

***Vouchers collected on Kaua‘i with notes on naturalization status
and other supplemental data***

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Repositories:

BISH / BPBM	Bernice Pauahi Bishop Museum, Honolulu, HI
PTBG	National Tropical Botanical Garden, Kalāheo, HI
UHIM	University of Hawai‘i Insect Museum, Honolulu, HI
HDOA	Hawai‘i Department of Agriculture, Honolulu, HI

Naturalization Terms:

Species are accompanied by a naturalization status using the following terms and phrases, and by an explanatory note if found surviving in the wild for the first time on Kaua‘i:

Cultivated: a plant purposefully kept in captivity, such as a garden, that has not escaped into the wild.

Not Self-Sustaining: surviving in the wild (i.e., outside of captivity) with sufficient evidence suggesting that offspring, if produced, do not contribute to a self-sustaining population.

Potentially Naturalizing: a non-native species found outside of cultivation but where self-sustaining populations have not been observed, either because adequate field surveys have not been conducted or insufficient time has passed for multiple reproductive cycles to occur.

Naturalized: a non-native species with self-sustaining populations existing outside of captivity or containment (e.g., cultivation).

New State Record: the first report of a status for a species in the Hawaiian Islands, including on Kaua‘i.

New Kaua‘i Record: a status for species previously recorded on other Hawaiian Islands but is the first such report on Kaua‘i.

New Host Record: a wasp species found to be using a novel *Ficus* host in contrast to its previously known host plant.

Note: this supplement does not provide a complete list of taxonomic synonyms.

Supplemental Tables

Table S1. Summary of locations for each individual fig tree surveyed, detailed in remainder of supplement, and associated GenBank accession numbers when relevant.

<i>Ficus</i> specimen	Location	GenBank # for fig	Pollinator present (number)	GenBank # for pollinator
<i>F. altissima</i>	21°54.46'N, 159°30.68'W			
<i>F. benghalensis</i> *	21°57.49'N, 159°40.68'W			
<i>F. benjamina</i>	22°13.12'N, 159°29.35'W			
<i>F. boninsimae</i>	21°54.00'N, 159°30.19'W			
<i>F. drupacea</i>	21°54.46'N, 159°30.68'W			
<i>F. elastica</i>	21°58.32'N, 159°20.70'W			
<i>F. macrophylla</i>	21°57.42'N, 159°31.11'W		<i>Pleistodontes froggatti</i> (90)	MW016949
<i>F. macrophylla</i> *	21°53.66'N, 159°30.22'W		<i>Pleistodontes froggatti</i> (86)	MW016948
<i>F. microcarpa</i>	21°53.06'N, 159°29.15'W		<i>Eupristina verticillata</i> (1)	
<i>F. nota</i>	21°54.00'N, 159°30.19'W			
<i>F. prolixa</i>	21°54.00'N, 159°30.19'W			
<i>F. pumila</i> *	21°52.95'N, 159°28.86'W			
<i>F. religiosa</i>	21°54.05'N, 159°30.24'W		<i>Platyscapa quadraticeps</i> (63)	
<i>F. religiosa</i> *	21°58.57'N, 159°22.05'W		<i>Platyscapa quadraticeps</i> (113)	
<i>F. rubiginosa</i>	21°57.72'N, 159°30.90'W	MW013803	<i>Pleistodontes imperialis</i> (53)	MW016944
<i>F. rubiginosa</i>	21°57.82'N, 159°30.83'W	MW013768	<i>Pleistodontes imperialis</i> (130)	MW016945
<i>F. rubra</i>	21°53.98'N, 159°30.27'W		<i>Pleistodontes imperialis</i> (23)	MW016946
<i>F. saussureana</i>	21°54.04'N, 159°30.21'W			
<i>F. scabra</i>	21°54.00'N, 159°30.19'W			
<i>F. superba</i>	21°54.00'N, 159°30.19'W			
<i>F. sycomorus</i>	21°54.03'N, 159°30.24'W			
<i>F. tinctoria</i>	21°54.00'N, 159°30.19'W			
<i>F. trigonata</i>	21°54.00'N, 159°30.19'W			
<i>F. vallis-choudae</i>	21°54.03'N, 159°30.19'W			
<i>F. virens</i>	21°54.05'N, 159°30.26'W		<i>Platyscapa cf coronata</i> (105)	
<i>F. watkinsiana</i>	21°54.45'N, 159°30.68'W		<i>Pleistodontes imperialis</i> (43)	MW016947
<i>F. watkinsiana</i> **	21°54.45'N, 159°30.68'W			

*Syconia collected but not herbarium specimen due to landowner restrictions.

**Herbarium specimen collected but no syconia present on immature plant.

Table S2. Germination rates of non-native figs that contained pollinator wasps on Kaua‘i, shown in mean \pm standard deviation. Other figs in this study did not produce seeds nor did they contain pollinators.

<i>Ficus</i>	PTBG accession number	Number of replicates sown	Number of seeds sown	Proportion germinated (mean \pm sd)
<i>F. macrophylla</i>	20170285	7	245	0.0286 \pm 0.0398
<i>F. microcarpa</i>	20170284	6	139	0.6248 \pm 0.4877
<i>F. religiosa</i>	20170047	9	270	0.3407 \pm 0.2702
<i>F. religiosa</i>	20170232	4	160	0.1875 \pm 0.0661
<i>F. rubiginosa</i>	20170286	6	249	0.0455 \pm 0.0628
<i>F. rubiginosa</i>	20170287	6	249	0.7020 \pm 0.7824
<i>F. rubra</i>	20170156	7	400	0.2714 \pm 0.3544
<i>F. virens</i>	20170337	3	150	0.2533 \pm 0.0833
<i>F. watkinsiana</i>	20170050	9	255	0.9541 \pm 0.1130

Table S3. Loadings of principal component analysis of morphometric variables for non-native fig species on Kaua‘i, graphically represented in Figure 2B.

Variable	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6
Reproduction	0.512	0.437	0.156	0.128	0.076	0.707
Syconium diameter	-0.333	0.560	-0.300	0.188	-0.671	0.000
Lateral bracts	-0.512	-0.437	-0.156	-0.128	-0.076	0.707
Ostiole diameter	-0.468	0.432	-0.180	0.185	0.726	0.000
Inner ostiolar bracts	-0.264	-0.114	0.699	0.648	-0.095	0.000
Outer ostiole shape	-0.274	0.324	0.583	-0.691	-0.049	0.000
Cumulative proportion	0.411	0.685	0.895	0.970	1.000	1.000
Proportion of variance	0.411	0.273	0.211	0.074	0.030	0.000
Standard deviation	1.571	1.281	1.124	0.668	0.427	0.000

Figs (Moraceae: *Ficus*)
***Ficus altissima* Blume**
Cultivated

 [= *Ficus laccifera* Roxb.; *Urostigma altissimum* (Blume) Miq.; *U. lacciferum* (Roxb.) Miq.]

