

New record of leaf galls on Grey Mangrove induced by gall midges (Diptera, Cecidomyiidae) in New Caledonia

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Abstract. A heavy infestation of leaf galls formed by a gall midge (Diptera, Cecidomyiidae) species was recently discovered on Grey Mangrove, *Avicennia marina* subsp. *australasica* (Walp.), in New Caledonia. In this study, we identify the gall midge as belonging to the genus *Actilasioptera* Gagné, 1999 and a potentially closely related species to the Australian *Actilasioptera coronata* Gagné, 1999. While the two species seem morphologically similar, differences in gall shapes suggest the need for further morphological examination and molecular comparison. Notes on life history traits and distribution are given, along with photographs of galls, larvae, pupae, and a female specimen.

Key words. *Avicennia*, Acanthaceae, biology, Cecidomyiinae, distribution, faunistic

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INTRODUCTION

Mangrove forests are distinct ecosystems in the intertidal zones in the tropical and subtropical regions (Giri et al. 2011). These forests are highly valuable due to their numerous ecological and socio-economic benefits. They provide essential habitat for a wide variety of flora and fauna (Saifullah 1996; Karunathilake 2003; Koh et al. 2018; Yudha et al. 2021), act as a protective natural barrier against coastal erosion, destructive waves and tsunami (Dahdouh-Guebas et al. 2005; Kamil et al. 2021), play a critical role in carbon sequestration to mitigate the impact of climate change (Kauffman et al. 2011; Alongi 2012), harbour medicinal plants and serve as a source of livelihood for local communities (Kusmana and Sukristijono 2016). Over the last decades, numerous studies have reported that worldwide mangrove forests are experiencing extensive deforestation, and many species are at extinction risk (Polidoro et al. 2010; Richards and Friess 2016). Thus, faunistic investigations are essential to identify potential endangered species as well as the associated indigenous biota of mangrove forests.

Gall midges (Diptera, Cecidomyiidae) are one of the most speciose groups of flies, with more than 6,800 known species. Although the vast majority of these species are plant-gall inducers, many species are predators or mycophagous (Gagné and Jaschhof 2025). Up to the present, seven cecidomyiid species are known to have associations with mangroves. These are *Meunieriella avicenniae* (Cook, 1909) inducing leaf galls on Black Mangrove, *Avicennia germinans* (L.) L. (Acanthaceae) (Gagné and Etienne 1996); *Actilasioptera falcaria* (Felt, 1921), *Ac. coronata* Gagné, 1999, *Ac. pustulata* Gagné, 1999, *Ac. subfolium* Gagné, 1999, and *Ac. tuberculata* Gagné, 1999 forming leaf galls on Grey Mangrove, *Av. marina* (Forssk.) Vierh. (Gagné and Law 1999; Kolesik and Gagné 2020); and *Dentifibula nigroapicalis* Kolesik, 2014 that preys on *Aulacaspis australis* Brimblecombe, 1959 (Hemiptera, Diaspididae) infesting Oriental Mangrove, *Bruguiera gymnorrhiza* (L.) Lam. ex Savigny (Rhizophoraceae) (Kolesik and Faveri 2014).

Recently, we discovered a heavy infestation of leaf galls induced by a gall midge species on Grey Mangrove, *Av. marina* subsp. *australasica* (Walp.) J. Everett, in several localities in New Caledonia (Figure 1A–H). In this study, we aim to identify this gall midge through morphological examination of the larval, pupal, and adult specimens.



