

## Insect galls found on Miyakejima and Hachijojima, the Izu Islands, Tokyo, Japan

**Tokuda, Makoto**

Laboratory of System Ecology, Faculty of Agriculture, Saga University

**Matsuo, Kazunori**

Entomological Laboratory, Graduate School of Bioresource and Bioenvironmental Sciences, Kyushu University

**Yukawa, Junichi**

Entomological Laboratory, Faculty of Agriculture, Kyushu University

<https://doi.org/10.5109/25397>

---

出版情報 : ESAKIA. 52, pp.59-66, 2012-03-27. Entomological Laboratory, Faculty of Agriculture, Kyushu University

バージョン :

権利関係 :

## Insect Galls Found on Miyakejima and Hachijojima, the Izu Islands, Tokyo, Japan

Makoto TOKUDA<sup>1)</sup>, Kazunori MATSUO<sup>2)</sup> and Junichi YUKAWA<sup>3)</sup>

1) Laboratory of System Ecology, Faculty of Agriculture, Saga University, Saga, 840-8502 Japan

2) Entomological Laboratory, Graduate School of Bioresource and Bioenvironmental Sciences,  
Kyushu University, Fukuoka, 812-8581 Japan

3) Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, 812-8581 Japan

**Abstract.** Cecidomyiid and other insect galls were surveyed from 2009 to 2011 on Miyakejima and Hachijojima, the Izu Islands, Tokyo, Japan. We found 18 and 21 sorts of cecidomyiid gall on Miyakejima and Hachijojima, respectively. Among them, leaf gall or necrosis on *Machilus thunbergii* (Lauraceae), leaf gall on *Styrax japonica* var. *kotoensis* (Styracaceae), and stem gall on *Artemisia indica* var. *maximowiczii* (Asteraceae) were newly discovered in this study. Stem gall induced on *Castanopsis sieboldii* (Fagaceae) was previously recorded only from Okinawa Island, but we revealed that it is distributed also on the Izu Islands. Furthermore, eight sorts of cecidomyiid gall were newly found from the Izu Islands, six sorts were from Miyakejima, and six sorts were from Hachijojima. As a supplementary result, two gall midge species newly found on Mikurajima Island were also reported in this study. Leaf gall induced by *Trioza cinnamomi* and *Trioza nigra* (Hemiptera: Psylloidea) was new to Miyakejima, and leaf gall induced by *Liothrips kuwanai* (Thysanoptera: Phlaeothripidae) and stem gall induced by *Ornataleides trifidus* (Coleoptera: Curculionidae) were new to Hachijojima. Then petiole gall induced by *Paratephritis fukaii* (Diptera: Tephritidae) was recorded for the first time from Miyakejima and Hachijojima.

**Key words:** biogeography, Cecidomyiidae, gall midge, host plant, new distribution records.

### Introduction

Many biologists have paid special attention to island biota, which exhibits differences in various aspects from that of mainland (e.g. MacArthur & Wilson, 1967; Thornton, 1996; Stuessy & Ono, 1998; Thornton *et al.*, 2002). The Izu Islands consist of several volcanic islands located south of the Izu Peninsula, Honshu, Japan, extending for about 230 km from north to south. The Islands have a unique biota represented by insects (e.g. Kurosawa, 1978; Inoue & Amano, 1986; Takaoka & Saito, 2005), terrestrial reptiles (e.g. Hasegawa, 2003), and plants (e.g. Inoue, 1988; Oiki *et al.*, 2001; Miyake & Inoue 2003).

Gall-inducing insects are suitable organisms for biogeographic studies, because galls are generally specific in shape and structure to gall inducers and remain on plants for a long period. Moreover, evidence indicating death or

survival of gall inducers exists long after the event. These features enable us to identify gall inducers without dissection of galls, evaluate population density, compile the life table of inducers, and investigate the gall-inducer fauna of nominated localities within a short period of surveys (e.g. Partomihardjo *et al.*, 2011; Tokuda *et al.*, 2012).

Various organisms such as predators, parasitoids, inquilines, cecidophages, and successors are known to be associated with galls and gall inducers (Mani, 1964; Yukawa, 1983). Gall inducers can be regarded as keystone taxa of the terrestrial ecosystem, because they affect not only associated organisms but also other herbivores through the manipulation of host characteristics (e.g. Ohgushi, 2005).

Gall inducers generally have high host specificity and the induction of galls is essential for the survival of most of them. Therefore, the colonization of oceanic islands by

gall inducers is premised on the existence of their host plants. In addition, many gall inducers such as gall midges (Diptera: Cecidomyiidae) are known to have weak flight and dispersal abilities due to degenerated wing veins and very short adult life span (e.g. Gagné, 1989, 1994; Yukawa & Masuda, 1996; Yukawa & Rohfrisch, 2005). Thus, the dispersal of gall midges depends primarily on the power of wind (Yukawa & Partomihardjo, 1997; Partomihardjo *et al.*, 2011).

As has been summarized by Tokuda *et al.* (2012), some researchers recorded gall midges occurring on the Izu Islands (Ishizawa, 1942; Yukawa, 1971, Sunose, 1981, Hachijojima Interpretation Association, 2007). Most recently Tokuda *et al.* (2012) reported gall midge faunas of Mikurajima and Aogashima Islands. Prior to the comprehensive biogeographic study of gall-inducers in the mainland (Honshu, Japan) and the Izu Islands, this paper intends to accumulate the faunal information on gall-inducing insects on Hachijojima (Hachijo, hereafter) and Miyakejima (Miyake) Islands, the Izu Islands, Tokyo, Japan. As supplementary records, gall midges newly found on Mikurajima Island (Mikura) were also included in this paper.

