New Species of Chalcidoid Wasps Associated with Stem Galls of *Ficus microcarpa* in Hawai'i

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Abstract. We describe *Josephiella manana* Magnacca & Zhang **sp. nov.** (Epichrysomallidae), which induces stem galls on the introduced Chinese banyan (*Ficus microcarpa*). In association with these galls, we also describe *Gibsonoma kuewa* Magnacca & Zhang **sp. nov.** (Eurytomidae, Eurytominae). Both species are introduced to Hawai'i and are likely established on all islands where *F. microcarpa* occurs. In addition, the Australian *Eurytoma longipetiolata* Girault is transferred to *Gibsonoma* as *Gibsonoma longipetiolata* (Girault) **comb. nov.**

Key words: *Josephiella*, Epichrysomallidae, Eurytomidae, *Gibsonoma*, banyan

Josephiella Narendran, 1993 is a genus of non-pollinating fig wasps in the family Epichrysomallidae that induce galls in vegetative tissue of banyan trees (*Ficus* L., Moraceae) (UCD Community 2023, Rasplus et al. 2025). In addition to its unusual biology (using vegetative parts rather than fruits of figs), the genus can be separated from all other Epichrysomallidae by the combination of occipital carina absent, clypeus bilobed, tarsi four-segmented, and antennal funicle five-segmented in female, three-segmented in the male (known only for *J. microcarpae* Beardsley & Rasplus, 2001) (Narendran and Sheela 1993, Beardsley and Rasplus 2001). It was originally established for *Josephiella malabarensis* Narendran, 1993, which induces leaf galls in *Ficus benghalensis* L. (Narendran and Sheela 1993). In 1989, a second leaf-galling species was found infesting Chinese banyan (*Ficus microcarpa* L.) in Hawai'i (Fig. 1A; Beardsley 1992). By the time it was described in 2001 as *J. microcarpae*, it had already spread to California and the Mediterranean (Beardsley and Rasplus 2001). It continues to be a significant pest of ornamental trees and expand its range (Bhandari and Cheng 2016, Kalaentzis et al. 2023).

In 2012, a second species of *Josephiella* appeared in Hawai'i, this time inducing stem galls on young twigs (Fig. 1B; HDOA 2012). Since then it has remained undescribed, and does not appear to have spread widely as *J. microcarpae* has. However, it is a serious pest in Hawai'i,

causing even more damage than the leaf galls of *J. microcarpae* and equally difficult to control (Bhandari and Cheng 2016). In order to facilitate further work on this species and enable its recognition at new introduction sites, particularly separation from the other two species, we describe it here.

During rearing of galled stems to obtain *Josephiella* specimens, an unusual eurytomid wasp with a long petiole in the female was also obtained. The same species was collected by sweeping branches as well. This eurytomid was identified as a member of the genus *Gibsonoma* Narendran, 1994 (Eurytomidae, Eurytominae), an apparent parasitoid or inquiline associate of the *Josephiella* galls, and is described here as well. In the process of attempting to identify if this species may have been previously described, the Australian taxon *Eurytoma longipetiolata* Girault, 1915 was brought to our attention (G. Delvare, pers. comm.). It is compared to the new species and characters to separate them given.

Methods

Specimens were examined from the Bernice Pauahi Bishop Museum (BPBM) and State of Hawai'i Department of Agriculture and Biosecurity (HDOA) collections and collected from *F. microcarpa* and by general sweeping. To ensure association with only stem galls, material collected for rearing was stripped of leaves to eliminate *J. microcarpae* and species associated with it. Specimens were imaged at BPBM using a Leica MZ16 microscope system and LAS X software (Leica Microsystems Inc.), and focus stacks produced using Helicon Focus 8. The syntypes of *Eurytoma longipetiolata* were imaged by staff of the Queensland Museum. General terminology follows Burks et al. (2025) and eurytomid-specific terms follow Lotfalizadeh et al. (2007).

Abbreviations: fu# = antennal funicle segment; Gt# = gastral tergite (counting from first large tergum, not counting petiole); SMV = submarginal vein; MV = marginal vein; PMV = postmarginal vein; STV = stigmal vein.

The type materials are deposited in BPBM (curator Neal Evenhuis), Smithsonian National Museum of Natural History (NMNH, Washington D.C., curator Michael Gates), and Centre de Biologie pour la Gestion des Populations (CBGP, Montpellier, France, curator Jean-Yves Rasplus).