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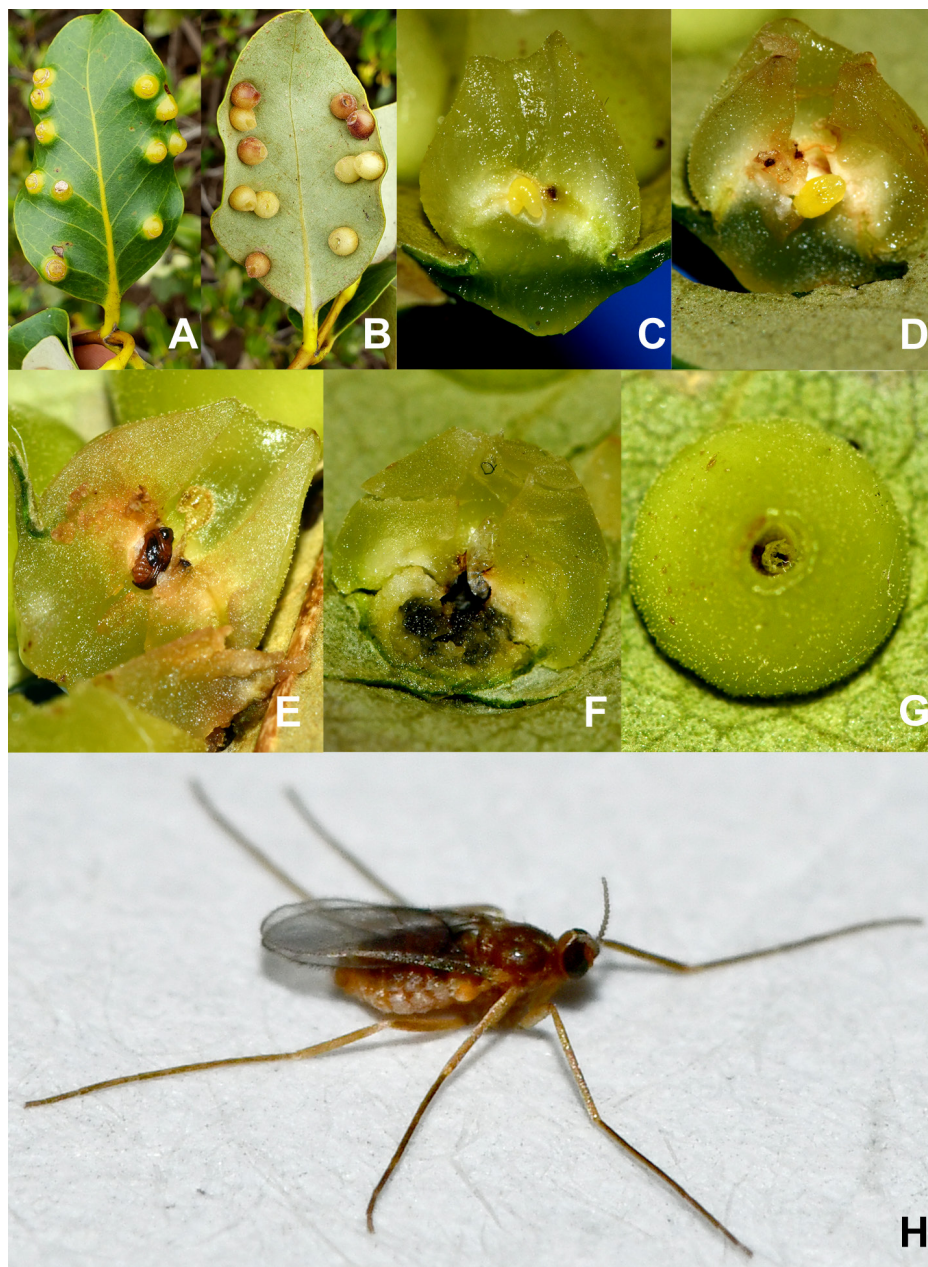


Figure 1. Leaf galls of *Actilasioptera* sp. on the grey mangrove *Avicennia marina* subsp. *australasica* (Acanthaceae) in New Caledonia. **A.** Upper surface of galled leaf. **B.** Lower surface of galled leaf. **C.** Third instar larva. **D.** Young pupa. **E.** Mature pupa. **F–G.** Pupal exuviae. **H.** Freshly emerged female.

METHODS

Leaves of *Avicennia marina* subsp. *australasica* with galls (Figure 1A, B) were collected in Noumea, New Caledonia in March 2020. Some galls were dissected to obtain larvae, while the remaining galls were kept in plastic bags for rearing adults. The pupal exuviae remained in galls after adult emergence were picked up from galls (Figure 1F, G). All specimens obtained were preserved in 99.5% ethanol and were mounted on slides following the technique outlined in Gagné (1994), with the modifications in Elsayed (2023). The slide-mounted specimens were examined under a bright-field and phase-contrast microscope (CX43, Olympus, Tokyo). Gall midge genus and species were identified based on the descriptions of Gagné and Law (1999). Materials examined are deposited in the Reference Collection of Terrestrial Invertebrates of New Caledonia - Xavier-MONTROUZIER (CXMNC), hosted in Institut Agronomique néo-Calédonien (IAC). The distribution map (Figure 2) was produced based on an image from Google Earth Pro v. 7.3.6.9796.

