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Host Plants and Larvae of Two Dicot-feeding Selandriine Sawflies (Hymenoptera, Tenthredinidae) from Japan

Akihiko Shinohara[1] and Shin-ichi Ibuki[2]

[1] Department of Zoology, National Museum of Nature and Science,
4–1–1 Amakubo, Tsukuba, Ibaraki, 305–0005 Japan
E-mail: shinohar@kahaku.go.jp
[2] Wami 1355–13, Nakagawa, Tochigi, 324–0612 Japan
E-mail: banbi-fa@ktd.biglobe.ne.jp

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Abstract Based on rearing experiments, *Pilea pumila* (L.) A. Gray [Urticaceae] is newly recorded as a host plant of *Busarbidea japonica* Takeuchi, 1941, and *Lysimachia vulgaris* L. var. *davurica* (Ledeb.) R. Knuth [Primulaceae] as a host plant of *Birka carinifrons* (Malaise, 1931). Notes are given on the life history of the two species and the larvae are illustrated. Only six selandriine sawflies were known to feed on dicots so far and *B. japonica* is the seventh species to be recorded.

Key words: Selandriinae, new host records, *Busarbidea japonica*, *Birka carinifrons*, *Pilea pumila*, *Lysimachia vulgaris* var. *davurica.*

Introduction

In the course of a survey of sawfly fauna of Nakagawa Town, Tochigi Prefecture, central Honshu, Ibuki found two species of unknown larvae and reared them, one feeding on *Pilea pumila* (L.) A. Gray [Urticaceae] and the other feeding on *Lysimachia vulgaris* L. var. *davurica* (Ledeb.) R. Knuth [Primulaceae]. Examination of the obtained adults has shown that the species on *Pilea* was *Busarbidea japonica* Takeuchi, 1941 and the species on *Lysimachia* was *Birka carinifrons* (Malaise, 1931), both belonging to the tenthredinid subfamily Selandriinae. The host plant and larva of *B. japonica* were unknown. *Lysimachia clethroides* Duby was recorded as a host plant of *B. carinifrons* (Okutani, 1967) but the larva of this species has not been described or illustrated. Here we report on the rearings of the two species and illustrate the larvae. Comments on the voltinism and pupation site preferences of the two species and dicot feeding in the Selandriinae are given.

Materials and methods

The material used in this work is kept in the National Museum of Nature and Science, Tsukuba. Larvae were collected in the field and reared in a room at Bambi Farm in Wami (N36°47′ E140°10′, about 240 m alt.), Nakagawa Town, Tochigi Prefecture. The temperature and day length were not controlled in the room, but the light was usually on for about 16 hours a day. All the photographs were taken by Ibuki with digital cameras, Sony DSC-H7, Ricoh CX3 and Canon Power Shot S95. The digital images were processed and arranged with Adobe Photoshop Elements 12 software. We followed Naito (1979a) and Naito *et al.* (2004) for the generic placement of the two species and Viitasaari (2002) for the larval morphological terminology.

Results

Busarbidea japonica Takeuchi, 1941

(Figs. 1–7)

Host plant. Urticaceae: *Pilea pumila* (L.) A. Gray. New record.

Rearing records (Table 1). In Wami, Nakagawa Town, Ibuki found a total of 35 larvae feeding on *Pilea pumila* and obtained three adults by rearing them. Four larvae were found on June 13, 2011, but all died before reaching maturity. One larva was collected on July 9, 2012, and it matured on July 20, but, apparently finding no suitable pupating sites, it stayed among the small grains of pumice at the bottom of the container without making a cocoon. When observed on July 25, it had become a pupa (Fig. 7) but it died thereafter. On October 10, 2012, six larvae were collected. They matured on October 15 and went into a dried tuber of Jerusalem artichoke making a round hole (Fig. 5) on October 16. The inside of the dried tuber was partly examined on April 19, 2013, and a prepupa was recognized in its own cell without making a cocoon (Fig. 6). One female each emerged on April 16, 17, and May 16, 2013. On July 7, 2014, eight larvae were collected and they reached maturity on July 12. No adults emerged from this lot. On October 20, 2016, 16 larvae were found. They matured on October 22 to 31 and entered a piece of rotten wood, where they remained until February, 2017.

Late instar larva (Figs. 2, 3). About 13 mm. Head black; trunk dark grey, lateral (epipleural region and below) and ventral sides pale grey. Head and trunk covered with distinct setae. Each annulet of abdominal segment with longitudinal series of tubercles. Subspiracular and surpedal lobes conspicuous.

Feeding habit (Fig. 1). The larvae usually stay on the underside of the leaf and solitarily feed on the leaf, leaving most of the veins.

Birka carinifrons (Malaise, 1931)

(Figs. 8, 9)

Host plants. Primulaceae: *Lysimachia clethroides* Duby (Okutani, 1967). *Lysimachia vulgaris* L. var. *davurica* (Ledeb.) R. Knuth. New record.

Rearing records (Table 1). In Wami, Nakagawa Town, Ibuki found six larvae feeding on *Lysimachia vulgaris* var. *davurica* on June 18, 2012. They were reared in a container without soil. The larvae ceased feeding on June 25 to 30 and moved around in the container. One larva cocooned under tissue paper, and others, after soil was supplied, entered the soil. Two females and three males emerged on July 10 and one female emerged on July 13 of the same year.

Late instar larva (Figs. 8, 9). About 15 mm. Head pale orange, trunk pale green, lateral and ventral sides very pale yellowish green to whitish. Head and trunk without distinct setae or tubercles. Subspiracular and surpedal lobes rather flat and inconspicuous.

Feeding habit (Fig. 8). The larvae usually stay on the underside of the leaf when at rest, but often cling to the edge of the leaf when eating it. They also consume the veins.