Results

Epichrysomallidae

Josephiella manana sp. nov. Magnacca & Zhang

Figure 1B, 2

https://zoobank.org/urn:lsid:zoobank.org:act:B56CB4A2-F0B0-4E47-BB05-99BF3CB2D4BA

Diagnosis. Very similar to *J. microcarpae* in general appearance (compare Figs. 2, 3). Readily distinguished by the smoother sculpture overall, particularly the polished scutellum and midlobe of the mesoscutum; notauli distinct as grooves, nearly complete to the posterior margin; and metabasitarsus short, only about 3/4 as long as the distitarsus (as long as the distitarsus in *J. microcarpae*). Separated from *J. malabarensis* (which also has distinct notauli) in having the scape narrower (2.7–2.8× longer than wide rather than 2.4×) and antennal funicle segments broader (middle segments 1.1–1.3× wider than long versus 1.5×), and smoother sculpture of the mesosoma. Uniquely compared to both, this species has large, conspicuous tentorial pits, appearing at least as wide as the interantennal space depending on lighting; in *J. microcarpae*, the pits are almost indistinguishable (compare Figs. 2B and 3B).

Description. Female. Total body length

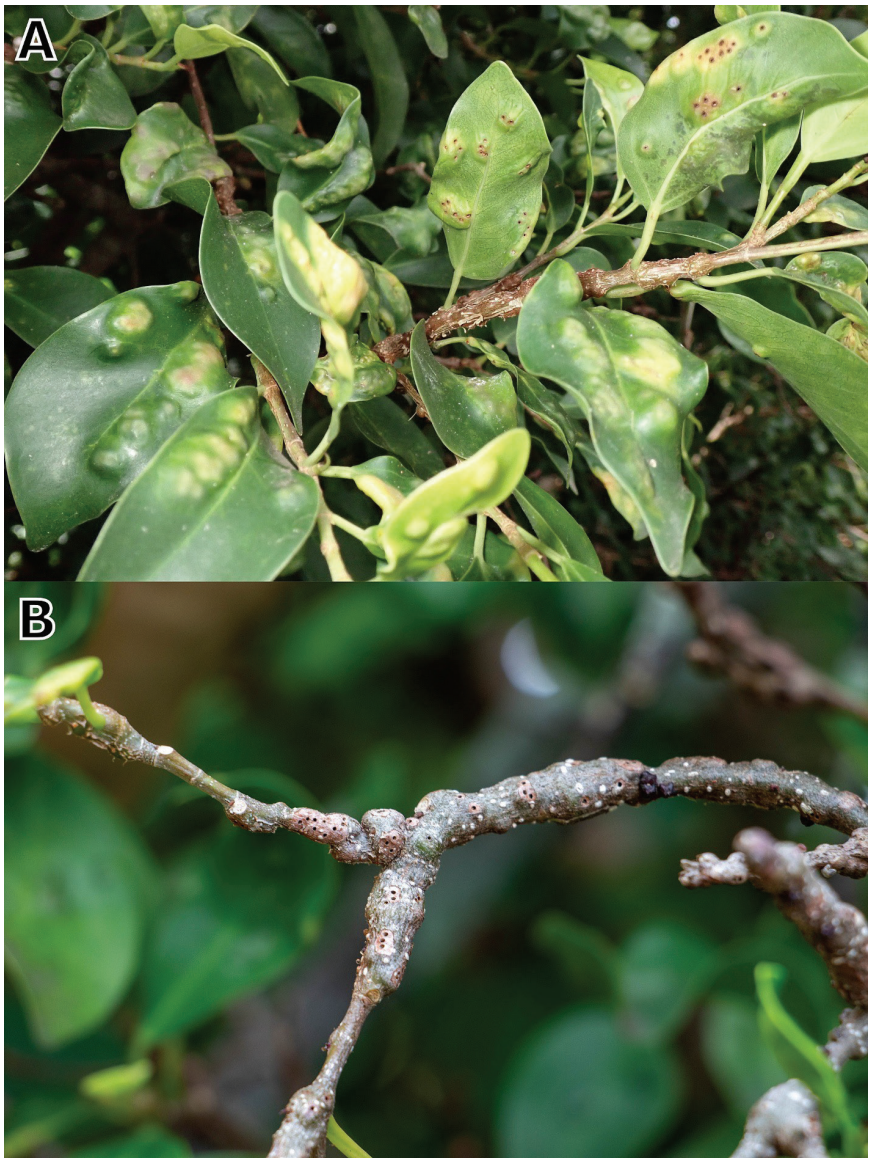

Figure 1. A: Leaf galls in *Ficus microcarpa* induced by *Josephiella microcarpae*, with exit holes on the underside of the leaves. B: Stem galls in *F. microcarpa* induced by *J. manana* sp. nov.

1.45–2.00 mm. *Color*. Head and body entirely dark brown to black except ventral half of clypeus orange. Antenna yellow, pedicel tinged with brown. Mandible yellow at base, teeth reddish brown. Legs predominantly pale cream except coxae mostly brown, femora variably tinged with brown except at apex.