## Methods

Galls induced by cecidomyiids and other gall inducers were surveyed on Miyake (10-12 Apr. & 6-7 May 2009 by MT; 5-6 Apr. 2010 by MT & KM; 16 Nov. 2011 by MT), Mikura (16-17 Nov. 2011 by MT, as a supplementary survey to Tokuda *et al.*, 2012), and Hachijo (8-9 Apr. & 8-9 May 2009 by MT; 8-10 Apr. 2010 by MT & KM; 6-7 Apr. 2011 by MT & KM; 20-23 Sept. 2011 by MT & KM; 17-18 Nov. 2011 by MT). Detailed methods of field survey and collecting galls are fundamentally the same as those described in Tokuda *et al.* (2012).

Each collecting record of gall consists of latitude, longitude, altitude, and collecting date. Galls induced by cecidomyiids are first listed according to the order in Yukawa & Masuda (1996) and then followed by those induced by other insects. Gall numbers designated by Yukawa & Masuda (1996) are shown in brackets for respective galls. Corresponding reference is cited in the case when the taxonomic status of gall inducer was newly proposed after Yukawa & Masuda (1996). Absence records of gall are also included in the results.

The family name of host plants follows the Angiosperm Phylogeny Group (APG) system of plant classification (Stevens, 2008). Plant and insect specimens collected during the course of this study are kept in the Laboratory of System Ecology, Faculty of Agriculture, Saga

University, Japan or in the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Japan.

## Results

### Galls induced by cecidomyiids

#### FAGACEAE

Stem gall induced by an unidentified cecidomyiid on *Castanopsis sieboldii* (Makino) Hatus. ex T. Yamaz. et Mashiba [C-163] (**New distribution record from Tokyo**) (Fig.1)

**Japanese name:** ‘Sudajji-eda-donguri-fushi’

**[Miyake]** N34°06′ E139°31′, Alt. 314 m, 16 Nov. 2011; N34°03′ E139°32′, Alt. 10-84 m, 16 Nov. 2011; N34°03′ E139°31′, Alt. 20 m, 16 Nov. 2011; N34°05′ E139°29′, Alt. 41 m, 16 Nov. 2011; N34°06′ E139°30′, Alt. 357 m, 16 Nov. 2011; N34°06′ E139°33′, Alt. 3 m, 16 Nov. 2011.

**[Mikura]** N33°54′ E139°36′, Alt. 106-233 m, 16-17 Nov. 2011; N33°53′ E139°37′, Alt. 368 m, 17 Nov. 2011.

**[Hachijo]** N33°07′ E139°47′, Alt. 16 m, 21 Sept. 2011; N33°06′ E139°48′, Alt. 68-301 m, 23 Sept. & 17 Nov. 2011; N33°07′ E139°49′, Alt. 108 m, 18 Nov. 2011; N33°05′ E139°48′, Alt. 270 m, 18 Nov. 2011; N33°04′ E139°49′, Alt. 198 m, 18 Nov. 2011; N33°04′ E139°50′, Alt. 271 m, 18 Nov. 2011; N33°06′ E139°51′, Alt. 225-282 m, 18 Nov. 2011.

**Remarks:** This gall was previously reported only from Okinawa Island (Yamauchi *et al.*, 1982). Detailed life history of the gall midge is still unknown.

#### AMARANTHACEAE

Stem gall induced by *Lasioptera achyranthii* Shinji on *Achyranthes bidentata* var. *japonica* Miq. [C-245] (**New distribution record from the Izu Islands**)

**Japanese name:** ‘Inokozuchi-kuki-maruzui-fushi’

**[Hachijo]** N33°06′ E139°47′, Alt. 86 m, 21 Sept. 2011; N33°05′ E139°47′, Alt. 198 m, 22 Sept. 2011; N33°09′ E139°45′, Alt. 59 m, 22 Sept. 2011.

#### LAURACEAE

Leaf gall induced by *Pseudasphondylia neolitsea* Yukawa on *Neolitsea sericea* (Blume) Koidz. [C-254]

**Japanese name:** ‘Shirodamo-ha-kobu-fushi’

**[Miyake]** N34°06′ E139°31′, Alt. 317-324 m, 11 Apr. 2009 & 5 Apr. 2010.

**[Hachijo]** N33°05′ E139°49′, Alt. 469-551 m, 8 Apr. 2009 & 9 Apr. 2010; N33°06′ E139°48′, Alt. 349 m, 8 Apr. 2010; N33°06′ E139°50′, Alt. 424 m, 9 Apr. 2010.

Barrel-shaped leaf gall induced by *Daphnephila machilicola* Yukawa on *Machilus thunbergii* Sieb. et Zucc. [C-256]

**Japanese name:** ‘Tabunoki-haura-usu-fushi’

[Miyake] N34°06′ E139°30′, Alt. 357 m, 11 Apr. 2009; N34°06′ E139°31′, Alt. 318 m, 11 Apr. 2009; N34°07′ E139°33′, Alt. 29-66 m, 11 Apr. 2009; N34°03′ E139°29′, Alt. 40 m, 5 Apr. 2010; N34°04′ E139°33′, Alt. 77 m, 6 Apr. 2010; N34°04′ E139°32′, Alt. 319 m, 6 Apr. 2010.

[Hachijo] N 33°06′ E 139°48′, Alt. 307 m, 8 Apr. 2009; N 33°05′ E 139°49′, Alt. 499-563 m, 8 Apr. 2009; N33°07′ E139°49′, Alt. 35-211 m, 9 Apr. 2009 & 9 Apr. 2010; N33°06′ E139°50′, Alt. 330-478 m, 9 Apr. 2009 & 9 Apr. 2010; N33°06′ E139°49′, Alt. 199-356 m, 9 Apr. 2009 & 9 Apr. 2010; N33°04′ E139°48′, Alt. 179 m, 6 May 2009; N33°05′ E139°47′, Alt. 235 m, 8 Apr. 2010; N33°07′ E139°47′, Alt. 16-90 m, 6 Apr. & 21 Sept. 2011; N33°09′ E139°45′, Alt. 59 m, 7 Apr. 2011; N33°06′ E139°47′, Alt. 86 m, 21 Sept. 2011; N33°07′ E139°46′, Alt. 27 m, 22 Sept. 2011.