Material examined: **Hawaiian Islands:** KAUA‘I: Kalāheo, PTBG Botanical Research Center (21°54.46’N, 159°30.68’W); vouchered from PTBG living collection (830489.004) originally collected in 1983 from the wild between Yatiyanthota and Nawalapitiya in Sri Lanka; 26 Jan. 2017; *D. Wolkis DMW1136* (PTBG).

***Ficus benjamina* L.**
Cultivated

 [= *Ficus comosa* Roxb.; *F. cuspidatocaudata* Hayata; *Urostigma benjaminum* (L.) Miq.]

Material examined: **Hawaiian Islands:** KAUA‘I: Princeville, near cul de sac of Liholiho Rd (22°13.12’N, 159°29.35’W); cultivated plant in yard, 6 m tall (pruned) with hanging adventitious roots; leaves dark green, leathery, lighter abaxially; fruiting prolifically, fruits red, usually paired, globose; 17 Mar. 2017; *K. Brock 969* (PTBG).

***Ficus boninsimae* Koidz.**
Cultivated

Material examined: **Hawaiian Islands:** KAUA‘I: Kōloa, McBryde Garden (21°54.00’N, 159°30.19’W); cultivated tree propagated from material from Chuo-Yama, Ogasawara Island, Chichijima, Japan; *Living Collection 950520* (PTBG).

***Ficus drupacea* Thunb.**
Cultivated

 [= *Ficus chrysochlamys* K.Schum. & Lauterb.; *F. chrysocoma* Blume; *Urostigma dasycarpum* Miq.; *U. drupaceum* (Thunb.) Miq.]

Material examined: **Hawaiian Islands:** KAUA‘I: Kalāheo, PTBG Botanical Research Center (21°54.46’N, 159°30.68’W); vouchered from PTBG living collection (830400.003) propagated from material collected in 1983 along the road from Balangoda to Maratenne in Sri Lanka; 26 Jan. 2017; *D. Wolkis DMW1137* (PTBG).

***Ficus elastica* Roxb. ex Hornem.**
Cultivated

 [= *Ficus taeda* Kunth & C.D.Bouché; *Stilpnophyllum elasticum* (Roxb. ex Hornem.) Drury; *Urostigma circumscissum* Miq.; *U. elasticum* (Roxb. ex Hornem.) Miq.]

Material examined: **Hawaiian Islands:** KAUA‘I: Līhu‘e, abandoned golf course south of airport (21°58.32’N, 159°20.70’W); cultivated tree 4 m tall with hanging branches; leaves dark green or

purple tinged and glossy, terminal stipule prominent, red; 1 Jun. 2017; *K. Brock 1010* (PTBG).



Figure S1. *Ficus macrophylla* growing along road in Wahiawā Mountains, Kauaʻi.

***Ficus macrophylla* Desf. ex Pers.**

[= *Ficus huegelii* Kunth & C.D.Bouché; *F. magnolioides* Borzì; *Urostigma macrophyllum* (Pers.) Miq.]
(Figure S1)

Potentially Naturalizing on Kauaʻi

Ficus macrophylla has existed in the Hawaiian Islands with its pollinator wasp since 1921, and has been reported as naturalized on three of the Hawaiian Islands. (See note for its obligatory pollinator *Pleistodontes froggatti* below.) However, the naturalization status of this plant on Kauaʻi is uncertain. Numerous *Ficus* species were planted throughout forest reserves in Hawaiʻi, including the Līhuʻe-Kōloa Forest Reserve where surveys for this study took place. Individuals seem to have been placed at random distances from one another amongst other vegetation (including native species), rather than in lines or some other pattern indicative of human-planted tree. Thus, it is very difficult to determine if trees observed in these forest reserves originated as

purposefully planted individuals, or if they are offspring of plants previously introduced in the area, which would be indicative of it forming multiple, self-sustaining populations (i.e., naturalized). However, at least one individual of three different size classes have been observed in the vicinity of the Līhu‘e-Kōloa Forest Reserve, including multiple saplings, a few trees ~10 m tall, and one tree over 25 m tall. Additional surveys to find more individuals alongside an investigation into growth rates and planting times may reveal that this species is definitively naturalized on Kaua‘i.

Material examined: **Hawaiian Islands:** KAUA‘I: North of Kalāheo, growing next to truck trail between Alexander Reservoir and Wahiwā bog (21°57.42’N, 159°31.11’W); native/non-native mixed forest; forestry plantings of various species in area; growing in full-scattered sunlight; tree ~10 m tall, leaves glossy dark green above with yellowish midvein and petiole, rusty brown below on young leaves but becoming grayish when older; fruits firm, pale green w/ orange spots; likely planted; other individuals sighted in area, but it is difficult to tell whether they are naturalized or planted; 6 Apr. 2017; *K. Brock 974* (PTBG).



Figure S2. *Ficus microcarpa* growing wild in McBryde Garden, emblematic of naturalized habit on Kaua‘i.

Ficus microcarpa* L.f.*Naturalized**

[= *Ficus aggregata* Vahl; *F. amblyphylla* (Miq.) Miq.; *Urostigma amblyphyllum* Miq.; *U. microcarpum* (L.f.) Miq.]

(Figure S2)

See below for notes on its obligatory pollinator *Eupristina verticillata*, and its parasitoids *Josephiella microcarpae*, *Philotrypesis emeryi*, *Sycoscapter* cf *gajimaru*, and *Walkerella microcarpae*.

Material examined: Hawaiian Islands: KAUA'I: West of Po'ipū, near Kukui'ula Boat Harbor at junction of Lawa'i Rd and Amio Rd (21°53.06'N, 159°29.15'W); cultivated tree in park, tree 6 m tall, leaves dark green and heavily impacted by insect galls; fruits paired, globose, yellowish–pink colored; aerial roots present along branches; 21 Apr. 2017; *K. Brock 979* (PTBG).

Ficus nota* (Blanco) Merr.*Cultivated**

Material examined: Hawaiian Islands: KAUA'I: Kōloa, McBryde Garden (21°54.00'N, 159°30.19'W); cultivated tree propagated from another cultivated plant on Kaua'i; *Living Collection 020058* (PTBG).

Ficus prolixa* G.Forst.*Cultivated**

[= *Ficus aoa* Warb.; *F. forsteriana* Endl.; *F. marquesensis* F.Br.; *F. prolixoides* Warb.; *Urostigma prolixum* (G.Forst.) Miq.]

Material examined: Hawaiian Islands: KAUA'I: Kōloa, McBryde Garden (21°54.00'N, 159°30.19'W); tree ~8 m tall; vouchered from PTBG living collection (000045.002) propagated from cuttings from Gabgab Beach Naval Station, Guam; 26 Jan. 2017; *D. Wolkis DMW1143* (PTBG).