Head. Width 0.42–0.51 mm, height 0.36–0.45 mm. Antenna with scape

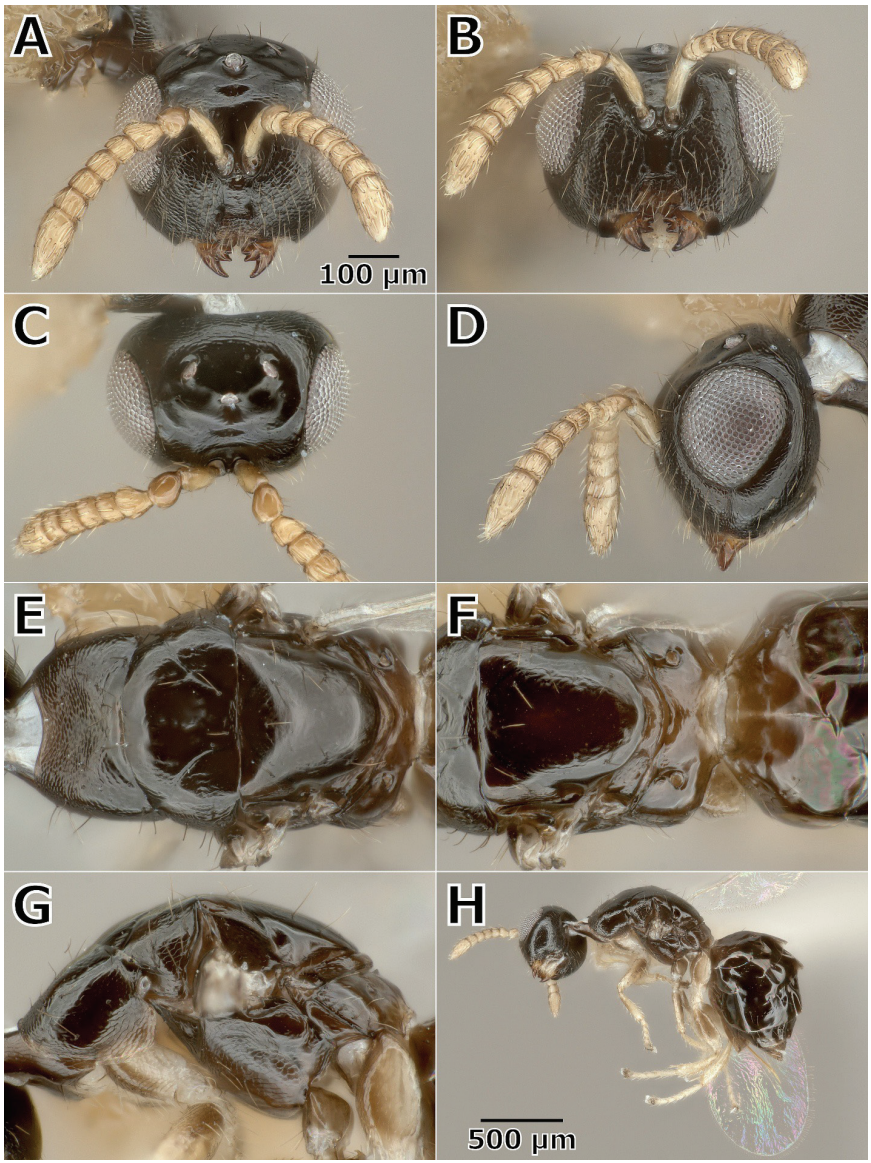

Figure 2. *Josephiella manana* sp. nov., holotype female. A: head, frontal; B: lower face, showing tentorial pits; C: head, dorsal; D: head, lateral; E: mesosoma, dorsal; F: mesosoma, posterodorsal; G: mesosoma, lateral; H: lateral habitus. A–G at the same scale.

not expanded, about 2.7–2.8× as long as wide, reaching to frontal angulation; funicle 5-segmented, fu1 asymmetrically trapezoidal, fu2–5 more or less cylindrical, all segments slightly wider than long, fu1–4 1.1–1.3× wider than long, fu5 1.5× wider than long. Clypeus about 1.2× as wide as long, ventral margin bilobed,