Stem gall induced by an unidentified cecidomyiid on *M. thunbergii* [C-259] (New distribution records from Miyake and Hachijo)

**Japanese name:** ‘Tabunoki-eda-zui-fushi’

[Miyake] N34°01′ E139°33′, Alt. 33 m, 5 Apr. 2010.

[Hachijo] N33°07′ E139°49′, Alt. 49 m, 9 Apr. 2010.

**Remarks:** The gall was previously recorded from the Southwest Islands of Japan (Yukawa and Masuda,

1996). A similar gall was also found on Mikura (Tokuda *et al.*, 2012).

Leaf gall induced by an unidentified cecidomyiid on *M. thunbergii* [C-262] (New distribution records from Miyake and Hachijo)

**Japanese name:** ‘Tabunoki-ha-fukure-fushi’

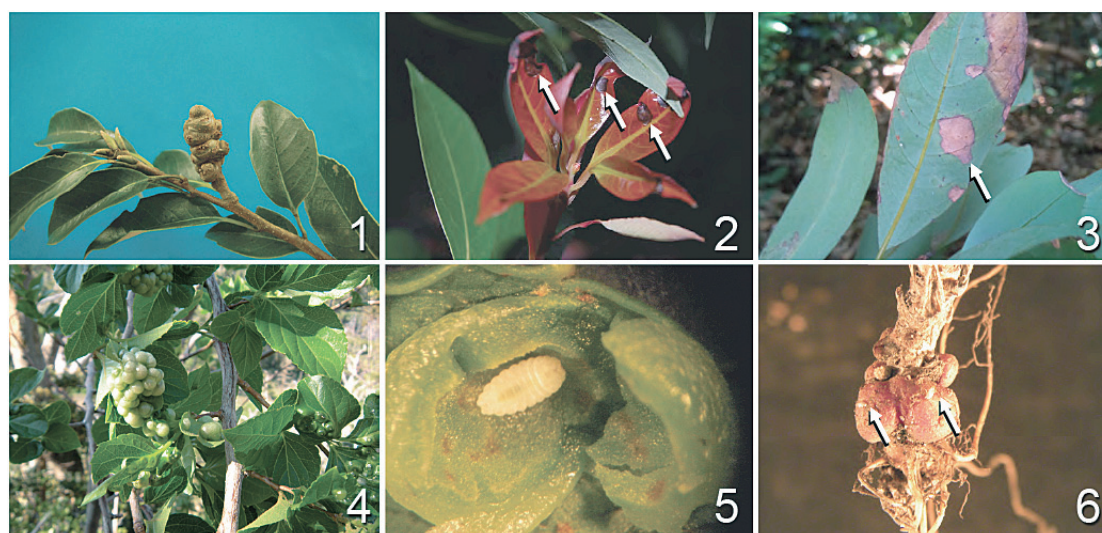
[Miyake] N34°04′ E139°29′, Alt. 105 m, 10 Apr. 2009 (old galls); N34°06′ E139°30′, Alt. 359 m, 11 Apr. 2009 (old galls); N34°06′ E139°31′, Alt. 318 m, 11 Apr. 2009 (old galls); N34°07′ E139°33′, Alt. 29-66 m, 11 Apr. 2009 & 6 Apr. 2010 (old galls); N34°06′ E139°32′, Alt. 245 m, 6 Apr. 2010 (old galls); N34°04′ E139°32′, Alt. 319 m, 6 Apr. 2010 (old galls).

[Hachijo] N33°06′ E139°49′, Alt. 666 m, 8 Apr. 2009 (old galls); N33°07′ E139°49′, Alt. 33 m, 9 Apr. 2009 (old galls).

Leaf gall or necrosis induced by an unidentified cecidomyiid on *M. thunbergii* (New finding) (Figs. 2-3)

[Miyake] N34°03′ E139°31′, Alt. 20 m, 6 Apr. 2010.

**Remarks.** The gall midge larvae were found in the inter-leaf spaces of host buds that were about to open. Leaf parts injured by the larvae blackened in April (Fig. 2), probably by the necrosis of host tissue surrounding the larvae. The injured parts turned into grayish brown spots in mature leaves (MT, Nov. 2011, personal observation of leaves marked in April 2010; Fig. 3). The spots were somewhat similar in color to the gall scars of C-262 in Yukawa and Masuda (1996),



**Figs. 1-6.** Cecidomyiid galls found on Miyake and Hachijo Islands. 1, a stem gall induced by an unidentified cecidomyiid on *Castanopsis sieboldii*; 2, leaf galls or necrosis (arrows) induced by an unidentified cecidomyiid on *Machilus thunbergii*; 3, a scar (arrow) of the leaf gall or necrosis on *M. thunbergii*; 4, leaf galls induced by an unidentified cecidomyiid on *Styrax japonica* var. *kotoensis*; 5, a gall midge larva inhabiting the leaf gall on *S. japonica* var. *kotoensis*; 6, stem galls induced by *Rhopalomyia* sp. on *Artemisia indica* var. *maximowiczii* and pupal exuviae (arrows) of the gall midge.



but the shape was not round but rather amorphous, and larger than the latter. The detailed life history of gall midge is unknown. Although we tentatively included the symptom in this list, further histological studies are needed to determine whether the leaf parts injured by the gall midge are galls or simple necrosis.

#### THEACEAE

Leaf-vein gall induced by *Lasioptera cameriae* Ohno & Yukawa on *Camellia japonica* L. [C-280]

**Japanese name:** 'Yabutsubaki-hamyaku-fukure-fushi'  
**[Miyake]** N34°03' E139°33', Alt. 88 m, 12 Apr. 2009;  
 N34°07' E139°33', Alt. 57 m, 6 Apr. 2010.