RESULTS

Actilasioptera sp.

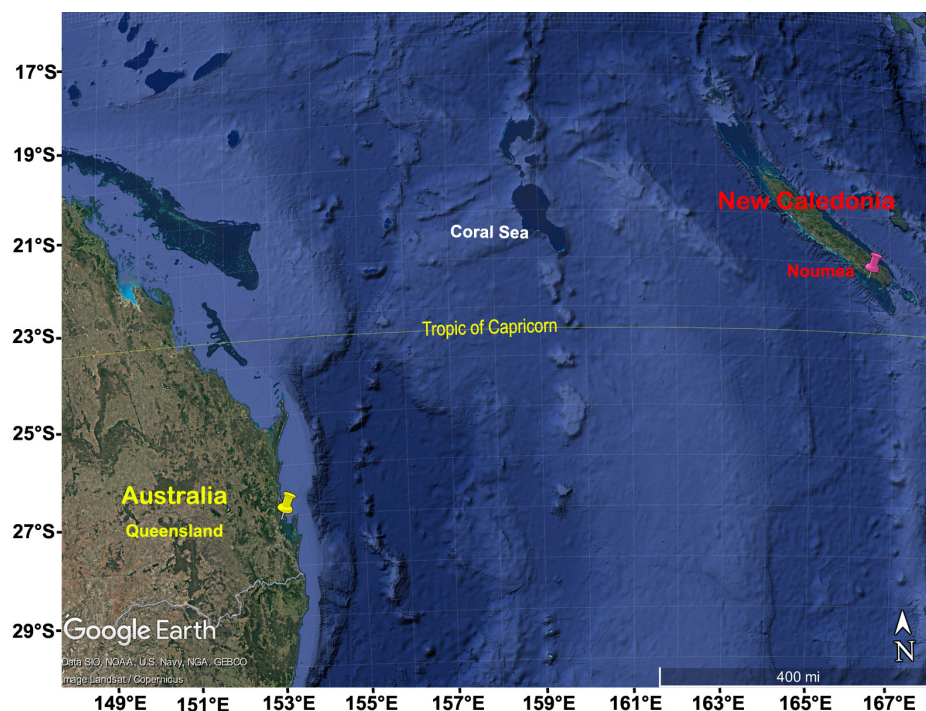
Figures 1A–H, 2

New records. NEW CALEDONIA — PROVINCE SUD · Noumea, Nr. Ouen Toro; 22°18'35"S, 166°27'30"E; collected 12.III.2020; A.K. Elsayed, C.G. Mille & A. Kawakita leg.; *Avicennia marina* subsp. *australasica* leaf galls; emerged 20.III.2020; 2 ♂, 1 ♀, 1 pupal exuviae and 1 larva, CXMNC, on slides, nos. Cecid. ET0125–ET0129.

Identification. The New Caledonian mangrove gall midge morphologically fits the definition of the *Avicennia*-associated genus *Actilasioptera* Gagné, 1999 due to the presence of the following characters: the reduction of adult palpus to one or two segments; the narrow, elongate aedeagus and ventral part of mediobasal lobes; the needle-like ovipositor; the developed pupal vertex; and the reduction of larval lateral and terminal papillae (Gagné and Law 1999). Referring to the key to species of *Actilasioptera* and the species description of the five known species given in Gagné and Law (1999), the New Caledonian species exhibits morphological similarities to *Ac. coronata* Gagné, 1999 as they share the following characters: the adult palpus is two-segmented and the second segment is longer than the first; the R_3 wing vein joins C slightly posterior to the wing midlength; the male hypoproct is convex distally; the ventral part of mediobasal lobes bears short setae; the protrusible part of the ovipositor is needle-like, straight and pointed apically, and is about twice as long as tergite VII; the pupal vertex is slightly produced ventrally and the pupal face lacks projections; the larval spatula is provided with four anterior lobes, the outermost lobes are longer than innermost; and the larval terminal segment bears two setose papillae. Despite these morphological similarities and the close geographic distribution of *Ac. coronata* in nearby Australia (Figure 2), the gall of the New Caledonian species is slightly different from that of *Ac. coronata*. The New Caledonian gall is hemispheroid and smooth on the upper leaf surface and dome-shaped with a central tunnel-like cavity on the lower surface, while the gall of *Ac. coronata* is unevenly hemispheroid and warty on the upper surface and cylindrical and craterlike on the lower surface (Gagné and Law 1999; R. Adair pers. comm. 17 June 2025; R.J. Gagné pers. comm. 27 June 2025). For these reasons, it is likely that the New Caledonian *Actilasioptera* sp. is a distinct species but closely related to the Australian *Ac. coronata*.