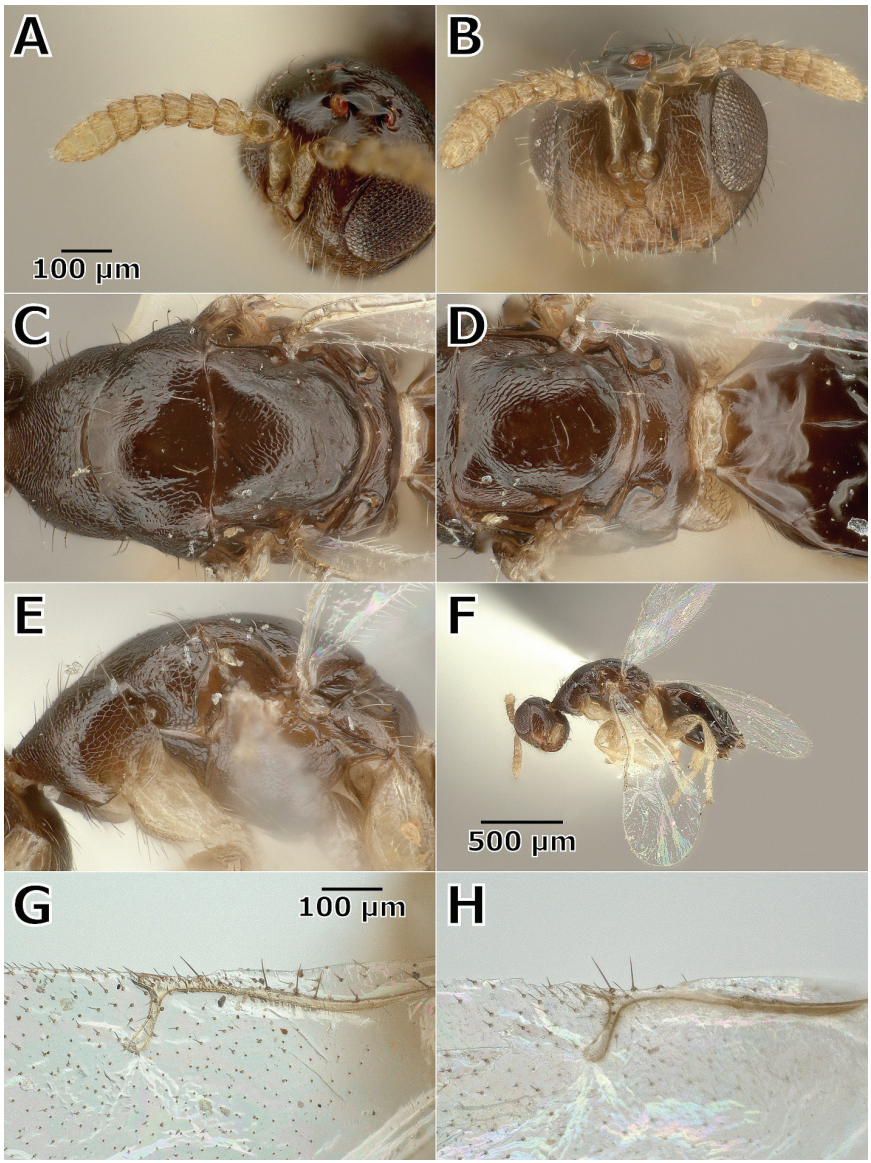

Figure 3. *Josephiella microcarpae* Beardsley & Rasplus, holotype female, A–G. A: antenna; B: lower face; C: mesosoma, dorsal; D: mesosoma, posterodorsal; E: mesosoma, lateral; F: lateral habitus; G: distal wing venation. H: *Josephiella manana* sp. nov., holotype female, distal wing venation. A–E at the same scale, G–H at the same scale.

densely reticulate and dull, distinctly different in sculpture from adjacent areas. Tentorial pits unusually large and prominent, visible as deep pits, each about half as wide as a torulus; clypeal, epistomal, and subantennal sulci weakly indicated. Supraclypeal area smooth and nearly polished, slightly longer than

wide. Lower face reticulate, coriaceous and matte, with abundant moderately long setae. Malar sulcus visible as a line of differentiated sculpture. Frons above toruli faintly reticulate, vertex polished around ocelli. Occiput and gena weakly reticulate. Eye setae sparse, each about as long as two ommatidia.

Mesosoma. Length 0.67–0.86 mm. Pronotum large and quadrate, dorsal surface conspicuously sculpted with transverse reticulation anteriorly, almost smooth on posterior third, more weakly reticulate on lateral face. Mesoscutum with notauli deeply grooved, approaching mesoscutal posterior margin; mid lobe smooth and nearly polished, with very faint reticulation anterolaterally and along posterior margin between notauli, with two anteriorly-directed setae on each side near notauli; lateral lobe very faintly reticulate, with about six setae laterally. Mesoscutellum smooth and nearly polished, with very faint reticulation visible at high magnification, with about four pairs of setae; axillar suture not visible externally. Prepectus and mesepisternum smoothly reticulate; mesepimeron mostly polished with some reticulation on posterior and ventral margins. Dorsellum smooth and polished, about 1/3 as long as propodeum on midline. Propodeum smooth and polished, without discal carinae, with 6–7 setae laterally near marginal carina; spiracle separate from anterior margin by about diameter of a spiracle. Pro- and metacoxae large, mesocoxa much smaller; metacoxa nearly as long as metafemur. Metabasitarsus about 3/4 as long as remainder of tarsus.

Metasoma. Entirely smooth and polished. Petiole transverse, usually concealed under propodeum. Gt1–3 weakly divided by median longitudinal crease. Hypopygium extending about to apex of Gt4. Ovipositor sheath hardly extending beyond apex of terga.