#### FABACEAE

Leaf gall induced by *Ptydiplosis puerariae* Yukawa, Ikenaga & Sato on *Pueraria lobata* (Willdenow) Ohwi [C-339] (**New distribution record from the Izu Islands**)

**Japanese name:** 'Kuzu-ha-togaritama-fushi'  
**Reference:** Yukawa *et al.* (2012).  
**[Mikura]** N33°54' E139°36', Alt. 125 m, 17 Nov. 2011.

#### AQUIFOLIACEAE

Bud gall induced by *Asteralobia sasakii* (Monzen) on *Ilex crenata* var. *hachijoensis* Nakai [C-373]

**Japanese name:** 'Hachijoinutsuge-me-tama-fushi'  
**Reference:** Tokuda *et al.* (2004a).  
**[Miyake]** N34°05' E139°30', Alt. 369 m, 5 Apr. 2010;  
 N34°06' E139°30', Alt. 357 m, 5 Apr. 2010; N34°04' E139°30', Alt. 300 m, 5 Apr. 2010.  
**[Hachijo]** N33°06' E139°48', Alt. 349 m, 8 Apr. 2009 (old galls); N33°07' E139°49', Alt. 145-273 m, 9 Apr. 2009, 9 Apr. 2010 & 6 Apr. 2011; N33°06' E139°50', Alt. 478 m, 9 Apr. 2009; N33°05' E139°49', Alt. 424 m, 9 Apr. 2009; N33°04' E139°47', Alt. 114 m, 6 May 2009; N33°04' E139°48', Alt. 179 m, 6 May 2009; N33°05' E139°51', Alt. 212 m, 7 May 2009; N33°05' E139°47', Alt. 209-235 m, 8 Apr. 2010; N33°09' E139°45', Alt. 59 m, 9 Apr. 2010; N33°05' E139°49', Alt. 451-469 m, 9 Apr. 2010; N33°07' E139°47', Alt. 90 m, 6 Apr. 2011; N33°08' E139°47', Alt. 156 m, 6 Apr. 2011.

Bud gall induced by *Asteralobia soyogo* (Kikutani) on *Ilex integra* Thunb. [C-375] (**New distribution record from Hachijo**)

**Japanese name:** 'Mochinoki-me-tama-fushi'  
**Reference:** Tokuda *et al.* (2004a).  
**[Hachijo]** N33°09' E139°45', Alt. 59 m, 7 May 2009 & 7 Apr. 2011; N33°07' E139°47', Alt. 16 m, 6 Apr.

2011.

#### VITACEAE

Fruit gall induced by *Asphondylia baca* Monzen on *Ampelopsis glandulosa* (Wall.) Momiy. var. *heterophylla* (Thunb.) Momiy. [C-386]

**Japanese name:** 'Nobudou-mi-fukure-fushi'  
**[Hachijo]** N33°07' E139°49', Alt. 33-211 m, 20 Sept 2011; N33°06' E139°48', Alt. 100-315 m, 23 Sept 2011.

#### ELAEAGNACEAE

Leaf gall induced by an unidentified cecidomyiid on *Elaeagnus umbellata* Thunb. (**New distribution record from the Izu Islands**)

**Japanese name:** 'Akigumi-ha-kobu-fushi'  
**Reference:** Usuba (1989).  
**[Miyake]** N34°03' E139°29', Alt. 36 m, 5 Apr. 2010.

#### AUCUBACEAE

Fruit gall induced on *Aucuba japonica* Thunb. var. *japonica* by *Asphondylia aucubae* Yukawa & Ohsaki [C-413]

**Japanese name:** 'Aoki-mi-midori-fushi'  
**[Miyake]** N34°06' E139°31', Alt. 318-333 m, 11 Apr. 2009 & 5 Apr. 2010.  
**[Hachijo]** N33°06' E139°50', Alt. 550 m, 9 Apr. 2009; N33°05' E139°49', Alt. 563-598 m, 9 Apr. 2010; N33°07' E139°47', Alt. 90 m, 6 Apr. 2011.

#### ARALIACEAE

Fruit gall induced by *Asphondylia* sp. on *Hedera rhombea* (Miq.) Bean [C-417] (**New distribution record from the Izu Islands**)

**Japanese name:** 'Kizuta-mi-fukure-fushi'  
**[Hachijo]** N33°05' E139°48', Alt. 200 m, 9 Apr. 2010; N33°07' E139°52', Alt. 329 m, 7 Apr. 2011.

#### STYRACACEAE

Ovate leaf gall induced by *Oxycephalomyia styraci* (Shinji) on *Styrax japonica* Sieb. et Zucc. var. *kotoensis* (Hayata) Masam. et T. Suzuki [D-015] (**New distribution records from Miyake and Hachijo**)

**Japanese name:** 'Ohbaegonoki-ha-tsubo-fushi'  
**Reference:** Tokuda *et al.* (2004b).  
**[Miyake]** N34°06' E139°30', Alt. 357 m, 5 Apr. 2010; N34°06' E139°31', Alt. 317 m, 5 Apr. 2010.  
**[Hachijo]** N33°07' E139°49', Alt. 145 m, 20 Sept 2011.

Leaf gall induced by an unidentified cecidomyiid on *S. japonica* var. *kotoensis* (**New gall**) (Figs. 4-5)

**Japanese name:** ‘Ohbaegonoki-haura-midoritama-fushi’ (new name)

[Miyake] N33°04' E139°29', Alt. 118 m, 10 Apr. 2009; N34°05' E139°29', Alt. 136 m, 9 May 2009; N34°06' E139°31', Alt. 317 m, 5 Apr. 2010.

**Remarks:** The gall is similar to D-016 in Yukawa and Masuda (1996), but the shape is more globular than D-016.

#### OLEACEAE

Fruit gall induced *Asphondylia sphaera* Monzen on *L. ovalifolium* Hassk. var. *pacificum* (Nakai) M. Mizush. [D-027]

**Japanese name:** ‘Hachijoibota-mi-midori-fushi’

[Miyake] N34°07' E139°33', Alt. 49-58 m, 11 Apr. 2009; N34°05' E139°29', Alt. 32-144 m, 9 May 2009 & 5 Apr. 2010; N34°03' E139°29', Alt. 40 m, 5 Apr. 2010.