Figure S3. *Ficus religiosa* (A) epiphytic and (B) free-living saplings outside of cultivation on Kaua‘i.

***Ficus religiosa* L.**

Potentially Naturalizing on Kaua‘i

[= *Ficus caudata* Stokes; *F. peepul* Griff.; *F. superstiosa* Link; *Urostigma religiosum* (L.) Gasp.]

(Figure S3)

Surveys on Kaua‘i completed from 2015–2017 located 6 mature cultivated trees, of which 4 were found to be producing saplings. Over 20 individuals of different size classes ranging 1–7 m tall were observed surrounding a large cultivated tree in Kekaha. Despite monitoring these non-cultivated individuals for two years, no fruit was observed, likely due to insufficient maturity of the offspring. Thus, insufficient time had passed since the arrival of the pollinator wasp for *F. religiosa* to have become truly naturalized on Kaua‘i at the time of the surveys. However, it is possible that mature wild-growing trees were undetected during surveys. The eventual naturalization of this species on Kaua‘i seems imminent considering that it is naturalized on other Hawaiian Islands where reproduction of cultivated trees was observed eight years earlier. See notes for its obligatory pollinator *Platyscapa quadraticeps* and associated parasitoid *Oritesella digitata* below.

Material examined: Hawaiian Islands: KAUA'I: Līhu'e, Old Courthouse next to State office building on corner of Umi and Hardy Sts; seedling without reproductive parts 0.3 m tall, but identifiable from unique leaf shape and milky sap; collected because of its proximity to what is likely its parent, a very large *F. religiosa* planted on Eiwa St ~127 m away; the location of this seedling in a gutter well above ground level growing with *Solanum americanum* suggest that the mature tree on Eiwa St is being pollinated and successfully producing viable seeds that are likely being dispersed by birds; 10 Nov. 2015; *A.M. Williams AMW194* (PTBG). Near Kīlauea, off of Wailapa Rd on the way to Kahili Beach; a single sapling, bark light brown with vertical striations becoming green at new growth, leaves dull dark green, veins prominently lighter in color, removal of this sapling has been attempted but appears to regenerate from roots established inside of host trees bark; 3 Jun. 2016; *K. Brock 846* (PTBG). Kōloa, McBryde Garden (21°54.05'N, 159°30.24'W); vouchered from PTBG living collection (710011.011) propagated from another cultivated tree near Kōloa; 26 Jan. 2017; *D. Wolkis DMW1138* (PTBG).

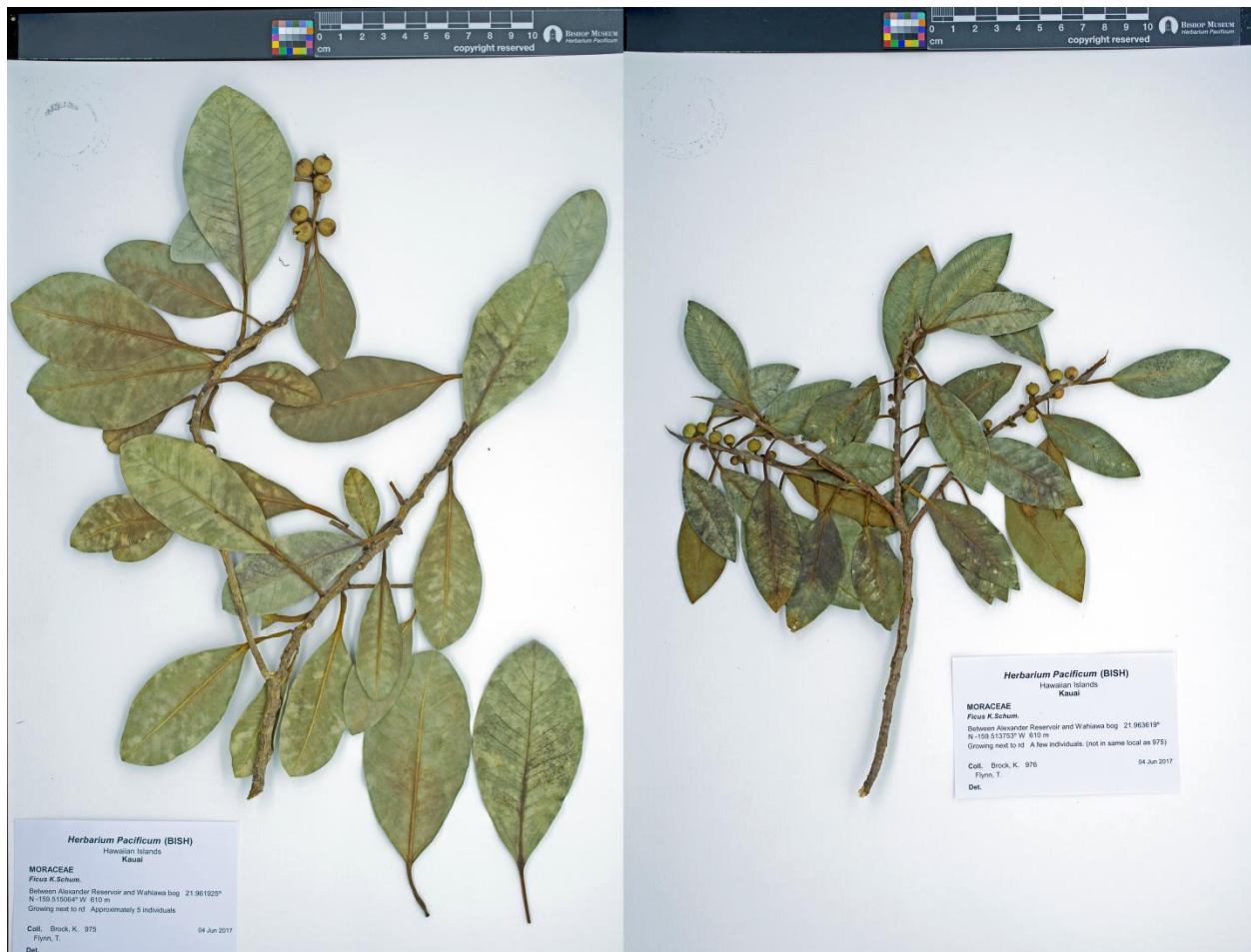


Figure S4. Two morphs of *Ficus rubiginosa* growing along road in Wahiawā Mountains, Kaua'i.

***Ficus rubiginosa* Desf. ex Vent.**
Potentially Naturalizing on Kauaʻi

[= *Ficus australis* Willd.; *F. macrophylla* var. *pubescens* F.M.Bailey; *F. obliqua* var. *petiolaris* (Benth.) Corner; *F. platypoda* var. *petiolaris* Benth.; *F. platypoda* var. *subacuminata* Benth.; *F. platypoda* var. *mollis* Benth.; *F. baileyana* Domin; *Mastosuke rubiginosa* (Vent.) Raf.;

Urostigma ferrugineum Miq.]