Wings. About 2.4× as long as wide. Microsetae very sparse. SMV with 4–5 long setae on basal portion, 2–3 distally. SV emerging at nearly right angle to wing margin, subequal to MV; PMV variable, 1/3–1/2 as long as SV (often varying within individuals).

Male. Unknown (probably parthenogenic).

Type Material. Holotype ♀: **HAWAIIAN ISLANDS: O‘ahu:** Mānoa, reared ex. gall in *Ficus microcarpa* stem, 29 Dec 2024, K.N. Magnacca, BPBMENT1000005584. **Paratypes: HAWAIIAN ISLANDS: Kaua‘i:** 1♀, Hā‘upu NW ridge 675 m, on *Metrosideros polymorpha*, 21.9259°N 159.4025°W, 14 Aug 2023, K.N. Magnacca, K23081404-25, BPBM. 1♀, Hā‘upu summit 700 m, night collecting, 21.9251°N 159.4016°W, 14 Aug 2023, K.N. Magnacca, K23081414-19, BPBM. 1♀, Hā‘upu summit 700 m, yellow pan trap, 21.9247°N 159.4013°W, 15 Aug 202,3 K.N. Magnacca, K23081503-15, BPBM. **O‘ahu:** 15♀, Nu‘uanu, 21.3241°N 157.8508°W, ex *Ficus microcarpa* stems, 2 Aug 2012, W. Nagamine, CBGP. 13♀, UH Mānoa East West Center, ex. *Ficus microcarpa* stems, 13 Jul 2012, D. Hulbert, #2012-230, HDOA. 1♀, west of Pu‘u Kahuauli, on Melaleuca, 28 Jan 2022, K.N. Magnacca, BPBM. 1♀, Central Kalua‘a Gulch, 630 m, Townes Malaise trap, 31 Mar–8 Jun 2023, O23060801-113, K.N. Magnacca, BPBM. **Hawai‘i:** 4♀, Hilo, Banyan Drive, ex. *Ficus microcarpa,* 30 Jul 2012, C. Hirayama, S. Chun, & L. Larish, #2012-332, HDOA. 10♀, Hilo, Wailoa Park, ex. *Ficus microcarpa* stem gall, 3 Apr 2025, Y.M. Zhang, BPBM. 10♀, same as previous, Y.M. Zhang, NMNH. 10♀, Hilo, Macadamia Rd., ex. *Ficus microcarpa* stem gall, 15 Jun 2025, Y.M. Zhang, BPBM. 10♀, Hilo, Wailoa Art Center, 19.7193°, -155.0759°, 29 Jun 2025, Y.M. Zhang, BPBM.

Etymology. From the Hawaiian

manana, swollen as with sickness, referring to the swellings of the galls on the stems of its host plant. It is a genderless adjective.

Biology. Induces multichambered, woody stem galls in twigs of Chinese banyan, *Ficus microcarpa* (Moraceae) (Fig. 1B).

Distribution. Found in Hawai'i, known from at least Kaua'i, O'ahu, Maui, and Hawai'i, as well as Miami, Florida based on collected specimens, personal observations, and iNaturalist records.

Discussion. Specimens in alcohol may be less distinct from *J. microcarpae*, as the notauli are visible internally in wet specimens and the sculpture is not always clear. However, the tentorial pits and scutellar sculpture are sufficient for separation (compare Figs. 2B, E–F and 3B–D). One specimen from the 2012 O'ahu series is dwarfed and may be a male, but the gaster is shriveled and obscured by glue. Another from the same series has only four antennal funicle segments on one side.

Eurytomidae

Gibsonoma kuewa sp. nov. Magnacca & Zhang

Figure 4

https://zoobank.org/urn:lsid:zoobank.org:act:BE07CE54-2169-4BCB-A9E4-90F6D1495484

Diagnosis. *Gibsonoma kuewa* fits within the current definition of *Gibsonoma sensu lato* (Zhang et al. 2025) by the following characters: Bilobed or emarginate clypeus, antennae inserted high on frons, short antennal scrobes, funiculars fusiform, axillar groves without pit at mid length, and Gt4 mostly well expanded, almost covering Gt5 (G. Delvare, pers. comm.). It is unique among the known Eurytomidae of Hawai'i in having the petiole elongate in the female. Differs from the type species, *G. budhai* Narendran, in the all-yellow antenna with fu2–5 becoming progressively shorter, and coarse areolate-punctate sculpture. The Madagascar species described by Risbec (1952) and transferred to *Gibsonoma* by Gates and Delvare (2008) all differ in having the petiole less than half the length of the scutellum (often much shorter), and usually at least the pedicel of the antenna dark. Differing from *G. longipetiolata* comb. nov. by the characters listed under that species below.