[Hachijo] N33°04' E139°47', Alt. 114 m, 6 May 2009 & 9 Apr. 2010; N33°05' E139°48', Alt. 200-211 m, 6 May 2009 & 9 Apr. 2010; N33°06' E139°51', Alt. 282 m, 6 May 2009; N33°05' E139°51', Alt. 212 m, 7 May 2009; N33°06' E139°48', Alt. 364 m, 8 Apr. 2010; N33°09' E139°45', Alt. 59 m, 9 Apr. 2010; N33°06' E139°47', Alt. 37 m, 10 Apr. 2010.

#### APOCYNACEAE

Root gall induced by *Ametrodiplosis* sp. on *Trachelospermum asiaticum* (Sieb. et Zucc.) Nakai [D-032] (**New distribution record from the Izu Islands**)

**Japanese name:** ‘Teikakazura-ne-kobu-fushi’

[Hachijo] N33°06' E139°48', Alt. 315 m, 23 Sept. 2011.

Fruit gall induced by *Asteralobia* sp. on *T. asiaticum* [D-033] (**New distribution record from Miyake**)

**Japanese name:** ‘Teikakazura-misaki-fukure-fushi’

[Miyake] N34°01' E139°33', Alt. 33 m, 5 Apr. 2010 (old galls); N34°06' E139°30', Alt. 357 m, 6 Apr. 2010 (old galls).

[Hachijo] N33°06' E139°51', Alt. 282 m, 6 May 2009 (old galls); N33°06' E139°48', Alt. 364 m, 8 Apr. 2010 (old galls); N33°07' E139°49', Alt. 49 m, 20 Sept 2011 (immature larvae).

#### RUBIACEAE

Flower bud gall induced by *Asphondyliini* gen. sp. on *Paederia scandens* (Lour.) Merr. [D-037] (**New distribution record from the Izu Islands**)

**Japanese name:** ‘Hekusokazura-tsubomi-maru-fushi’

[Hachijo] N33°06' E139°47', Alt. 86 m, 22 Sept. 2011.

#### CAPRIFOLIACEAE

Bud gall induced by *A. baca* on *Weigela coraeensis* var. *fragrans* (Ohwi) H. Hara [D-061] (**New distribution record from Hachijo**)

**Japanese name:** ‘Nioiutsugi-me-tama-fushi’

**Reference:** Uechi *et al.* (2004).

[Hachijo] N33°05' E139°49', Alt. 469-563 m, 6 May 2009 & 9 Apr. 2010.

#### ASTERACEAE

Leaf gall induced by *Rhopalomyia chrysanthemum* Monzen on *Chrysanthemum pacificum* Nakai [D-075] (**New distribution records from Miyake and Hachijo**)

**Japanese name:** ‘Isogiku-ha-ibo-fushi’

**Reference:** Tokuda *et al.* (2012).

[Miyake] N34°07' E139°33', Alt. 21 m, 8 May 2009; N34°06' E139°29', Alt. 12 m, 9 May 2009 & 5 Apr. 2010.

[Hachijo] N33°04' E139°50', Alt. 18 m, 6 May 2009 & 9 Apr. 2010; N33°07' E139°45', Alt. 9-84 m, 7 May 2009 & 10 Apr. 2010; N33°06' E139°46', Alt. 26 m, 9 Apr. 2010.

Bud gall induced by *Rhopalomyia* sp. on *C. pacificum* [D-087] (**New distribution record from Miyake**)

**Japanese name:** ‘Isogiku-me-nagatsubo-fushi’

**Reference:** Tokuda *et al.* (2012).

[Miyake] N34°03' E139°29', Alt. 36 m, 5 Apr. 2010.

Stem gall induced by *Rhopalomyia* sp. on *Artemisia indica* var. *maximowiczii* (**New gall**) (Fig. 6)

**Japanese name:** ‘Yomogi-negiwakuki-kobu-fushi’ (new name)

[Miyake] N34°05' E139°29', Alt. 32 m, 8 May 2009.

[Hachijo] N33°07' E139°45', Alt. 84 m, 7 May 2009.

**Remarks:** This gall is similar in shape to D-102 in Yukawa and Masuda (1996), but it is multi-chambered and induced only on the basal part of stem (= situated very close to the ground). The gall does not dehisce when gall midge adults emerge from it.

Leaf gall induced by *Rhopalomyia cinerarius* Monzen on *A. indica* var. *maximowiczii* [D-113] (**New distribution record from the Izu Islands**)

**Japanese name:** ‘Yomogi-ha-shiroketama-fushi’

[Miyake] N34°05' E139°29', Alt. 32 m, 8 May 2009.

[Hachijo] N33°07' E139°49', Alt. 49 m, 20 Sept 2011; N33°06' E139°48', Alt. 68 m, 21 Sept 2011; N33°05' E139°47', Alt. 198 m, 22 Sept. 2011.

**POACEAE**

Seed gall induced by an unidentified cecidomyiid on *Setaria glauca* (L.) P. Beauv. (**New distribution record from the Izu Islands**)

**Japanese name:** ‘Kin-enokoro-mi-fukure-fushi’

**Reference:** Yamauchi *et al.* (1982).

**[Hachijo]** N33°09' E139°45', Alt. 59 m, 22 Sept. 2011.

**Galls induced by insects other than  
Cecidomyiidae**

Stem gall induced by *Merus piceus* (Roelofs) (Coleoptera: Curculionidae) on *C. sieboldii* [C-105]

**Japanese name:** ‘Sudajii-wakaeda-maruzui-fushi’

**[Hachijo]** N33°07' E139°49', Alt. 78 m, 20 Sept. 2011;  
N33°06' E139°48', Alt. 315 m, 23 Sept. 2011.

Leaf-vein gall induced by *Trioza cinnamomi* (Boselli) (Hemiptera: Psylloidea) on *Cinnamomum tenuifolium* (Makino) Sugim. ex. H. Hara (Lauraceae) [C-263] (**New distribution record from Miyake**)

**Japanese name:** ‘Yabunikkei-hamyaku-ibo-fushi’

**[Miyake]** N34°06' E139°30', Alt. 345 m, 11 Apr. 2009;  
N34°07' E139°33', Alt. 58 m, 11 Apr. 2009; N34°03'  
E139°29', Alt. 37 m, 12 Apr. 2009.