(Figure S4)

Ficus rubiginosa has existed in the Hawaiian Islands with its pollinator wasp since the 1920s and has been reported more recently as naturalized on other Hawaiian Islands. However, because this species was planted randomly among other wild-growing plants, the naturalization status of this plant on Kauaʻi is uncertain for the same reasons that cloud the status of *F. macrophylla* (see above). It is possible that this species is naturalized in the area, but only 6 mature individuals were observed during surveys, with only one fitting into a slightly smaller size class than the others (i.e., insufficient evidence to suggest that multiple surviving generations are being produced). Interestingly, this species exists as two recognizably different morphs within the Līhuʻe-Kōloa Forest Reserve on Kauaʻi, although ITS markers confirmed them as both *F. rubiginosa* and both contained the same species of pollinating wasp (see note for *Pleistodontes imperialis* below). This includes one morph with smaller, elliptical leaves and stems obviously covered with rusty hairs, and another with larger ovate-obovate leaves with stems less conspicuously hairy.

Material examined: Hawaiian Islands: KAUAʻI: North of Kalāheo (21°57.72ʻN, 159°30.90ʻW); ~5 individuals, (apparently planted?) growing next to road between Alexander Reservoir and Wahiawā bog, non-native/native mixed forest; tree ~15 m tall, leaves dark green, glossy with margins slightly revolute particularly at tip, leaves lighter and shiny when younger, a few red adventitious roots arising from larger branches; fruit round, pale green with raised white spots; 6 Apr. 2017; genetically confirmed by Weiblen Lab, GenBank #MW013803; *K. Brock 975* (BISH, PTBG). North of Kalāheo (21°57.82ʻN, 159°30.83ʻW); a few individuals growing next to truck trail between Alexander Reservoir and Wahiawā bog, growing in native/non-native mixed forest with forest plantings present; tree ~8 m tall, leaves dark green, shiny but paler below with yellowish–light green midrib and petioles; stipules and branch tips brown-hairy; fruits globose and bright orange; likely planted; 6 Apr. 2017; genetically confirmed by Weiblen Lab, GenBank #MW013768; *K. Brock 976* (BISH, PTBG).



Figure S5. *Ficus rubra* cultivated in McBryde Garden, Kaua‘i.

***Ficus rubra* Vahl**

Cultivated

[= *Ficus avi-avi* Chapel. ex Bojer; *F. cinerea* Cordem.; *F. consimilis* Baker; *Urostigma rubrum* (Vahl) Miq.]

(Figure S5)

On Kaua‘i, this species produces viable seeds, but no offspring were observed during surveys. See note for *Pleistodontes imperialis* below.

Material examined: Hawaiian Islands: KAUA‘I: Kōloa, McBryde Garden (21°53.98’N, 159°30.27’W); cultivated tree ~15 m tall; vouchered from PTBG living collection (000621.001) propagated with material originally from Ile Aux Aigrettes, Mauritius; 6 Mar. 2017; *D. Wolkis DMW1145* (PTBG).

Ficus saussureana* De Candolle*Cultivated**

[= *Ficus galactophora* Ten.; *F. monbuttuensis* Warb.; *Urostigma galactophorum* (Ten.) Miq.; *U. saussureanum* Miq.; *Galoglychia saussureana* Gasp.]

Material examined: **Hawaiian Islands:** KAUA'I: Kōloa, McBryde Garden (21°54.04'N, 159°30.21'W), large cultivated tree with dark bark and aerial roots; leaves dark green and tightly clustered near branch tips with margins undulate near leaf apex; syconia dull yellow-orange, sessile, vouchered from PTBG living collection (760340) propagated from seed collected from Busiro, Uganda; 25 May 2017; *K. Brock 1003* (PTBG).

Ficus scabra* G.Forst.*Cultivated**

[= *Ficus ciliata* Warb.; *F. marensis* Warb.; *F. reineckeii* Warb.]

Material examined: **Hawaiian Islands:** KAUA'I: Kōloa, McBryde Garden (21°54.00'N, 159°30.19'W); cultivated tree propagated from seeds from Ofu, Manua Island, American Samoa near Asaga Point, along coastal road on ocean side of road embankment; *Living Collection 010221* (PTBG).

Ficus superba* Miq.*Cultivated**

[= *Ficus tenuipes* S.Moore; *F. timorensis* Decne.; *Urostigma accedens* Miq.; *U. superbum* Miq.]

Material examined: **Hawaiian Islands:** KAUA'I: Kōloa, McBryde Garden (21°54.00'N, 159°30.19'W); tree ~9 m tall; vouchered from PTBG living collection (110263); 6 Mar. 2017; *D. Wolkis DMW1146* (PTBG).

Ficus sycomorus* L.*Cultivated**

[= *Ficus comorensis* Warb.; *F. damarensis* Engl.; *Sycomorus gnaphalocarpa* Miq.; *S. rigida* Miq.]

Material examined: **Hawaiian Islands:** KAUA'I: Kōloa, McBryde Garden (21°54.03'N, 159°30.24'W); tree; vouchered from PTBG living collection (800677.001) propagated from seed collected from the wild along the Talek River, Maasai-Mara Preserve, Kenya; 26 Jan. 2017; *D. Wolkis DMW1139* (PTBG).

Ficus tinctoria* G.Forst.*Cultivated**

[= *Ficus antoniana* Elmer; *F. michelii* H.Lév.; *Urostigma excelsum* Miq.]

Material examined: **Hawaiian Islands:** KAUA'I: Kōloa, McBryde Garden (21°54.00'N, 159°30.19'W); tree; vouchered from PTBG living collection (990581.005) propagated from seed collected from rock face in coastal forest at Tamutupu Point, Olosega, American Samoa; 6 Mar.

2017; *D. Wolkis DMW1144* (PTBG).

***Ficus trigonata* L.**

Cultivated

[= *Urostigma trigonatum* (L.) Griseb.]

Material examined: **Hawaiian Islands:** KAUA‘I: Kōloa, McBryde Garden (21°54.00’N, 159°30.19’W); tree ~15 m tall; vouchered from PTBG living collection (080114.001); 6 Mar. 2017; *D. Wolkis DMW1142* (PTBG).

***Ficus vallis-choudae* Delile**

Cultivated

[= *Ficus schweinfurthii* Miq. ex Schweinf.]

Material examined: **Hawaiian Islands:** KAUA‘I: Kōloa, McBryde Garden (21°54.03’N, 159°30.19’W); tree; vouchered from PTBG living collection (760181.001) propagated from seed collected from the wild in Busino County, Mengo District, Uganda; 26 Jan. 2017; *D. Wolkis DMW1140* (PTBG).



