

Arthropod Galls Newly Found on the Izu Islands, Tokyo, Japan

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Abstract During field surveys on the Izu Islands, Tokyo, Japan from 2011 to 2014, a fruit gall induced by *Asphondylia* sp. (Diptera: Cecidomyiidae) on *Gardneria nutans* (Loganiaceae) was discovered and a stem gall induced by *Eucosma metzneriana* (Lepidoptera: Tortricidae) on *Altemisia indica* var. *maximowiczii* was newly recorded from the Izu Islands. In addition, several cecidomyiid and other arthropod galls were newly recorded from Niiijima, Shikinejima, Miyakejima, Hachijojima, and Aogashima Islands.

Introduction

Faunistic studies of gall inducing insects are of importance in terms of biogeographical and ecological studies on insular arthropod communities (e.g. MacArthur and Wilson, 1967; Thornton, 1996; Sunose, 1981; Stuessy and Ono, 1998; Thornton *et al.*, 2002; Fujii *et al.*, 2012). In recent years, we have been paying special attention to clarify the gall midge (Diptera: Cecidomyiidae) fauna of the Izu Islands (Tokuda *et al.*, 2012a, 2012b, 2013; Tokuda and Kawauchi, 2013a). So far, 13 cecidomyiid galls have been recorded from Ohshima, 17 from Toshima, 14 from Niiijima, nine from Shikinejima, 16 from Kozushima, 18 from Miyakejima, 15 from Mikurajima, 21 from Hachijojima, and three from Aogashima Islands.

In this paper, we report cecidomyiid and other arthropod galls that were newly collected from the Izu Islands during the course of field surveys between 2011 and 2014.

Methods

Galls induced by Cecidomyiidae and other arthropods were surveyed on Niiijima Island on 10 and 11 Dec. 2013 by MT, on Shikinejima on 11 Dec. 2013 and on 10 Dec. 2014 by MT, on Miyakejima Island on 8 Dec. 2013 by MT, and on Hachijojima Island on 25 Apr. 2012 by MT and KK, 21 Nov. 2012 by MT and KK, and 18 May 2013 by MT, and on Aogashima on 20 Nov. 2012 by MT and KK. In addition, TK and YI living on Hachijojima Island occasionally searched for galls there and gave the information to MT.

Detailed methods for field survey and collecting and dissection of galls were already shown in Tokuda *et al.* (2012a). Each collecting record of gall consists of latitude, longitude, altitude and collecting date. Galls are listed according to the order in Yukawa and Masuda (1996) and gall numbers designated by Yukawa and Masuda (1996) are shown in brackets for each gall.

The family name of host plants follows the Angiosperm Phylogeny Group (APG) system of plant clarification (Stevens, 2008). Specimens collected in this study are kept in Laboratory of Systems Ecology, Faculty of Agriculture, Saga University, Japan.

Results

Arthropod galls found on the Izu Islands

FAGACEAE

1. Inflorescence gall induced by an unidentified cecidomyiid (Diptera) on *Castanopsis sieboldii* (Makino) Hatus. ex T. Yamaz. et Mashiba [C-163] (**New records from Niiijima and Aogashima Islands**)

Japanese name: ‘Sudajii-hanaeda-fukure-fushi’

[Niiijima] N 34° 21' E 139° 15', Alt. 357 m, 10 Dec. 2013 & 11 Dec 2014; N 34° 21' E 139° 15', Alt. 257 m, 11 Dec 2014.

[Aogashima] N 32° 27' E 139° 46', Alt. 107–134 m, 20 Nov. 2012; N 32° 28' E 139° 46', Alt. 120–260 m, 20 Nov. 2012.

Remarks. On the Izu Islands, this gall was previously recorded from Shikinejima, Kozushima, Miyakejima, Mikurajima and Hachijojima Islands (Tokuda *et al.*, 2012b, 2013; Tokuda and Kawauchi, 2013a).

AMARANTHACEAE

2. Stem gall induced by *Lasioptera achyranthii* Shinji (Diptera: Cecidomyiidae) on *Achyranthes bidentata* var. *japonica* Miq. [C-245] (**New record from Miyakejima Island**)

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

[Miyakejima] N 34° 03' E 139° 31', Alt. 20 m, 8 Dec. 2013.

Remarks. On the Izu Islands, this gall was previously recorded from Hachijojima Island (Tokuda *et al.*, 2012b).

LAURACEAE

3. Barrel-shaped leaf gall induced by *Daphnephila machilicola* Yukawa (Diptera: Cecidomyiidae) on *Machilus thunbergii* Siebold et Zucc. [C-256] (**New record from Shikinejima Island**)

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

[Miyakejima] N 34° 03' E 139° 31', Alt. 20 m, 8 Dec. 2013.

[Shikinejima] N 34° 19' E 139° 13', Alt. 40 m, 11 Dec. 2013; N 34° 20' E 139° 13', Alt. 14 m, 10 Dec. 2014.

Remarks. On the Izu Islands, this gall was previously recorded from Ohshima, Toshima, Niiijima, Kozushima, Miyakejima, Mikurajima, Hachijojima and Aogashima Islands (Tokuda *et al.*, 2012a, b, 2013; Tokuda and Kawauchi, 2013a).



Figs. 1–2. Insect galls found on the Izu Islands. – 1, Fruit galls induced by *Asphondylia* sp. on *Gardneria nutans*; 2, a stem gall induced by *Eucosma metzneriana* on *Altemisia indica* var. *maximowiczii*.

On Miyakejima Island, the gall was previously recorded only from mountainous areas (Alt. 317–324 m) (Tokuda *et al.*, 2012b).