**[Hachijo]** N33°05' E139°47', Alt. 235 m, 8 Apr. 2009;  
N33°06' E139°48', Alt. 332-348 m, 8 Apr. 2009 & 23  
Sept 2011; N33°05' E139°49', Alt. 352-636 m, 8-9  
Apr. 2009; N33°07' E139°49', Alt. 145-258 m, 9 Apr.  
2009; N33°06' E139°49', Alt. 424 m, 9 Apr. 2009;  
N33°06' E139°49', Alt. 423 m, 20 Sept 2011; N33°07'  
E139°47', Alt. 16 m, 21 Sept. 2011; N33°07' E139°46',  
Alt. 27 m, 22 Sept. 2011.

Leaf gall induced by *Liothrips kuwanai* (Moulton) (Thysanoptera: Phlaeothripidae) on *Piper kadsura* (Choisy) Ohwi (Piperaceae) [C-269] (**New distribution record from Hachijo**)

**Japanese name:** ‘Fuhtoukazura-ha-chijimi-fushi’

**[Miyake]** N34°04' E139°29', Alt. 153 m, 10 Apr.  
2009; N34°06' E139°30', Alt. 359 m, 11 Apr. 2009;  
N34°06' E139°31', Alt. 333 m, 11 Apr. 2009; N34°07'  
E139°33', Alt. 38 m, 11 Apr. 2009; N34°03' E139°29',  
Alt. 40 m, 12 Apr. 2009; N34°03' E139°31', Alt. 22 m,  
12 Apr. 2009; N34°01' E139°33', Alt. 33 m, 12 Apr.  
2009.

**[Hachijo]** N33°05' E139°47', Alt. 128 m, 8 Apr. 2009;  
N33°07' E139°49', Alt. 33-211 m, 9 Apr. 2009 & 20  
Sept. 2011; N33°06' E139°49', Alt. 424 m, 9 Apr.  
2009; N33°05' E139°49', Alt. 424 m, 9 Apr. 2009;  
N33°05' E139°51', Alt. 71 m, 6 May 2009; N33°06'

E139°48', Alt. 315-364 m, 8 Apr. 2010 & 23 Sept.  
2011; N33°06' E139°47', Alt. 86 m, 21 Sept 2011;  
N33°07' E139°46', Alt. 27 m, 22 Sept. 2011.

Stem gall induced by *Ornatacidodes (Mesalcidodes) trifidus* (Pascoe) (Coleoptera: Curculionidae) on *P. lobata* [C-337] (**New distribution record from Hachijo**)

**Japanese name:** ‘Kuzu-kuki-tsuto-fushi’

**[Hachijo]** N33°07' E139°49', Alt. 49 m, 20 Sept. 2011.

Leaf gall induced by *Trioza nigra* Kuwayama (Hemiptera: Psylloidea) on *S. japonica* var. *kotoensis* [D-014] (**New distribution record from Miyake**)

**Japanese name:** ‘Egonoki-ha-kubomi-fushi’

**[Miyake]** N34°06' E139°31', Alt. 324 m, 11 Apr. 2009.  
**[Hachijo]** N33°06' E139°49', Alt. 422 m, 9 Apr. 2010;  
N33°07' E139°49', Alt. 145 m, 20 Sept. 2011.

Petiole gall induced by *Paratephritis fukaii* Shiraki (Diptera: Tephritidae) on *Farfugium hiberniflorum* (Makino) Kitam. (Asteraceae) [D-085] (**New distribution records from Miyake and Hachijo**)

**Japanese name:** ‘Tsuwabuki-haguki-fukure-fushi’

**[Miyake]** N34°07' E139°33', Alt. 29-38 m, 11 Apr.  
2009; N34°06' E139°31', Alt. 317 m, 8 May 2009 & 5  
Apr. 2010; N34°03' E139°32', Alt. 3 m, 9 May 2009;  
N34°06' E139°30', Alt. 357 m, 5 Apr. 2010; N34°06'  
E139°29', Alt. 12 m, 5 Apr. 2010; N34°04' E139°30',  
Alt. 300 m, 5 Apr. 2010.

**[Hachijo]** N33°04' E139°48', Alt. 179 m, 6 May 2009  
& 9 Apr. 2010; N33°05' E139°49', Alt. 424 m, 6 May  
2009; N33°05' E139°51', Alt. 212 m, 7 May 2009;  
N33°05' E139°47', Alt. 189 m, 8 Apr. 2010; N33°07'  
E139°47', Alt. 16 m, 23 Sept. 2011; N33°06' E139°49',  
Alt. 423 m, 20 Sept 2011.

**Absence records of gall inducers**

On Miyake, we surveyed several individuals of *Euonymus japonicus* Thunb. (Celastraceae), *H. rhombea*, and *Alpinia intermedia* Gagnep. (Zingiberaceae), but galls were not found.

On Hachijo, we surveyed about 50 trees of *Camellia japonica*, 50 trees of *E. japonicus*, 75 trees of *Elaeocarpus sylvestris* (Lour.) Poir. var. *ellipticus* (Thunb.) H. Hara (Elaeocarpaceae), and 50 plants of *A. intermedia*, but galls were not found.