Figure S6. *Ficus virens* cultivated in McBryde Garden, Kaua‘i.

Ficus virens* Aiton*Cultivated**

[= *Ficus infectoria* (Miq.) Miq.]
(Figure S6)

This species produces viable seeds on Kauaʻi, but no offspring were observed during surveys. See note for its obligatory pollinator *Platyscapa cf coronata* below.

Material examined: Hawaiian Islands: KAUAʻI: Kōloa, McBryde Garden (21°54.05ʻN, 159°30.26ʻW); large tree; leaves dark green, paler beneath and sparsely arranged on branches; syconia paired, pale pink, globose; vouchered from PTBG living collection (110283.001); 25 May 2017; K. Brock 1001 (PTBG).



Figure S7. *Ficus watkinsiana* (A) mature cultivated tree and (B) wild-growing epiphytic sapling near the PTBG Botanical Research Center, Kauaʻi.

Ficus watkinsiana* F.M. Bailey*Not Self-Sustaining on Kauaʻi**

[= *Ficus bellengeri* C.Moore; *F. simmondsii* F.M.Bailey]
(Figures S7, 1B & D)

We found only a single mature *F. watkinsiana* tree during island-wide surveys, which was cultivated. A single sapling was identified 40 m away in a non-native-dominated forest. The surrounding area was searched for additional offspring, and while more saplings may exist, no mature trees have been found in the wild. Because survival and reproduction of the saplings is not yet occurring, this species is not considered naturalized or naturalizing. See below for note on *Pleistodontes imperialis*.

Material examined: **Hawaiian Islands:** KAUA‘I: Kalāheo, PTBG Botanical Research Center (21°54.45’N, 159°30.68’W); tree; vouchered from PTBG living collection (760181.001) propagated from seed donated from the Royal Botanic Garden in South Yarra, Victoria, Australia; 26 Jan. 2017; *D. Volkis DMW1135* (PTBG). Kalāheo, next to PTBG Botanical Research Center on the edge of non-native-dominated forest (21°54.45’N, 159°30.68’W); multi-branched sapling growing epiphytically in Java plum (*Syzygium cumini* [L.] Skeels.), 1–3 m tall; not cultivated, likely arising from cultivated tree (PTBG living collection 760181.001) growing 40 m to the southwest; 9 Feb. 2017; *K. Brock 944* (PTBG).

Fig wasps (Chalcidoidea: Agaonidae, Pteromalidae)

***Eupristina verticillata* Waterston**

Naturalized

[= *Blastophaga verticillata* Grandi; *Parapristina verticillata* Wiebes]

Identified following Beardsley (1998). It is the obligate pollinator of *Ficus microcarpa* (Beardsley, 1998; Wang et al., 2015).

Known localities: Cosmopolitan, including Malaysia, Philippines, Hong Kong, United Arab Emirates, Bermuda, Brazil, Central America, México, Hawai‘i Island, O‘ahu, and Kaua‘i (Beardsley and Rasplus, 2001; van Noort and Rasplus, 2010; Wang et al. 2015).

Material examined: **Hawaiian Islands:** KAUA‘I: Numila, Kaua‘i Coffee Company (21°53.60’N, 159°30.29’W), in Brocap trap in coffee plantation, coll. J. Bernard, 25 Oct. 2016, det. J. Bernard (1 ♀ pinned, PTBG); Po‘ipū, Kukui‘ula Boat Harbor (21°53.06’N, 159°29.15’W), ex. *Ficus microcarpa* syconia, coll. J. Bernard & K. Brock, 25 Apr. 2017, det. J. Bernard (1 ♀ in 95% EtOH, UHIM).

***Josephiella microcarpae* Beardsley & Rasplus**

Naturalized

Identified following Beardsley and Rasplus (2001). It parasitizes leaves on *Ficus microcarpa* (Beardsley and Rasplus, 2001).

Known localities: Kaua‘i, Moloka‘i, O‘ahu, California, and Tenerife (Beardsley and Rasplus, 2001).

Material examined: **Hawaiian Islands:** KAUA‘I: Numila, Kaua‘i Coffee Company (21°53.77’N, 159°33.58’W), in Brocap trap in coffee plantation, coll. J. Bernard, 7 Nov. 2016, det. J. Bernard (1 ♀ pinned, UHIM); Kalāheo, PTBG Botanical Research Center (21°54.46’N, 159°30.68’W), on *Ficus altissima* syconia with nearby *F. microcarpa*, coll. J. Bernard & K. Brock, 26 Jan. 2017, det. J. Bernard (2 ♀ in 95% EtOH, BPBM); Numila, Kaua‘i Coffee Company (21°53.60’N, 159°30.29’W), in Brocap trap in coffee plantation, coll. J. Bernard, 31 Jan. 2017,

det. J. Bernard (1 ♀ pinned, PTBG).



Figure S8. *Otitesella digitata* (A) female and (B) male.

***Otitesella digitata* Westwood**

New State Naturalization Record

[= *Otitesella religiosa* Westwood; *Terastiozoon incompletum* Joseph; *Walkerella incompleta* (Joseph)]

(Figure S8)

The metallic green female wasp is distinguished by a medially constricted propodeum, and the wingless tawny male has a wide bidentate mandible twice as long as the space between antennae, identified following Berg and Wiebes (1992) and van Noort and Rasplus (1997). It parasitizes *Ficus religiosa* syconia (van Noort and Rasplus, 1997). Our discovery of new adults emerging from galls in ovules supports its status as naturalized on Kaua‘i, which is the first such record in the Hawaiian Islands.

Previously known localities: South Asia, including India and Malaysia (van Noort and Rasplus, 1997).

Material examined: **Hawaiian Islands:** KAUA‘I: Kōloa, McBryde Garden (21°54.05’N, 159°30.24’W), ex. *Ficus religiosa* syconia, coll. J. Bernard & K. Brock, 26 Jan. 2017, det. J. Bernard (1 ♀ pinned, BPBM); Līhu‘e, State Building (21°58.57’N, 159°22.05’W), ex. *Ficus religiosa* syconia, coll. J. Bernard, 22 Mar. 2017, det. J. Bernard (1 ♀ and 1 ♂ pinned, UHIM; 5 ♀ and 2 ♂ in 95% EtOH, BPBM).

