leaf damage is associated with an increase in flower buds and flower production [10]. This paper presents new reports of

Fergusonina flies from *Eucalyptus urophylla* in Mt. Mutis, East Nusa Tenggara (NTT) Province.

1.1. Materials and Methods

Terminal leaf bud galls (Figure 1) from plants in the *E. urophylla* were collected from 3 high-elevation locations in the Nature Reserve region. Gall found in Nature Reserve Mount Mutis, Timor Tengah Selatan District, East Nusa Tenggara Province. Galled leaves were removed from the host plant and transported to the laboratory. Symptomatic parts of the plant were also observed morphologically under the Olympus SZ51 stereo microscope and photo speciation using a Leica M205C digital microscope along with a Leica DFC450 digital camera and LAS applications. V.4.4.) (Build: 454) connected to a PC computer. Some galls were dissected under a stereoscopic microscope to obtain larvae and pupae. Other galled leaves kept in plastics until adult's emergence.

All reared material was preserved in 70% alcohol and then the specimens were mounted on slides. Male and female terminalia were dissected from some ethanol-preserved specimens for drawing. All drawings were made using a camera lucida, with editing done using Adobe Illustrator CS4 (Adobe Systems) and Adobe Photoshop Elements 6 (Adobe Systems). All specimens were incorporated in the Biosystematic Insect Laboratory, Plant Protection Department, IPB University. An attempt to identify adult specimens was made initially using the Tonnoir method [5] and using description Nelson *et al.* [6].

1.2. Our Contribution

This paper presents the first report *Fergusonina* sp. that causes gall on eucalyptus plants in East Nusa Tenggara Province, Indonesia, based on morphological character. This finding also implies that special precautions are needed for the eucalyptus forest industry on other islands such as Java, Sumatra, and Kalimantan where *Fergusonina*'s gall flies still do not exist.

1.3. Paper Structure

The rest of the paper is organized as follows. Section 2 introduces the preliminaries used in this paper, which includes collecting symptoms of the eucalyptus plant, describing the gall symptoms and shape of the gall, rearing for pre-adult and adult stadia insects that cause the gall, identifying morphologically based on literature from Nelson *et.al.* [6]. Finally, Section 3 concludes the paper and presents direction for future research.

2. RESULTS AND DISCUSSION

The formed gall on *E. urophylla* is a closed gall. This gall-forming insects is *Fergusonina* sp. which belongs to the order of the family Diptera, Fergusoninidae. This insect was first reported in the *E. urophylla* plant in South Central Timor Regency, East Nusa Tenggara Province, Indonesia. The vertical distribution of the gall in Mt. Mutis was at the altitude of 1.450 to 2.400 m asl. The incidence of insect attack causes gall on *E. urophylla* at several altitudes ranging from 48-100%. *Fergusonina* induces leaf bud terminals in *E. urophylla*. Its growth is visible from young shoots. Symptoms of gall begin with red colour. In advanced symptoms, the size and colour of the gall is greenish-red and then green. Gall is round and can be formed singly or in groups clustered with a regular round (Figure 1a), clustered irregularly because it was parasitized

(Figure 1b), malformations leave by curves because it was parasitized (Figure 1c), and single round (Figure 1d). The diameter of the gall ranges from 1-5 mm. Gall spreads on all surfaces of young leaves. Usually attacks eucalyptus plants that are young or old, especially in the shoots. In one leaf eucalyptus can be formed dozens of gall which are hollow or intact. Insects will come out of the upper surface of the leaf. A through description of this genus has already been given by Taylor [1]. Adult terminology follows Taylor [1] who in turn followed McAlpine [11]. Flies have been identified in insect biosystematics laboratory, Faculty of Agriculture, IPB University with the scientific name *Fergusonina* sp. by comparing the descriptions given by Nelson *et al.* [6] (Figure 2).

Adult. General colour yellow with black markings where indicated and on abdominal tergites (Fig 2a, 2b, 2c). Small (wing length range 2.03–2.81 mm), Mesopleuron and thorax with two lateral dark brown vittae split past the suture and two medial lighter vittae. In most species of *Fergusonina*, females have a distinct arrangement of setae on the tubular. Wing distinctly light grey in colour; broadly elongate oval; costa bearing differentiated setae to little beyond R2 + 3; costa very feint beyond R4 + 5; veins R2 + 3 and R4 + 5 divergent to mid-length, parallel beyond; anterior cross vein r-m short, posterior cross vein slightly angled mid-length (Figure 2d).

Larva. The immature stage can be seen in (Figure 4). Dorsal shield with transverse sclerotized bands on each of mesothorax and metathorax, and abdominal segments 1–5; strongest band on abdominal segment 1 and prominent dark sclerotized spicules present on each band shape ovate-pyriform; cephalothorax strongly sclerotized, anterior and posterior spiracles strongly sclerotized, abdomen with nine visible segments; dorsal shield comprising separate transverse sclerotised bands with prominent dark sclerotized spicules on each of the mesothorax and metathorax and abdominal segments 1–5. Some larvae display a few faint spicules on abdominal segment 6. The bands vary in width and extent of sclerotization, with the strongest band on abdominal segment 1.