The bud gall on *C. pacificum* [D-087] was found on Miyake (present study) and Mikura (Tokuda *et al.*, 2012), while not on Hachijo in spite of the intensive survey of about 20 communities (at least 2,000 individuals) during

the course of the field surveys from 2009 to 2011. In addition, we searched for galls induced by *Quadrastichus erythrinae* Kim (Hymenoptera: Eulophidae) on about 20 trees of *Erythrina crista-galli* L. (Fabaceae) and those induced by *Asteralobia patriniae* (Shinji) (Diptera: Cecidomyiidae) on 60 individuals of *Patrinia villosa* (Thunb.) Dufur. (Valerianaceae) on Hachijo in September 2011, but we did not find these galls.

### Discussion

Through the field surveys from 2009 to 2011, 18 and 21 sorts of cecidomyiid gall were found on Miyake and Hachijo, respectively. In addition, stem gall on *C. sieboldii* (Fig. 1) and leaf gall on *P. lobata* were newly recorded from Mikura. Leaf gall or necrosis on *M. thunbergii* (Figs 2 and 3), leaf gall on *S. japonica* var. *kotoensis* (Figs. 4-5), and stem gall on *A. indica* var. *maximowiczii* (Fig. 6) were newly discovered in this study. Stem gall induced on *C. sieboldii* (Fig. 1) was previously recorded only from Okinawa Island (Yamauchi et al., 1982), but we revealed that it is distributed also on the three islands surveyed in this study. Furthermore, eight sorts of cecidomyiid gall were newly found from the Izu Islands, six sorts were from Miyake, and six sorts were from Hachijo.

As a result of our field survey on southern parts of the Izu Islands (from Miyake to Aogashima), galls recorded from Miyake, Mikura, Hachijo, and Aogashima became 18, 16, 23, and 3 sorts, respectively. Among the 23 sorts on Hachijo, fruit gall on *A. glandulosa* and bud gall on *W. coraeensis* var. *fragrans* are induced by the same gall midge species, *A. baca*, as a result of host alternation (Uechi et al., 2004). Therefore, the numbers of gall-inducing cecidomyiids recorded are 18, 16, 22, and 3 species on Miyake, Mikura, Hachijo, and Aogashima, respectively.

*L. camelliae* was previously recorded from Izu-Oshima, the northern most island of the Izu Islands, to Mikura, but not from Hachijo (Sunose, 1981; Tokuda et al., 2012). Through our field survey, we also did not find *L. camelliae* on Hachijo, suggesting that the gall midge has never colonized Hachijo or its population density was extremely low on this island.

*T. cinnamomi* was previously known to occur on Hachijo, Mikura, and Aogashima (Miyatake, 1966, Tokuda et al., 2012), and was reported for the first time from Miyake in this study. *L. kuwanai*, previously recorded from Miyake, Mikura, and Aogashima (Okajima, 2006; Tokuda et al., 2012), was newly found on Hachijo. *O. (M.) trifidus* had been recorded from Shikinejima Island by Morimoto & Miyakawa (1985) and was found for the first time from Hachijo in this study. *T. nigra* was

reported from Hachijo by Miyatake (1966) and was found for the first time from Miyake in this study. *P. fukaii* was recorded from Mikura and Aogashima in our previous study (Tokuda et al., 2012) and from Miyake and Hachijo in this paper.

### Acknowledgments

We thank the Miyake Village Office for permitting us to conduct field surveys in restricted areas around Mount Oyama on Miyake, and the Mikurajima Village Office for permitting us to collect galls and gall-inducing insects on Mikura. Our thanks are extended to Y. Iwasaki, H. Shinoki, T. Hishii, and K. Kogi for their kind support in field survey. KM thanks Prof. O. Tadauchi and Assoc. Prof. S. Kamitani for their encouragement. This study was supported in part by a Grant-in-aid for Young Scientists B (21780052) from Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan to MT, Research Grant for Plant Science from The New Technology Development Foundation to MT, Japan-Taiwan Joint Research Program from Interchange Association, Japan to MT, and by Global COE Program (Center of excellence for Asian conservation ecology as a basis of human-nature mutualism), MEXT to KM.

### References

- Gagné, R. J., 1989. *The Plant-Feeding Gall Midges of North America*. Cornell University Press.
- Gagné, R. J. 1994. *The Gall Midges of the Neotropical Region*. Cornell University Press, Ithaca, New York.
- Hachijojima Interpretation Association, 2007. *Field Guide Hachijo-jima*. Hachijojima Kankou Shinkou Jikkou Inkai, Tokyo. (In Japanese.)
- Hasegawa, M., 2003. Ecological diversification of insular terrestrial reptiles: a review of the studies on the lizard and snakes of the Izu Islands. *Global Envir. Res.*, **7**: 59–67.
- Inoue, K., 1988. Pattern of breeding-system change in the Izu Islands in *Campanula punctata*: bumblebee-absence hypothesis. *Plant Species Biol.*, **3**: 125–128.
- Inoue, K. & M. Amano, 1986. Evolution of *Campanula punctata* Lam. in the Izu Islands: changes of pollinators and evolution of breeding systems. *Plant Species Biol.*, **1**: 89–97.
- Ishizawa, J., 1942. [*Insects in the Four Seasons.*] Ars, Tokyo. (In Japanese.)
- Kurosawa, Y., 1978. Phylogeny and distribution of *Lucanus gamunus* Sawada et Y. Watanabe (Coleoptera, Lucanidae), endemic to the Izu Islands, central Japan. *Mem. Nat. Sci. Mus., Tokyo*, **11**: 141–153.
- MacArthur, R. H. & E. O. Wilson, 1967. *The Theory of Island Biogeography*. Princeton University Press.
- Mani, M. S., 1964. *Ecology of Plant Galls*. Dr. W. Junk Publishers, The Hague.
- Miyake, T. & K. Inoue, 2003. Character displacement in style