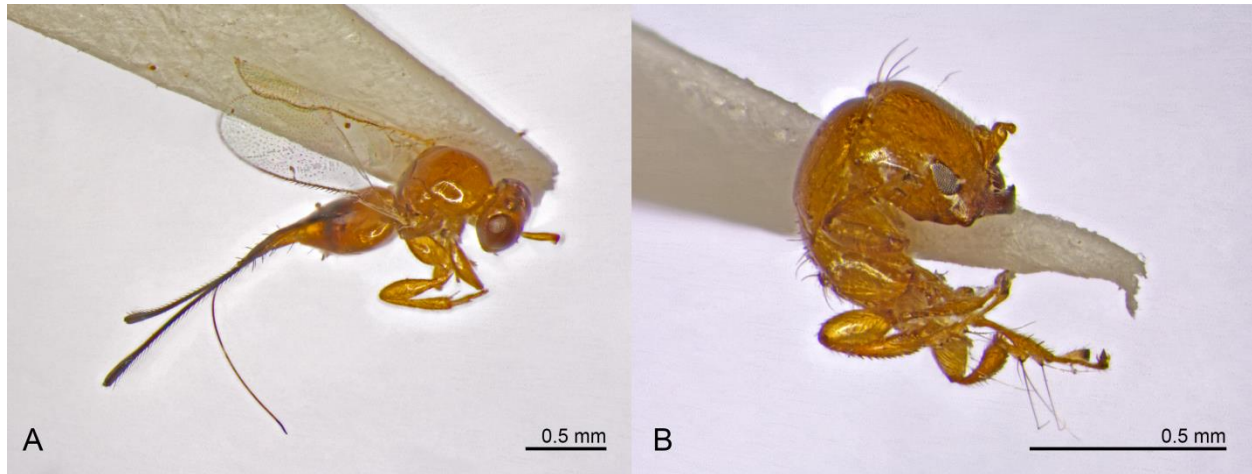


Figure S9. *Philotrypesis emeryi* (A) female and (B) male.

***Philotrypesis emeryi* Grandi**
(Figure S9)

New Kaua‘i Naturalization Record

The female is tawny with a darkened posterodorsal metasoma and the tawny flightless male has setae along the sides of the head that are much shorter than the head’s width, identified following Beardsley (1998). It parasitizes *Ficus microcarpa* syconia (Beardsley, 1998; Wang et al., 2015). The emergence of new adults from the ovules justifies this species as naturalized on Kaua‘i.

Previously known localities: Sumatra, Guangzhou, Hong Kong, Xishuangbanna, Taiwan, Thailand, Brazil, Greece, Italy, Puerto Rico, Florida, and O‘ahu (Beardsley, 1998; Bain et al., 2015; Wang et al., 2015).

Material examined: **Hawaiian Islands:** KAUA‘I: Po‘ipū, Kukui‘ula Boat Harbor (21°53.06’N, 159°29.15’W), ex. *Ficus microcarpa* syconia, coll. J. Bernard & K. Brock, 25 Apr. 2017, det. J. Bernard (1 ♀ and 1 ♂ pinned, UHIM; 1 ♀ pinned, 3 ♀ and 5 ♂ in 95% EtOH, BPBM).

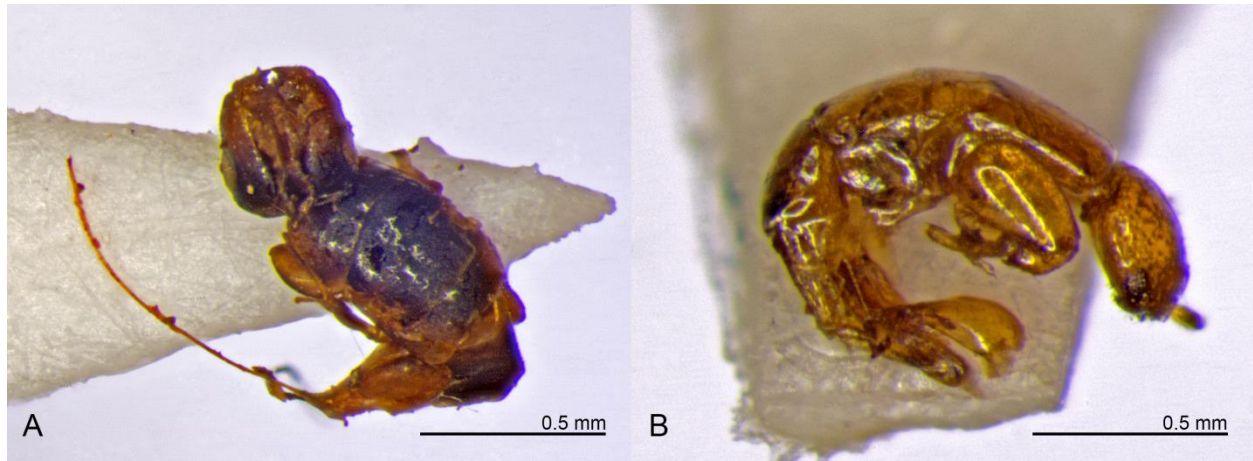


Figure S10. *Platyscapa cf. coronata* (A) female and (B) male.

***Platyscapa cf. coronata* (Grandi)**

New State Naturalization Record

[= *Blastophaga coronata* Grandi; *Blastophaga constabularis* Joseph; *Blastophaga glabellae* Hoffmeyer]

(Figure S10)

The female has a dark integument and sensilla extending only slightly beyond each antennal segment, and the wingless tawny male has a divided metanotum and very short antennal groove, identified following Wiebes (1994). It is the obligate pollinator of *Ficus virens* (Wiebes, 1994). We determined it to be naturalized on Kaua‘i owing to the appearance of new generations from *F. virens* ovules, although we did not yet find evidence that the fig is also naturalizing. This the first report of this wasp from the Hawaiian Islands. Cultivated *F. virens* on O‘ahu have not been found to contain wasps.

Previously known localities: India, Sumatra, Hong Kong, and Queensland (Wiebes, 1994).

Material examined: **Hawaiian Islands:** KAUA‘I: Kōloa, McBryde Garden (21°54.05’N, 159°30.26’W), ex. *Ficus virens* syconia, coll. J. Bernard & K. Brock, 25 Apr. 2017, det. J. Bernard (1 ♀ and 1 ♂ pinned, 39 ♀ in 95% EtOH, UHIM; 1 ♀ pinned, 60 ♀ and 2 ♂ in 95% EtOH, BPBM).