Description. Female. Total body length 1.80–1.95 mm. *Color.* Head and body predominantly black; petiole except ventral apex and ventral metasoma orange-brown; also a faint tinge of brown on pronotum anterolaterally. Mandible dark reddish brown. Legs mostly yellow except procoxa dark brown, meso- and metacoxa and profemur tinged with brown.

Head. Width 0.53–0.56 mm, height 0.43–0.44 mm. In frontal view about 1.2–1.3× wider than long. Predominantly coarsely areolate-punctate, bottoms of areolae flat and polished, dividing ridges mostly carinulate, but where interspaces visible, surface dull and sculpted. Clypeus weakly emarginate on ventral margin, smooth; supraclypeal area smooth or weakly transverse striate to toruli, striations grading into areolate sculpture directly below toruli. Epistomal and subantennal sulci and tentorial pits obsolete. Malar sulcus thin, with narrow smooth polished area posterior; malar space about 0.55× eye height. Genal carina present, ventrally slightly reflexed, without postgenal depression. Toruli placed slightly above middle of head, near middle of eye; median margin raised into interantennal prominence. Scrobal depression short, polished, margined by weak carina. Scape flask-shaped, broadest near base, reaching above dorsal margin of anterior ocellus; two anelli present; pedicel and fu1 obovate, fu2–5 short

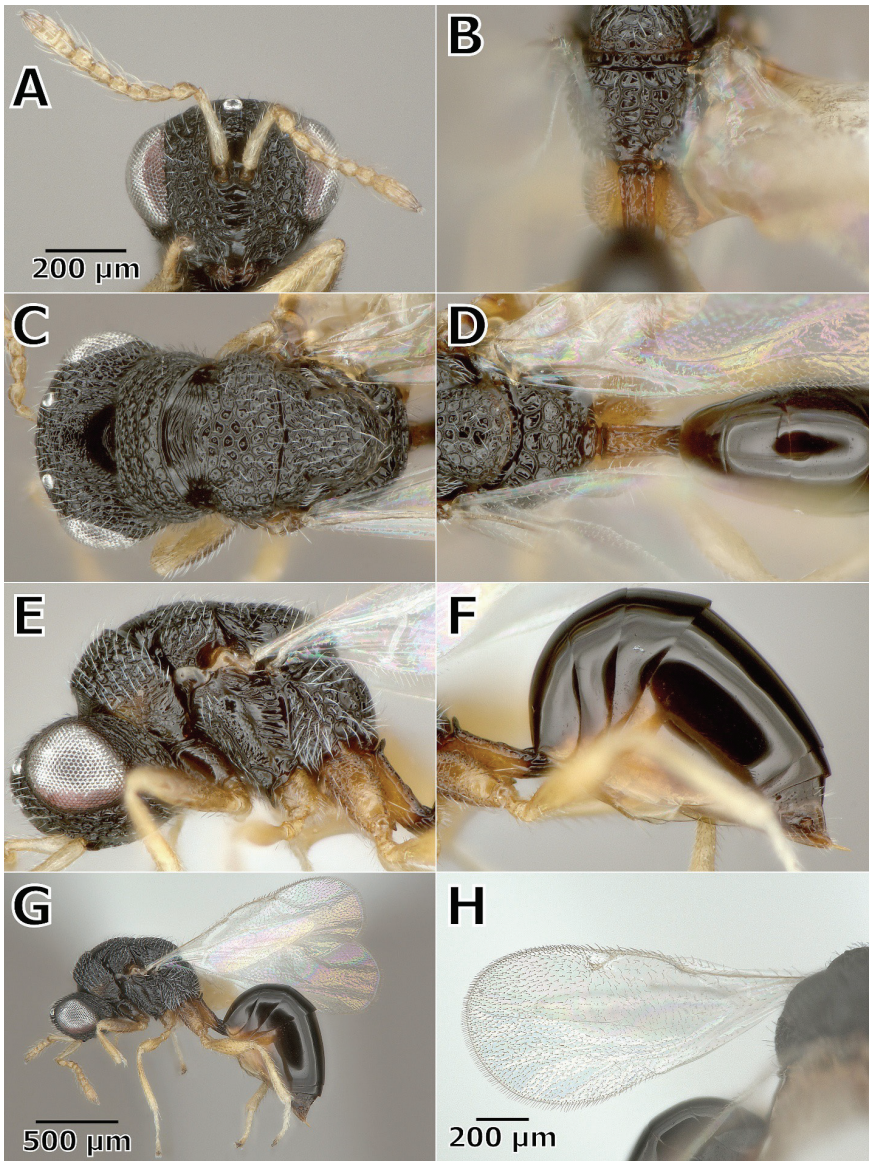

Figure 4. *Gibsonoma kuewa* sp. nov., holotype female. A: head, frontal; B: propodeum; C: mesosoma, dorsal; D: posterior mesosoma, petiole, and anterior metasoma, dorsal; E: mesosoma, lateral; F: metasoma, lateral; G: lateral habitus; H: fore wing. A–F at the same scale.

barrel-shaped; clava elongate, about as long as fu3–5 combined. Antennae with a single row of setae per segment.