- length between pollinator-sharing *Clerodendrum trichotomum* and *C. izuinsulare* (Verbenaceae). *Plant Syst. Evol.*, **243**: 31–38.
- Miyatake, Y., 1966. On some species of Psyllidae from the Hachijō Islands. *Kontyū*, **34**: 327–330.
- Morimoto, K. & S. Miyakawa, 1985. Weevil fauna of the Izu Islands, Japan (Coleoptera). *Mushi*, **50**: 19–85.
- Ohgushi, T., 2005. Indirect interaction webs: herbivore-induced effects through trait change in plants. *Annu. Rev. Ecol., Evol. Syst.*, **36**: 81–105.
- Oiki, S., T. Kawahara, K. Inoue, M. Ohara & M. Maki, 2001. Random amplified polymorphic DNA (RAPD) variation among populations of the insular endemic plant *Campanula microdonata* (Campanulaceae). *Ann. Bot.*, **87**: 661–667.
- Okajima, S., 2006. *The Insects of Japan, Volume 2: The Suborder Tubulifera (Thysanoptera)*. The Entomological Society of Japan, Touka Shobo Co. Ltd., Fukuoka.
- Partomihardjo, T., J. Yukawa, N. Uechi & J. Abe, 2011. Arthropod galls found on the Krakatau Islands and in Adjacent Areas of Indonesia, with reference to faunistic disharmony between the islands and the whole of Indonesia. *Esakia*, (50): 9–21.
- Stevens, P. F., 2008. Angiosperm Phylogeny Website, Version 9. <http://www.mobot.org/MOBOT/research/APweb/>
- Stuessy, T. F. & M. Ono, 1998. *Evolution and Speciation of Island Plants*. Cambridge University Press.
- Sunose, T., 1981. [A study of biogeography in the Izu Islands with notes on the distribution of gall midges.] *Panmixia*, **4**: 8–12. (In Japanese.)
- Takaoka, H. & K. Saito, 2005. A new species of *Simulium* (*Nevermannia*) from Izu Islands, Japan (Diptera: Simuliidae). *Med. Entomol. Zool.*, **56**: 309–317.
- Thornton, I. W. B., 1996. *Krakatau*. The destruction and reassembly of an island ecosystem. Harvard University Press, Cambridge, USA.
- Thornton, I. W. B., D. Runciman, S. Cook, L. F. Lumsden, T. Partomihardjo, N. K. Schedvin, J. Yukawa & S. A. Ward, 2002. How important were stepping stones in the colonization of Krakatau? *Biol. J. Linn. Soc.* **77**: 275–317.
- Tokuda, M., K. Matsuo & J. Yukawa, 2012. Insect galls found on Mikurajima and Aogashuima, the Izu Islands, Tokyo, Japan. *Jpn. J. Entomol. (New Ser.)* **15**: in press. (In Japanese with English summary.)
- Tokuda, M., K. Tabuchi, J. Yukawa & H. Amano, 2004a. Inter- and intraspecific comparisons between *Asteralobia* gall midges (Diptera: Cecidomyiidae) causing axillary bud galls on *Ilex* species (Aquifoliaceae): species identification, host range, and mode of speciation. *Ann. Entomol. Soc. Amer.*, **97**: 957–970.
- Tokuda, M., M. Nohara, J. Yukawa, S. Usuba & M. Yukinari, 2004b. *Oxycephalomyia*, gen. nov., and life history strategy of *O. styraci* comb. nov. (Diptera: Cecidomyiidae) on *Styrax japonicus* (Styracaceae). *Entomol. Sci.*, **7**: 51–62.
- Uechi, N., J. Yukawa & D. Yamaguchi, 2004. Host alternation by gall midges of the genus *Asphondylia* (Diptera: Cecidomyiidae). *Bishop Mus. Bull. Entomol.*, **12**: 53–66.
- Usuba, S., 1989. [Miscellaneous notes on insect galls X.] *Insect*, **40**: 124–128. (In Japanese.)
- Yamauchi, S., H. Ikenaga & J. Yukawa, 1982. Midge galls collected from the south-west islands of Japan. *Satsuma*, **31**: 1–23. (In Japanese with English summary.)
- Yukawa, J., 1971. A revision of the Japanese gall midges (Diptera: Cecidomyiidae). *Mem. Fac. Agr., Kagoshima Univ.*, **8**: 1–203.
- Yukawa, J., 1983. Arthropod community centred upon the neolitsea leaf gall midge, *Pseudasphondylia neolitsea* Yukawa (Diptera, Cecidomyiidae) and its host plant, *Neolitsea sericea* (Blume) Koidz. (Lauraceae). *Mem. Fac. Agr., Kagoshima Univ.*, **19**: 89–96.
- Yukawa, J., H. Ikenaga, S. Sato, M. Tokuda, T. Ganaha-Kikumura, N. Uechi, K. Matsuo, M. Mishima, G. S. Tung, J. C. Paik, B. Q. Ren & X. Y. Dong, 2012. Description and ecological traits of a new species of *Pitydiplosis* (Diptera: Cecidomyiidae) that induces leaf galls on *Pueraria* (Fabaceae) in East Asia, with a possible diversification scenario of intraspecific groups. *Entomol. Sci.*, **15**: 81–98.
- Yukawa, J. & H. Masuda, 1996. *Insect and Mite Galls of Japan in Colors*. Zenkoku Nōson Kyōiku Kyōkai, Tokyo, Japan. (In Japanese with English explanation for color plates.)
- Yukawa, J. & T. Partomihardjo, 1997. Insect and mite galls collected from Peucang, Panaitan, and the Krakatau Islands, Indonesia. *Tropics*, **7**: 141–152.
- Yukawa, J. & O. Rohfrisch, 2005. Biology and ecology of gall-inducing Cecidomyiidae (Diptera: Cecidomyiidae). In: Raman, A., C. W. Schaefer & T. M. Withers (eds.) *Biol., Ecol., Evol. Gall-inducing Arthropods*, **1**: 273–304. Science Publishers, Enfield.