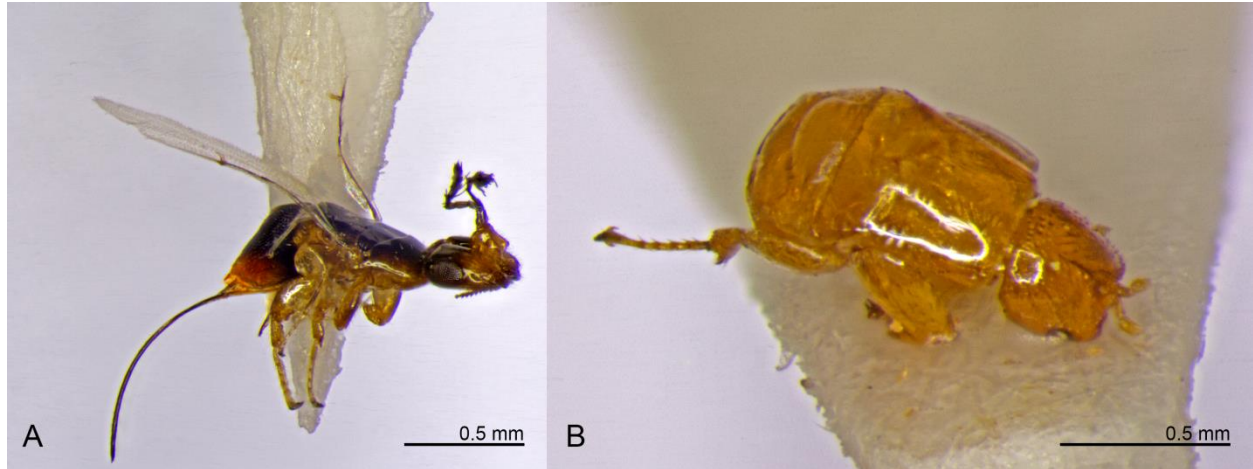


Figure S11. *Platyscapa quadraticeps* (A) female and (B) male.

***Platyscapa quadraticeps* (Mayr)**

New State Naturalization Record

[= *Blastophaga quadraticeps* Mayr; *Blastophaga arnottiana* Joseph]

(Figure S11)

The female is fuscous and yellowish with sensilla projecting far beyond antennal segments, and the wingless yellow male has two large anelli and an antennal groove extending two-thirds the length of its head, identified following Wiebes (1994). It is the sole pollinator of *Ficus religiosa* (Wiebes, 1994). New adults emerging from the fig ovules demonstrate the establishment of multiple generations, supporting its status as naturalized. Surveyors have inferred the existence of *P. quadraticeps* in the Hawaiian Islands because *F. religiosa* is naturalized on O‘ahu, Maui, Moloka‘i, and we found this fig to be potentially naturalizing on Kaua‘i as well (reported above), although to our knowledge this is the first collection of the wasp itself in the archipelago. Judging by the naturalization of the host, this wasp is likely naturalized on at least those 4 islands rather than merely Kaua‘i. The naturalization of *Otitesella digitata* (see above) furthermore suggests that a mature syconia-bearing *F. religiosa* arrived in the archipelago, containing both the pollinator and the non-pollinator, which is a more parsimonious explanation than independent arrivals.

Previously known localities: India, Sri Lanka, Malaysia, Singapore, Israel, Taiwan, and the United Arab Emirates (Wiebes, 1994; van Noort and Rasplus, 2010; Bain et al., 2015).

Material examined: **Hawaiian Islands:** KAUA‘I: Kōloa, McBryde Garden (21°54.05’N, 159°30.24’W), ex. *Ficus religiosa* syconia, coll. J. Bernard & K. Brock, 26 Jan. 2017, det. J. Bernard (2 ♀ and 1 ♂ pinned, 60 ♀ in 95% EtOH, BPBM); Līhu‘e, State Building (21°58.57’N, 159°22.05’W), ex. *Ficus religiosa* syconia, coll. J. Bernard, 22 Mar. 2017, det. J. Bernard (1 ♀ and 1 ♂ pinned, 37 ♀ and 18 ♂ in 95% EtOH, UHIM; 1 ♀ pinned, PTBG; 36 ♀ and 18 ♂ in

95% EtOH, BPBM).



Figure S12. *Pleistodontes froggatti* (A) female partial specimen and (B) male.

***Pleistodontes froggatti* Mayr**

Naturalized

[= *Pleistodontes semiruficeps* Girault; *Pleistodontes listzi* Girault]

(Figure S12)

Identified following Lopez-Vaamonde et al. (2002). It is in an obligate mutualism with *Ficus macrophylla* (Lopez-Vaamonde et al., 2002).

Known localities: its natural range is the east coast of Australia, and it has been introduced to Western Australia and the Hawaiian Islands, including Hawai‘i Island, Lana‘i, O‘ahu, Kaua‘i, and Midway Atoll (Beardsley, 1999; Lopez-Vaamonde et al., 2002).

Material examined: **Hawaiian Islands:** KAUA‘I: Wahiawā Mountains, Līhu‘e-Kōloa Forest Reserve (21°57.42’N, 159°31.11’W), ex. *Ficus macrophylla* syconia, coll. J. Bernard & K. Brock, 6 Apr. 2017, det. J. Bernard (taxonomic) and Weiblen Lab (GenBank #MW016949) (36 ♀ and 9 ♂ in 95% EtOH, UHIM; 35 ♀ and 9 ♂, BPBM); Kōloa, Allerton Garden (21°53.66’N, 159°30.22’W), ex. *Ficus macrophylla* syconia, coll. S. Walsh & D. Wolkis, 7 Apr. 2017, det. J. Bernard (taxonomic) and Weiblen Lab (GenBank #MW016948) (1 ♀ and 1 ♂ pinned, 38 ♂ in 95% EtOH, UHIM; 1 ♀ pinned, PTBG; 6 ♀ and 38 ♂, BPBM).

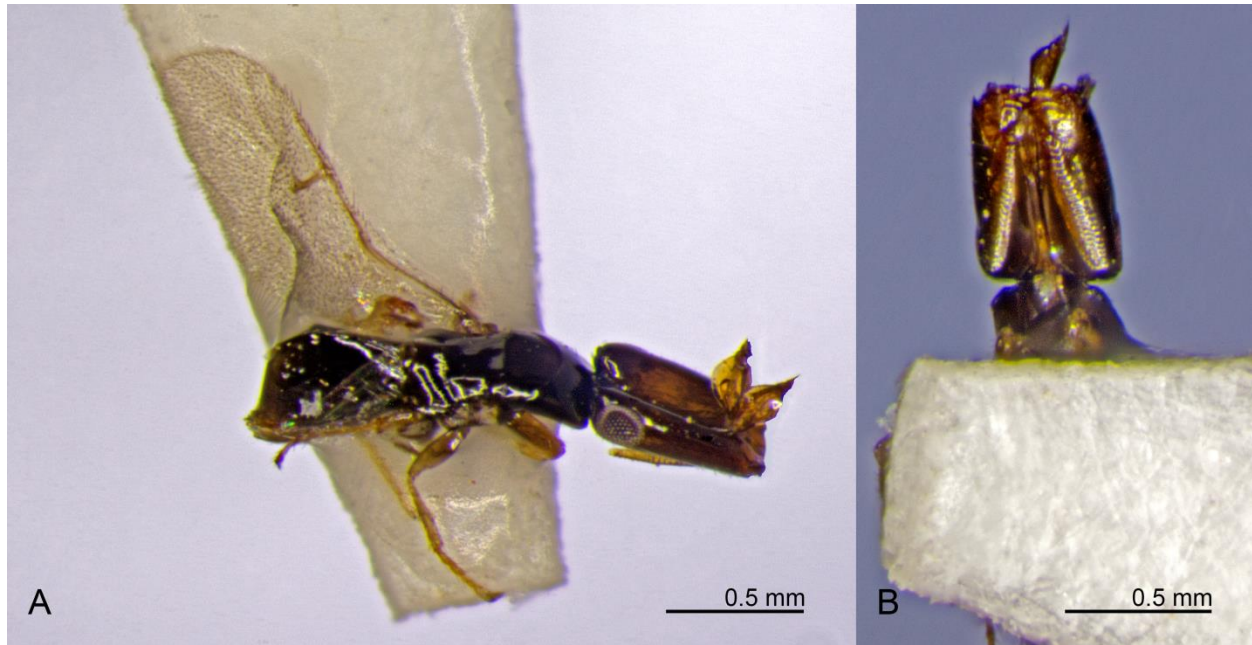


Figure S13. *Pleistodontes imperialis* female (A) partial specimen and (B) ventral head.