Mesosoma. Length 0.76–0.79 mm, width between tegulae 0.41–0.43 mm, depth 0.45–0.47 mm. Mostly areolate-punctate; about 1.7× longer than wide and deep; setae short, thin, setiform,

mostly inconspicuous. Pronotum with irregular rugose-striate sculpture on lateral face. Anterior surface of mesoscutum transversely striolate (can be hidden by pronotum). Notauli and axillar grooves indistinct near transscutal line, indicated by slight depressions obscured by sculpture. Prepectus smooth and polished, narrow ventral portion carinate. Mesepisternum rugulose anteriorly, separated by vertical carina from lateral-facing portion which has angled striae extending from anterior margin; ventrally with precoxal tooth formed by raised adscrobal carina in front of mesocoxal foramen. Mesepimeron separated by line of fine punctures, also polished with carinulate striae. Metapleuron fused to propodeum, no indication of suture. Posterior face of propodeum coarsely and irregularly rugose, without distinct median depression; nucha absent. Procoxa smooth and almost polished, very faintly reticulate. Metacoxa very strongly but somewhat finely rugulose.

Metasoma. Petiole elongate, over twice as long dorsally as wide, with dorsolateral and lateral carinae; anteriorly raised into laminar flange against propodeum; posteriorly with five ventral and ventrolateral foveae at apex. Gt1–4 highly polished, Gt5–6 very finely spiculate, syntergum weakly reticulate. Gt1–3 short and subequal, most of gaster comprised of Gt4 which is longer than others combined. Ventral margin of gaster straight in lateral view, ovipositor in line with ventral margin.

Wings. Venation very pale. Ratio SMV:MV:PMV:SV 55:20:7:10. Cubital and basal lines with complete setal rows, but cubital line weakly differentiated from discal setae. Speculum narrow, parallel to basal line and parastigma.

Male. Unknown.

Type Material. Holotype ♀: **HAWAIIAN ISLANDS: O'ahu:** Mānoa, reared ex gall in *Ficus microcarpa* stem, 29 Dec 2024, K.N. Magnacca, BPBMENT1000005585. **Paratypes: HAWAIIAN ISLANDS: Moloka'i:** 2♀, Pāpio Stream, 600 ft [180 m], yellow sticky board trap, 24 Jun–8 Aug 1994, W.D. Perreira & M. Fukada, BPBM. 2♀, same data as previous, 16–30 Sep 1994, BPBM. **Hawai'i:** 1♀, Hilo Bayfront Park, sweeping *Ficus microcarpa*, 11 Oct 2024, K.N. Magnacca, BPBM. 1♀, Hilo, Highway 11 85 m, 19.6448°N 155.0476°W, sweeping *Ficus microcarpa*, 18 May 2025, K.N. Magnacca, NMNH.

Etymology. From the Hawaiian *kuewa*, vagabond or exile, referring to its unknown native range, biology, and generic placement.

Biology. Associated with stem galls of *Josephiella manana* in twigs of *Ficus microcarpa*; it is unclear if it is a parasitoid or inquiline. It is a noun in apposition.

Distribution. Found in Hawai'i, at least on the islands of O'ahu, Moloka'i, and Hawai'i.

***Gibsonoma longipetiolata* (Girault), comb. nov.**

Figure 5

Eurytoma longipetiolata Girault, 1915: 254

We compared the newly described *G. kuewa* with *E. longipetiolata*, a morphologically similar species that is only known from Queensland, Australia (Girault 1915). Girault's original description mentions characters on the head and antennae, but these cannot be verified as the more intact of the two syntypes is missing its head, while the other is represented only by the gaster. Nevertheless, based on the combination of the description and the specimens, it belongs in *Gibsonoma* based on the axillar grooves without pit at mid length, elongate petiole, and enlarged Gt4, and is therefore transferred to *Gibsonoma longipetiolata* comb. nov. Although the type images are