Figure 1 The gall formation causes by *Fergusonina* in *E. urophylla* on buds and young leaves (a) regularly rounded cluster, (b) irregularly rounded cluster, (c) malformations leave, (d) single round

Puparium. Barrel-shaped, smooth, brown, annulated, bearing dorsal shield. Epandrium on male postabdomen was light brown. Epandrium with 19 pairs of setae (including one pair of large differentiated dorsal set setae); telomeres hook-shaped; cerci small and articulating with the ventral margin of the epandrium (Figure 5a). Aedeagal orifice oval, postgonites with one large distal tooth. (Figure 5b). Female

abdomen similar to males except for elements of the ovipositor (segment 6 to end) largely black. The apex of segment 6 orange with a row of six dorsal setae, and a row of four ventral setae. Abdomen segment 7 is black and short, with four scattered dorsal setae and four ventral setae (Figure 3).

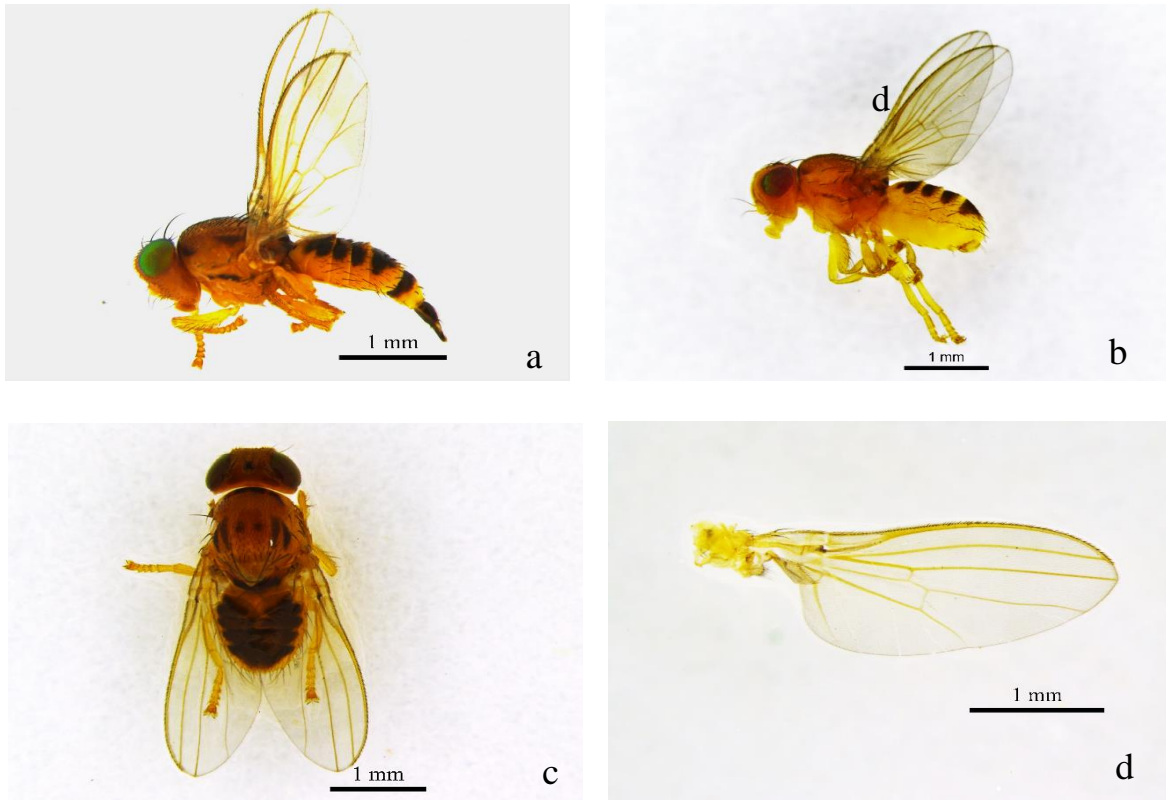


Figure 2 The adult *Fergusonina* sp. gall fly: (a) adult female, (b) adult male, (c) male dorsal aspect, (d) forewing