Discussion

Life history

The rearing records given above strongly suggest that both *B. japonica* and *B. carinifrons* have a multivoltine life cycle. The larvae of the former species were found in the field in June, July and October in Nakagawa Town and those found in October became adults in April and May of the next year (Table 1). We failed to obtain adults from the larvae collected in June and July, but we believe that *B. japonica* has at least two generations a year. This is supported by the collecting records of adults in Chitose, Hokkaido, where adults were collected in May to June, and August to September (National Museum of Nature and Science, 2017). *Birka carinifrons* is also multivoltine, because the lar-

Figs. 1–9. *Busarbidea japonica* (1–7) and *Birka carinifrons* (8, 9), photographed in Wami, Nakagawa Town, Tochigi Prefecture, by S. Ibuki. 1, Damaged leaves of *Pilea pumila*, July 1, 2011; 2, probably late instar larva, October 7, 2012; 3, late instar larva, October 15, 2012; 4, mature larvae, July 12, 2014; 5, dried tuber of Jerusalem artichoke with an entrance hole of mature larva (arrowed), October 16, 2012; 6, prepupa in a cell in dried tuber of Jerusalem artichoke, April 19, 2013; 7, pupa, pupated without making cell, July 25, 2012; 8, 9, middle or late instar larvae on *Lysimachia vulgaris* var. *davurica*, June 18, 2012.

Table 1. Rearing records of two sawfly species in Nakagawa Town (Wami) in 2011–2016. See text for more details.

Species	Host plant	Larva found	Number	Matured	Emergence of the adults	Remarks
Busarbidea japonica	*Pilea pumila*	June 13, 2011	4			All dead before maturity
		July 9, 2012	1	July 20		Pupa observed on July 25 (Fig. 7)
		October 10, 2012	6	October 15	April 16, 2013 (1 ♀) April 17, 2013 (1 ♀) May 16, 2013 (1 ♀)	Entered dried tuber of Jerusalem artichoke
		July 7, 2014	8	July 12		
		October 20, 2016	16	October 22–31		Entered rotten wood
Birka carinifrons	*Lysimachia vulgaris* var. *davurica*	June 18, 2012	6	June 25–30	July 10, 2012 (2 ♀, 3 ♂) July 13, 2012 (1 ♀)	Cocooned in soil or under tissue paper

vae collected in the field in June became adults in July of the same year in Nakagawa Town (Table 1) and a long series of adults was collected in April to September (Naito *et al.*, 2004; National Museum of Nature and Science, 2017).

Busarbidea japonica and *B. carinifrons* may differ in the selection of the pupating sites. The mature larva of *B. japonica* entered a dried tuber of Jerusalem artichoke or a piece of rotten wood and made a cell inside, where it stayed and pupated without making a cocoon. The mature larva of *B. carinifrons*, on the other hand, went into the soil and made a cocoon. Okutani (1957) noted that many of the Selandriinae s. str. (not including the "Dolerinae") utilize rotten wood as pupating sites and, as in *B. japonica*, make no distinct cocoon. The European *Birka cinereipes* (Klug, 1816), which is associated with *Myosotis scorpioides* L. [Boraginaceae], makes a cocoon in the soil, between leaves, or on the stem (Lorenz and Kraus, 1957).

Dicots as host plants of Selandriinae

So far as is known, the selandriine sawflies are associated with ferns and monocots (Vikberg and Nuorteva, 1997), with the exception of only seven species, six on dicots and one on mosses: *Alphastromboceros konowi* (Jakowlew, 1891) on *Urtica thunbergiana* Siebold et Zucc. [Urticaceae] (Naito, 1979b), *Birka annulitarsis* (Thomson, 1870) on *Pulmonaria angustifolia* L. [Boraginaceae] (Macek, 2013), *Birka carinifrons* on *Lysimachia clethroides* [Primulaceae] (Okutani, 1967), *Birka cinereipes* (Klug, 1816) on *Myosotis scorpioides* [Boraginaceae] (Lorenz and Kraus, 1957), *Nipponorhynchus mirabilis* Takeuchi, 1941, and *N. bimaculatus* Naito, 1972, on *Chrysosplenium macrostemon* Maxim. var. *shiobarense* (Franch.) H. Hara [Saxifragaceae] (Saito and Ibuki, 2010), and *Nesoselandria morio* (Fabricius, 1781) on several species of mosses (Vikberg and Nuorteva, 1997). *Busarbidea japonica* on *Pilea pumila* [Urticaceae] is therefore the seventh species of selandriine sawfly known to feed on dicots. The host plant of *Busarbidea* species was previously unknown.

The subfamily Selandriinae s. lat. (including the "Dolerinae") is a large group represented by 74 genera (Taeger *et al.*, 2010). The tribal arrangement of the genera has been proposed mainly for European, Nearctic and part of the East Asian faunae (Benson, 1938; Takeuchi, 1941; Smith, 1969), and many of the Oriental and Neotropical genera have not been assigned to tribes. Phylogenetic hypotheses among the genera are available only for a limited number of mainly European genera (e.g., nine genera in Malm and Nyman, 2014, and 16 genera in Vilhelmsen, 2015), and information on the host plants and biology is missing for most genera. The four dicot host plant families, Urticaceae, Primulaceae, Saxifragaceae and Boraginaceae, all belong to the huge clade of core eudicots, but they are not very closely related (APG III, 2009).

It is likely that the seemingly exceptional cases of dicot feeding in Selandriinae represent secondary and largely independent specializations within the subfamily. This very rough hypothesis should be more precisely formulated and tested with much more information about the

phylogenetic relationships and host plant associations within the subfamily.

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