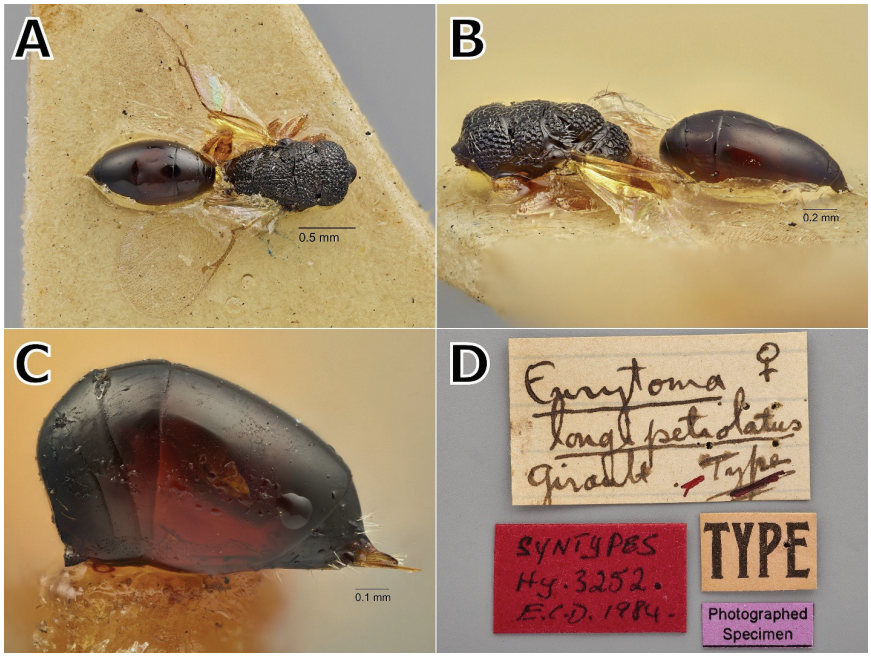

Figure 5. *Gibsonoma longipetiolata* (Girault) comb. nov., syntypes. A: syntype 1, mesosoma and metasoma, dorsal; B: syntype 1, mesosoma and metasoma, lateral; C: syntype 2, gaster, lateral; D: labels. Images © Queensland Museum, Lily Kumpe and Chris Burwell.

insufficient to provide a full redescription of the species, they show a number of clear differences from the morphologically similar *G. kuewa* as follows:

Character	***G. kuewa***	***G. longipetiolata***
Pronotal posterior margin	smooth posterior marginal area delimited by carina	posterior marginal area not delimited by carina
Pronotal punctation	crowded and distorted anteriorly and laterally, interspaces absent	all round, distinct interspaces present at least laterally, up to half pit width
Mesoscutal punctation	about 5 longitudinal rows of punctures	6–7 longitudinal rows of punctures
Anterolateral angle of mid lobe of mesoscutum	not differentiated	with area of coriaceous sculpture (lacking large punctures) mesad notauli
Notauli	distinct on anterior half, obscured by punctation posteriorly	distinct over entire length

Discussion

The reason for the lack of spread of *J. manana* around the world compared to *J. microcarpae* is unknown. It is much more difficult to rear, probably because twigs are more difficult to keep both damp and soft without molding (even when the cambium stays alive, the outer bark often dries and hardens, potentially keeping the wasps from emerging). *Josephiella* stem gall wasps were intercepted in Italy on a shipment of bonsai *F. microcarpa* from China, but apparently did not become established and it is unclear if they were the same species treated here (NPPO of Italy 2015). Clearly, live plant material can serve as a vector, but perhaps not loose debris that might be accidentally caught by a hiker's backpack. Both of the *Josephiella* species readily disperse long distances by wind, at least within an island in Hawai'i, and are commonly found by sweeping vegetation or in traps far from any *Ficus*.

By contrast, *G. kuewa* is relatively rare, especially compared to the large number and ubiquity of its presumed host *J. manana*, and aside from the Moloka'i records discussed below, has not been found except by rearing or sweeping branches infested with *J. manana*. This is also the first record of a *Gibsonoma* associated with Moraceae, as other members of the genus are associated with various plant galls in Madagascar (Gates and Delvare 2008). Currently the genus *Gibsonoma* and its related groups *sensu* Zhang et al. (2025) are poorly defined, and revisionary work is needed to reliably separate these genera (Zhang unpublished data, G. Delvare, pers. comm.).

The collection of *G. kuewa* from Moloka'i in 1994, long before *J. manana* was first discovered in Hawai'i, is puzzling. The Madagascan *Gibsonoma* species have been reared from both leaf and stem galls but no one species from both (Gates and Delvare 2008), and none have emerged as a result of extensive rearing of *J. microcarpae* from leaf galls. It seems extremely unlikely that *J. manana* was already established on Moloka'i at that time yet did not spread to the point it was noticed on the other islands for another 18 years. Although *J. manana* was already established on O'ahu, Maui, and Hawai'i by 2012 (HDOA 2012), the importance of banyan as an ornamental tree, ongoing study of *J. microcarpae* control, and easy dispersal of the wasps (at least within islands), makes it unlikely that it was established for so long without being noticed. An alternative possibility is that *G. kuewa* is able to utilize other structurally similar galls, but there are no obvious candidates that we know of.

Acknowledgements

We thank Gérard Delvare (CIRAD, France) and Jean-Yves Rasplus (INRAE, France) for providing insights on the diagnostics and biology of the two species. We also thank Lily Kumpe, Chris Burwell, and Nicole Gunter of the Queensland Museum for providing us with the images of the *Eurytoma longipetiolata* types and granting permission to reproduce them here.

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