Figure 3 Female post abdomen

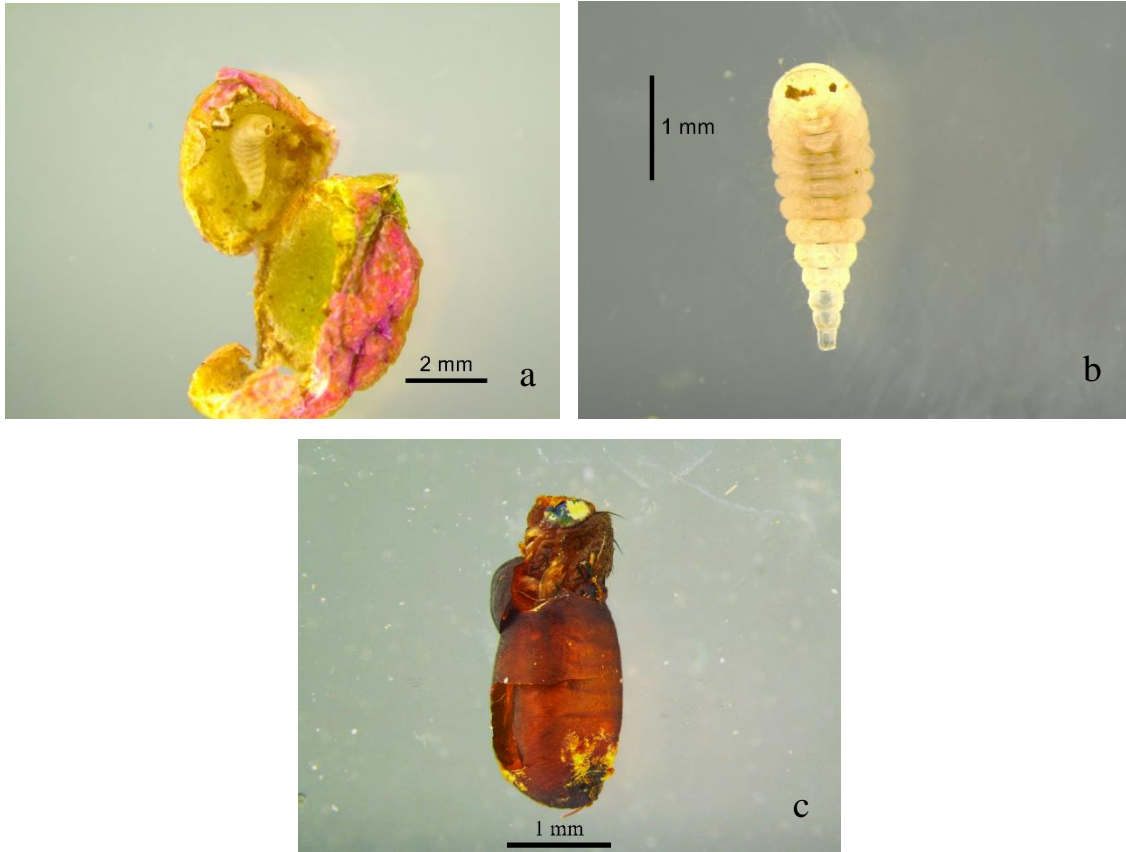


Figure 4 The immature *Fergusonina* sp. gall fly: (a) a larvae inside opened gall, (b) larvae, (c) the adult that will come out of the pupa

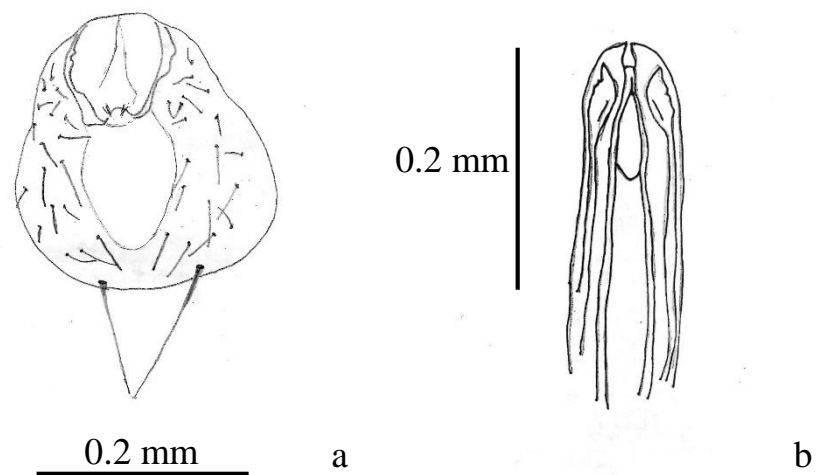


Figure 5 Male genitalia *Fergusonina* sp. (a) Epandrium, (b) aedeagus

3. CONCLUSION

Fergusonina was first reported on *E. urophylla* at the Timor Tengah Selatan District of NTT province. *Fergusonina* considered one of the most dangerous gall inducer on *Eucalyptus* and it is recorded in high incidence in NTT province. This research is very important and can be used to justify that quarantine needs to maintain *Eucalyptus* traffic in Indonesia so that this pest does not spread to *Eucalyptus* HTI in Sumatra Island and others.

ACKNOWLEDGMENT

This research was funded partly by BUDI LPDP and RAPP.

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