4. Leaf-vein gall induced by *Trioza machilicola* Miyatake (Hemiptera: Psylloidea) on *M. thunbergii* [C-257] (**New record from Niijima Island**)

Japanese name: ‘Tabunoki-ha-kubomi-fushi’

[Niijima] N 34° 24' E 139° 17', Alt. 154 m, 11 Dec. 2014.

Remarks. On the Izu Islands, this gall was previously recorded from Toshima Island (Tokuda and Kawauchi, 2013a).

STACHYURACEAE

5. Leaf gall induced by *Phyllocoptes* sp. (Acari: Eriophyidae) on *Stachyurus praecox* Siebold et Zucc. var. *matsuzakii* (Nakai) Makino ex H. Hara [C-407] (**New record from Hachijo Island**)

Japanese name: ‘Kibushi-ha-kobuke-fushi’

[Hachiojima] N 33° 07' E 139° 47', Alt. 100 m, 18 May 2013.

Remarks. On the Izu Islands, this gall was previously recorded from Toshima Island (Tokuda and Kawauchi, 2013a).

LOGANIACEAE

6. Fruit gall induced by *Asphondylia* sp. (Diptera: Cecidomyiidae) on *Gardneria nutans* Siebold et Zucc. (**New gall**)

Japanese name: ‘Houraikazura-mi-midori-fushi’ (Newly proposed name)

[Hachiojima] N 33° 07' E 139° 47', Alt. 16 m, 25 Apr. 2012 & 21 Nov. 2012.

Remarks. This gall is single-chambered and galled fruit remains green. The diameter and length of gall are 7.9–8.3 mm and 7.0–8.0 mm, respectively ($n = 6$). The second and third instars were found in galls collected on 25 Apr. 2012 and dissected on 2 May 2012. Detailed life history of this gall midge has not yet been clarified.

ASTERACEAE

7. Stem gall induced by *Eucosma metzneriana* (Treitschké)

(Lepidoptera: Tortricidae) on *Altemisia indica* Willd. var. *maximowiczii* (Nakai) [D-104] (**New record from the Izu Islands**)

Japanese name: ‘Yomogi-kuki-tsuto-fushi’

[Aogashima] N 32° 27' E 139° 46', Alt. 119–168 m, 20 Nov. 2012.

Remarks. This gall was previously recorded from Hokkaido, Honshu, Shikoku, and Kyushu, Japan (Yukawa and Masuda, 1996).

8. Bud gall induced by *Rhopalomyia iwataensis* Shinji on *A. indica* var. *maximowiczii* [D-108] (**New records from Niijima and Shikinejima Islands**)

Japanese name: ‘Yomogi-shintome-fushi’

[Niijima] N 34° 24' E 139° 17', Alt. 164 m, 11 Dec. 2014.

[Shikinejima] N 34° 20' E 139° 13', Alt. 39 m, 10 Dec. 2014.

Remarks. On the Izu Islands, this gall was previously recorded from Toshima Island (Tokuda and Kawauchi, 2013a).

Absence records of galls and gall inducers

On Hachiojima Island, we surveyed ten trees (ca. 500 current shoots) of *Celtis sinensis* Pers. (Cannabaceae) but leaf galls induced by *Celticosis japonica* Yukawa et Tsuda and by an unidentified cecidomyiid (Gall No. C-200 in Yukawa and Masuda, 1996) were not found.

On Aogashima Island, we surveyed seven trees (ca. 250 current shoots) of *Camellia japonica* L. (Theaceae) but leaf galls induced by *Lasioptera camelliae* Ohno et Yukawa were not found.

Discussion

In this study, we newly found two sorts of cecidomyiid gall on Niijima and Shikinejima Islands, respectively, and one sort on each of Miyakejima, Hachiojima, and Aogashima Islands. As a result, cecidomyiid galls recorded from the nine inhabited islands of the Izu Islands became 13, 17, 18, 11, 14, 19, 15, 24, and four sorts on Ohshima, Toshima, Niijima, Shikinejima, Kouzushima, Miyakejima, Mikurajima,

Hachijojima, and Aogashima Islands, respectively (Tokuda *et al.*, 2012a, b, 2013; Tokuda and Kawauchi, 2013a).

The fruit gall induced by *Asphondylia* sp. on *Gardneria nutans* (Loganiaceae) was discovered from Hachijojima Island in this study. In the genus *Asphondylia*, some species are known to exhibit host alternation habit (e.g. Uechi *et al.*, 2004; Tokuda, 2012). Further studies are needed to clarify the life history and, if any, alternate host plants of the *Asphondylia* species associated with *G. nutans*. In addition, to confirm the presence or absence of this gall midge on *G. nutans* in Honshu and other areas in Japan is also necessary to infer the origin of this gall midge.

Through the present study and previous reports, inflorescence gall induced on *Castanopsis sieboldii* by an unidentified cecidomyiid (Gall No. C-163 in Yukawa and Masuda, 1996) was clarified to exist from Nijijima to Aogashima Island on the Izu Islands. Because this gall was previously recorded only from southern Kyushu (Nagai, 2010; Tokuda and Kawauchi, 2013b) and Okinawa Island (Yamauchi *et al.*, 1982), the present paper records Nijijima Island as the northernmost distribution range of this gall.

Barrel-shaped leaf galls induced by *D. machilicola* were revealed to exist on all inhabiting islands of the Izu Islands. This is contrastive to *T. machilicola*, a psyllid associated with the same host plant, which has been reported only from Toshima (Tokuda and Kawauchi, 2013) and Nijijima (present study) Islands in the Izu Islands.

Collecting records of other gall inducers from the Izu Islands are still fragmental. Further studies are needed to discuss their biogeographical aspects.

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