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Larvae, Life History and Host Plants of *Arge rejecta* (Hymenoptera, Argidae) in Japan

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Abstract The larvae of *A. rejecta* are briefly described and illustrated and its life history is outlined, mainly based on rearing experiments and studies of the collection data of preserved adult specimens. This species probably has three generations per year in the lowlands of central Honshu and one generation per year in the highlands of Honshu. The larvae are mostly greenish, solitary and cryptic. *Rubus subcrataegifolius* is newly recorded as a host plant of *A. rejecta*.
Key words: Argidae, larvae, life history, new host record, *Rubus*.

Introduction

Arge rejecta (Kirby, 1882) is a small species of argid sawfly associated with *Rubus* (Rosaceae). It is distributed widely in Japan and has been recorded also in China (Hara, 2020). Takeuchi (1949) was the first to record a host plant of this species. He simply mentioned "*Rubus*" as a host plant of *A. rejecta* in his checklist of host plants of Japanese sawflies. Okutani (1967) recorded three species of *Rubus*, *R. parvifolius* L., *R. microphyllus* L. and *R. crataegifolius* Bunge, as the host plants of *A. rejecta* but he did not publish any details about the larvae and life history. Murase (2012) reported on her successful rearing of this species from larvae feeding on *Rubus hirsutus* Thunb., a new host record, with a color picture of the larva. These are the only references regarding the immature stages and life history of this sawfly.

Here I briefly describe the larvae of *A. rejecta* and provide an overview of its life history, based mainly on my own research conducted in various localities in 2006 to 2008 and collection records of preserved adult specimens.

Materials and Methods

The materials used for rearing were obtained in the following localities in Honshu and Shikoku from 2006 to 2008 (Table 1). **Honshu: Tokyo Metropolis**: Tamagawadai-koen, 30 m, Ota-ku; Hodokubo, 110 m, Hino-shi; Yokosawairi, 130 m, Akiruno-shi; Uratakao, 200 m, Hachioji-shi. **Kanagawa Prefecture**: Nokendai, 30 m, Yokohama-shi. **Gunma Prefecture**: Manza-onsen, 1700 m, Tsumakoi-mura. **Nagano Prefecture**: Shiga-kogen, 1680 m, Yamanouchi-machi. **Hyogo Prefecture**: Nunobiki, 350 m, Kobe-shi. **Shikoku: Kochi Prefecture**: Godaisan, 100 m, Kochi-shi. The adult specimens are kept in the National Museum of Nature and Science, Tsukuba. Rearing experiments were performed in Kuramae, Tokyo, at an altitude of 2 m. The temperature and day length of the rearing room were not controlled, except that the highest temperature was set at 25°C. Photographs were taken with digital cameras, Canon EOS Kiss Digital X (Fig. 1A–H) and Konica Minolta DiMAGE A200 (Fig. 1I). The digital images were processed and arranged with Adobe Photoshop Elements 15 software. For the larval morphological terminology, I followed Viitasaari (2002).

Table 1. Records of 32 successful cases of rearing experiments (from larvae to adults) of *Arge rejecta*. For details of the localities, see Materials and Methods. Abbreviations for host plants are: RS: *Rubus subcrataegifolius*, RH: *Rubus hirsutus*. ME refers to the number of days from the time the larva matured until the adult emerged; bold letters show the overwintering individuals.