Leaf galls of *Actilasioptera* sp. are about 5.2–5.8 mm in diameter and 6.8–8.4 mm in height ($n = 10$). The galls are yellowish on the upper surface, but pale to brownish, slightly trichose on the lower surface (Figure 1A, B, G). The dome-shaped part has a central tunnel-like cavity from which the adult gall midge emerges, leaving pupal exuviae inside (Figure 1F, G). The gall is single-chambered and contains one larva or pupa and covered internally with white hyphae of symbiotic fungus (Figure 1C–E). Immature larvae are white but turn yellow when mature. Dissected galls on the same leaf or branch contained larvae and pupae at different developmental stages suggesting that oviposition is asynchronous over a season.

Figure 2. Map of New Caledonia and east of Australia showing the distribution points of *Actilasioptera* sp. and its potentially closely related species *Ac. coronata* (edited Google Earth Pro image). The pink marker indicates the newly recorded galls of *Actilasioptera* sp. in Noumea, New Caledonia, and the yellow marker shows previously known point of occurrence of *Ac. coronata* in Queensland, Australia (Gagné and Law 1999).



DISCUSSION

The New Caledonian *Actilasioptera* sp. seems to be closely related to the Australian *Ac. coronata* morphologically, but their gall shapes are slightly different. Such difference in gall shape suggests that the species are potentially distinct. Thus, collection of further specimens of *Actilasioptera* sp., comparison with the type specimens of *Ac. coronata*, and molecular analyses are necessary to clarify the identity of *Actilasioptera* sp. and its relationship to *Ac. coronata*.

Based on our observations along the western coast of New Caledonia, the leaf galls of *Actilasioptera* sp. are commonly found on the grey mangrove, with heavy infestation in several localities. Considering that Grey Mangrove covers about 35,000 ha in New Caledonia (Audrey Leopold pers. comm. 20 May 2025), further studies are needed to confirm the pest status of *Actilasioptera* sp. and to determine the extent of its impact on mangrove populations.

Phytophagous gall midges are commonly associated with a particular plant genus or a few host plant genera within a single plant family, such as *Procontarinia* Kieffer & Cecconi, 1906 on *Mangifera* L. (Anacardiaceae), *Semudobia* Kieffer, 1913 and *Massalongia* Kieffer, 1897 on *Betula* L. (Betulaceae), and *Ampelomyia* Elsayed & Tokuda, 2019 and *Vitisiella* Fedotova & Kovalev, 2003 on Vitaceae (Elsayed et al. 2019, 2020, 2022; Kolesik et al. 2009; So et al. 2022). The genus *Actilasioptera* appears to be closely associated with leaves of *Av. marina*, with five named species presently and three other undescribed species in the UAE (Gagné and Jaschhof 2025; Harris and Harten 2010). Additional leaf galls induced by undescribed gall midges, possibly *Actilasioptera*, were reported on several *Avicennia* species worldwide (Santos et al. 2013; Sharma et al. 2003; Sharma and Das 1984). Identification of further *Actilasioptera* species and their ecological surveys may shed light on their coevolutionary aspects and speciation processes on *Avicennia*.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: AKE, CGM, AK. Data curation: AKE, CGM. Formal analysis: AKE, CGM. Funding acquisition: AKE, CGM. Investigation: AKE, CGM, AK. Methodology: AKE. Visualization: AKE. Writing – original draft: AKE. Writing – review and editing: AKE, CGM, AK.

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Data availability

All data that support the findings of this study are available in the main text.

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