***Pleistodontes imperialis* Saunders**

New Host Records

[= *Pleistodontes nigris* Girault; *Pleistodontes nigricaput* Girault]
(Figures S13, 1A–C)

The female wasp has a mucro on the median anterior margin of the clypeus and >23 lamellae on the mandibles, identified following Lopez-Vaamonde et al. (2002). It is the obligate pollinator of *Ficus rubiginosa* (Lopez-Vaamonde et al., 2002). However, our discovery of new generations emerging from syconia of *Ficus rubra* and *F. watkinsiana* demonstrates that it is also capable of using these species as successful hosts, and seeds from these species germinated.

Known localities: naturally distributed along the coast of eastern Australia, and introduced to New Zealand, Israel, California, and the Hawaiian Islands, where it was intentionally released on Lana‘i, O‘ahu, and Kaua‘i (Lopez-Vaamonde et al., 2002).

Material examined: **Hawaiian Islands:** KAUA‘I: Kalāheo, PTBG Botanical Research Center (21°54.45’N, 159°30.68’W), ex. *Ficus watkinsiana* syconia, coll. J. Bernard & K. Brock, 26 Jan. 2017, det. J. Bernard (taxonomic) and Weiblen Lab (GenBank #MW016947) (1 ♀ pinned, UHIM; 41 ♀, BPBM); Kōloa, McBryde Garden (21°53.98’N, 159°30.27’W), ex. *Ficus rubra* syconia, 6 Mar. 2017, det. J. Bernard (1 ♀ pinned, UHIM; 7 ♀, BPBM); Wahiawā Mountains, Līhu‘e-Kōloa Forest Reserve (21°57.72’N, 159°30.90’W), ex. *Ficus rubiginosa* syconia, coll. J. Bernard & K. Brock, 6 Apr. 2017, det. J. Bernard (taxonomic) and Weiblen Lab (GenBank #MW016944) (27 ♀ in 95% EtOH, UHIM; 25 ♀, BPBM); Wahiawā Mountains, Līhu‘e-Kōloa Forest Reserve (21°57.82’N, 159°30.83’W), ex. *Ficus rubiginosa* syconia, coll. K. Brock, J.

Bernard & T. Flynn, 6 Apr. 2017, det. J. Bernard (taxonomic) and Weiblen Lab (GenBank #MW016945) (1 ♀ and 1 ♂ pinned, 32 ♀ and 31 ♂ in 95% EtOH, UHIM; 1 ♀ and 1 ♂ pinned, PTBG; 31 ♀ and 31 ♂, BPBM); Kōloa, McBryde Garden (21°53.98'N, 159°30.27'W), coll. J. Bernard & K. Brock, 25 May 2017, ex. *Ficus rubra* syconia, det. J. Bernard (taxonomic) and Weiblen Lab (GenBank #MW016946) (14 ♀, BPBM).



Figure S14. *Sycoscapter cf. gajimaru* (A) female and (B) male.

***Sycoscapter cf. gajimaru* (Ishii)**

[= *Goniogaster gajimaru* Ishii]

(Figure S14)

New State Naturalization Record

Metallic green-bronze female with an ovipositor $> 3\times$ body length, obtuse clypeus, and sparse thick setae adjacent to a rectangular stigma, identified following Ishii (1934), Wiebes (1964), and Berg and Wiebes (1992). Its known host is *Ficus microcarpa* syconia (Ishii, 1934; Wiebes, 1964). The emergence of new adults from the syconia demonstrates its naturalized status on Kauaʻi, and it may be present on the other Hawaiian Islands where *F. microcarpa* has naturalized.

Previously known localities: Japan, Malaysia, and Hong Kong (Wiebes, 1964; van Noort and Rasplus, 2010; Wang et al., 2015).

Material examined: **Hawaiian Islands:** KAUAʻI: Poʻipū, Kukuiʻula Boat Harbor (21°53.06'N, 159°29.15'W), ex. *Ficus microcarpa* syconia, coll. J. Bernard & K. Brock, 25 Apr. 2017, det. J. Bernard (1 ♀ and 1 ♂ pinned, 6 ♀ in 95% EtOH, UHIM; 1 ♀ pinned, 7 ♀ and 2 ♂ in 95% EtOH, BPBM; 1 ♀ pinned, PTBG; 1 ♀ pinned, HDOA).



Figure S15. *Walkerella microcarpae* (A) female and (B) male.

***Walkerella microcarpae* Bouček**

[= *Walkerella yashimi* (Ishii)]

(Figure S15)

New Kaua‘i Naturalization Record

The stout female wasp has a sculptured dark blue or blackish head and thorax, fuscous femurs on otherwise yellowish legs, metallic blue-black metasoma, and very short ovipositor, and the tawny flightless males have a square-shaped head and no space between antennae, identified following Beardsley (1998). It parasitizes *Ficus microcarpa* syconia (Beardsley, 1998; van Noort et al., 2013). New adults emerging from *F. microcarpa* ovules evince its status as naturalized on Kaua‘i.

Previously known localities: Okinawa, Malaysia, Hong Kong, China, Mediterranean Region, South Africa, Bermuda, Grand Cayman, Brazil, Florida, California, and O‘ahu (Beardsley, 1998; van Noort et al., 2013; Wang et al., 2015).

Material examined: **Hawaiian Islands:** KAUA‘I: Po‘ipū, Kukui‘ula Boat Harbor (21°53.06’N, 159°29.15’W), ex. *Ficus microcarpa* syconia, coll. J. Bernard & K. Brock, 25 Apr. 2017, det. J. Bernard (1 ♀ and 1 ♂ pinned, 24 ♀ and 8 ♂ in 95% EtOH, UHIM; 1 ♀ and 1 ♂ pinned, 24 ♀ and 9 ♂ in 95% EtOH, BPBM; 1 ♀ and 1 ♂ pinned, PTBG; 1 ♀ and 1 ♂ pinned, HDOA).