Locality	Host	Larva found	Matured	Adult emerged	Sex	ME (days)
Shiga-kogen, Nagano	RS	17 VIII 2006	18 VIII	18 IV 2007	male	**233**
Tamagawadai-koen, Tokyo	RH	3 XI 2006	11 XI	15 IV 2007	male	**156**
Nokendai, Kanagawa	RH	29 VII 2007	11 VIII	5 X 2007	male	55
			13 VIII	15 X 2007	female	65
			16 VIII	11 IV 2008	male	**238**
Manza-onsen, Gunma	RS	10 IX 2007	12 IX	20 VI 2008	female	**282**
Nunobiki, Hyogo	RH	17 IX 2007	27 IX	4 XI 2007	female	38
Hodokubo, Tokyo	RH	8 X 2007	18 X	4 XI 2007	female	17
			18 X	7 V 2008	male	**201**
			19 X	5 XI 2007	male	17
Yokosawairi, Tokyo	RH	13, 14 X 2007	14 X	3 XI 2007	male	20
			14 X	8 XI 2007	male	25
			17 X	4 XI 2007	female	18
			18 X	8 XI 2007	female	21
			18 X	9 XI 2007	male	22
			18 X	7 V 2008	male	**201**
			21 X	11 XI 2007	female	21
			21 X	13 XI 2007	male	23
			23 X	7 V 2008	male	**196**
Uratakao, Tokyo	RH	21 X 2007	24 X	12 XI 2007	male	19
			24 X	13 XI 2007	female	20
			26 X	11 IV 2008	male	**167**
			27 X	21 V 2008	male	**206**
Godaisan, Kochi	RH	3 XI 2007	4 XI	3 XII 2007	female	29
			5 XI	6 XII 2007	female	31
			6 XI	3 XII 2007	female	27
			6 XI	11 IV 2008	male	**156**
			6 XI	12 IV 2008	male	**157**
			7 XI	15 IV 2008	male	**159**
			7 XI	19 IV 2008	male	**163**
			7 XI	23 IV 2008	male	**167**
			9 XI	11 V 2008	female	**183**

Results and Discussion

Rearing records and outline of life history. After numerous unsuccessful rearing experiments, I succeeded in obtaining 32 adults by rearing larvae from nine localities in Honshu and Shikoku from 2006 to 2008 (Table 1). In two cases, the larvae were found feeding on *Rubus subcrataegifolius* on high mountains, whereas all the others fed on *R. hirsutus* in lowlands or on low mountains.

The larvae were collected in summer to autumn, and reached maturity from August 11 to November 11. This does not mean that larvae do not occur during earlier seasons, but rather that the larvae used in my rearing experiments happened to be collected from summer to autumn. Of the 32 larvae reared, 17 became adults within the same year as they matured (17 to 65 days in the cocoon), whereas 15 went into prolonged diapause and became adults next year, after hibernation (156 to 282 days in the cocoon). The emergence of the adults in November and December in the field is unlikely, because no suitably fresh leaves would be available. The high frequency of emergence without prolonged diapause in my experiments most probably resulted from the high temperature in the rearing room. Tempera-

Fig. 1. *Arge rejecta*, larvae feeding on *Rubus hirsutus*, Yokohama, July and August, 2007 (A–H) and mature larva on *Rubus subcrataegifolius*, Shiga-kogen, August, 2006 (I). — A, B, Probably 2nd instar, July 29; C, D, probably 3rd instar, July 31; E, F, probably 4th instar, August 2; G, H, 5th instar, August 8; I, August 18, 2006. All photographed by Shinohara.

tures appear to determine whether mature larvae undergo prolonged diapause.

Beside the 32 reared specimens mentioned above, I have examined a total of 265 field-collected adult specimens of *A. rejecta* (National Museum of Nature and Science, 2025), which are from almost all known parts of its geographic range in Japan. They were collected from April to September. In the Imperial Palace gardens, Tokyo, 69 specimens were obtained in 1996–1999 and 2009–2012 using hand nets and Malaise traps (Shinohara, 2000, 2014, Table 2). The adults were collected in late April to early June (A), late June to July (B) and late August to September (C), with a peak in May and apparent gaps (no collection data) in mid-June and in August, suggesting possible occurrence of three generations (A, B, C) per year in Tokyo or in the lowlands of central Honshu. In the highlands of central Honshu, most of the specimens were col-

Table 2. Number of adults of *A. rejecta* collected in Imperial Palace, Tokyo, in 1996–1999 and 2009–2012 by hand nets and in Malaise traps (data taken from Shinohara, 2000, 2014). A, B, C: Period of adult occurrences.

	Label data	Male	Female	Total
	26 IV–4 V	4		4
	4–12 V	12	2	14
A	12–17 V	6	3	9
26 IV–8 VI	17–25 V	13	1	14
	24 V–2 VI	1	3	4
	1–8 VI	1		1
	20–30 VI	2		2
B	30 VI–5 VII	2	1	3
20 VI–27 VII	5–14 VII	2	1	3
	20–27 VII	2	3	5
C	31 VIII	1		1
31 VIII–21 IX	10–21 IX	5	4	9

lected in July and August (National Museum of Nature and Science, 2025). This suggests that this species has only one generation per year in cool regions.

Arge rejecta may be the third most common species of Argidae in urban areas of central Tokyo (Shinohara, 2000, 2005, 2014) after *Arge similis* (Vollenhoven, 1860) on *Rhododendron* (Ericaceae) and *A. nigronodosa* (Motschulsky, 1860) on *Rosa* (Rosaceae) (National Museum of Nature and Science, 2025, Shinohara, unpublished data). *Arge rejecta* ranks third simply because its host plants, brambles, are much less common in urban areas than azaleas and roses.

Larvae. Early instar (*probably 2nd and 3rd instars*) (Fig. 1A–D): Head pale brown with longitudinal line along coronal suture and area around ocularium black; trunk pale green, thoracic legs pale brownish with coxae black; head and trunk covered with long blackish hairs. *Middle instar* (*probably 4th instar*) (Fig. 1E, F): Similar to early instar, but head pale greenish brown, black longitudinal line narrower, black area on coxa smaller and black hairs covering body less conspicuous. *Late instar* (*probably 5th instar*) (Fig. 1G, H): Head pale olive green with narrow longitudinal line along coronal suture and area around ocularium black; trunk pale green, with paired longitudinal creamy white lines dorsally; head and trunk rather sparsely covered with blackish hairs. *Mature larva* (Fig. 1I): Similar to late instar, but entire body vivid pale green, blackish longitudinal line along coronal suture less distinct and paired whitish longitudinal lines on trunk inconspicuous.

The larvae of the genus *Arge* could roughly be classified into two groups based on their appearance and behavior: the solitary and cryptic species, and the gregarious and conspicuous species. However, the distinction is not clear-cut and there are various intermediate cases (Boevé *et al.*, 2018). The mostly greenish larva of *A. rejecta* is solitary and cryptic (Fig. 1). Without host plant information, it may be difficult to distinguish from similarly solitary and cryptic larvae of some other species, such as *A. longicornis* Kuznetzov-Ugamskij, 1927 on *Berberis*, *A. nipponensis* Rohwer, 1910 on *Rosa*, and *A. suzukii* (Matsumura, 1912) on *Abelia*. They contrast with the gregarious and conspicuous larvae of some other congeners, such as *A. pullata* (Zaddach, 1859) on *Betula*, *A. captiva* (Smith, 1874) on *Ulmus*, *A. meliosmae* Shinohara & Hara, 2011, on *Meliosma*, *A. jonasi* (Kirby, 1882) on *Sorbus*, etc.

Two species of *Arge* are known to be associated with *Rubus* in Japan: *A. rejecta* and *A. gracilicornis* (Klug, 1814). The larva of *A. rejecta* is distinguished from that of *A. gracilicornis* by the mostly brownish (early instar) or pale olive green (late instar) head, absence of black dots on the trunk in all instars, and absence of yellow marks on the trunk in the late instars. The larva of *A. rejecta* is solitary and cryptic as noted above, whereas that of *A. gracilicornis* is gregarious in earlier stages and the late instars are fairly conspicuous (Hara *et al.*, 2022). *Arge gracilicornis* is a boreal species in Japan, in Honshu occurring only in the highlands, whereas *A. rejecta* is more commonly found in the lowlands.

Host plants. Rosaceae: *Rubus crataegifolius* Bunge, *R. microphyllus* L.f., *R. parvifolius* L. (Okutani, 1967). *Rubus hirsutus* Thunb. (Murase, 2012). *Rubus subcrataegifolius* (H.Lév. et Vaniot) H.Lév. (new record).

I have seen the larvae of this species only on

Rubus hirsutus and *R. subcrataegifolius*. The latter is a new host plant record for *A. rejecta*.

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