Blasticotoma filiceti Klug, 1834 new to Belgium (Hymenoptera: Blasticotomidae)

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Abstract

Blasticotoma filiceti is reported here for the first time in Belgium. It was observed in Willerzie (province Namur) and Hamont-Achel (province Limburg). *B. filiceti* is an exceptional sawfly feeding on ferns with a striking foam production at the larval stage. We discuss the species' distribution outside Belgium, morphology, habitat, life cycle and ecology. Finally, we try to grasp the meaning of this finding from a larger perspective about the ecology and distribution of this sawfly species.

Keywords: *Blasticotoma filiceti*, Tenthredinoidea, sawfly, distribution, Belgium

Samenvatting

Blasticotoma filiceti wordt voor het eerst gemeld in België. De soort werd gezien in Willerzie (provincie Namen) en Hamont-Achel (provincie Limburg). *B. filiceti* is een bijzondere bladwespensoort op varens, met een opvallende schuimproductie in het larvale stadium. We bespreken verder de verspreiding buiten België, de morfologie, de habitat, de levenscyclus en de ecologie van de soort. Tot slot proberen we de betekenis van deze vondsten te duiden vanuit een breder perspectief omtrent de ecologie en de verspreiding van de soort.

Résumé

Blasticotoma filiceti est rapportée pour la première fois en Belgique. L'espèce a été vue à Willerzie (province de Namur) et Hamont-Achel (province de Limburg). *B. filiceti* est un symphyte lié aux fougères avec une production remarquable d'écume au stade larvaire. Nous traitons la dispersion, la morphologie, le territoire, le cycle de vie et l'écologie de l'espèce. Finalement nous essayons de définir l'importance de ces observations plus amplement au niveau de l'écologie et de la distribution géographique de cette espèce de symphyte.

Introduction

The family of the Blasticotomidae is believed to be one of the oldest living groups from the Tenthredinoidea, the dominant superfamily within the Symphyta. Analysing fossil data, it is said the family was separated from its sister-families in the Permian, as early as 280 Ma (RONQUIST *et al.*, 2012; SCHMIDT *et al.*, 2017). Worldwide only fourteen species in two different genera exist (TAEGER *et al.*, 2010). Furthermore, *B. filiceti* is the only known species from the Western Palaearctic. The other species mostly live in the eastern parts of Asia and Japan. All live in temperate regions and are related to ferns.

Material and methods

Blasticotoma filiceti, also called common fern-sawfly, is not that common. Although it can be locally abundant in certain years whereas impossible to find in others (SHCHERBAKOV, 2006), the overall density especially for adults seems to be rather low. Adults are caught with a sweeping net above the ferns and while the weather is rainy (LISTON, 2007), or under sunny conditions (KEY, 1998). The presence of the froth, produced by the larva, is also ambiguous. In certain areas, it is rarely observed (NOVGORODOVA & BIRYUKOVA, 2011a) and some authors hypothesize that the froth is completely consumed by ants (LISTON, 2007), while others demonstrated that ants were uninterested (NOVGORODOVA & BIRYUKOVA, 2011a). Therefore, it may be more probable that the foam bubble is destroyed or consumed by other invertebrates such as ladybirds, yellow jackets, or even parasitoids (VAN ACHTERBERG & ALTENHOFER, 2013). When there is no froth, the larva of *B. filiceti* can still be detected due to the mines and holes within the often blackened fern stems.

The adults are predominantly active in May and June. They are coloured mainly black with yellowish femora, tibiae and tarsi, and venter. Their wings are slightly infuscate with piceous stigma and venation (Fig. 1.). The total length is about 8 mm (BENSON, 1951). Moreover, as records in Europe show until now, all caught adults are females. This indeed strongly suggests parthenogenetic reproduction. At the end of June and the beginning of July, females start laying their eggs on ferns. Host plants reported with certainty in Europe are *Dryopteris filix-mas* (L.). Schott, 1834, *D. carthusiana* (Vill.) Fuchs, 1959, *Athyrium distentifolium* Tausch ex Opiz and *Matteuccia struthiopteris* (L.) Tod, but above all *Athyrium filix-femina* (L.) Roth is preferred (LISTON, 2007). The habitat and biotope seem to differ greatly, from coniferous forests in the eastern parts of Europe (NOVGORODOVA & BIRYUKOVA, 2011a) to wetlands and/or bog vegetation with peat, or even horticultural gardens (see below) in the more western parts of Europe (e.g. KEY, 1998).

Fig. 1. *B. filiceti* ♀, coll. Ad Mol; Boxtel, De Geelders (Netherlands), 14.V.2018 (© Tineke Cramer).

From the beginning of July, the larval development starts and is observable until the end of August. The larva has remarkable dorsal appendages at the posterior end. On the ventral side of the tenth segment a pair of cerci is present. The larva furthermore bear stigmata on the first seven abdominal segments and the first thoracic segment, which has three pairs of well-developed thoracic legs. Abdominal prolegs are missing. Finally, the head is coloured ginger and antennae have six segments. Additionally, it is yellow and horn-shaped (more details see also LORENZ & KRAUS, 1957).

When the larva is fully developed, it feeds mostly on plant saps, inside extending tunnels that are more or less equal to their own growing length. Two openings can be found within the rachis of the fern. They are made by the larva to breathe (anterior hole) and excrete (posterior hole). Moreover, the stem

often blackens and fern fronds in the vicinity dry out on the place where the holes are made, due to the interrupted sap circuit (see also Fig. 3). Three kinds of excreta are made by the larva: liquid, solid and frothy (Fig. 2). The foam or frothy part is quite exceptional. Much like the foam from *Philaenus spumarius* (Linnaeus, 1758) (Hemiptera, Aphrophoridae), spots are sometimes created on the ferns, occasionally reaching the size of a walnut. However, it is the liquid fraction that attracts ants (see below). Before reaching the soil to develop into the prepupal stage, the last larval instar very slowly leaves its tunnel, first appearing with the last segments of their abdomen (NOVGORODOVA & BIRYUKOVA, 2011a).

Distribution outside Belgium

While the species records are very low due to the behaviour and ecology of the wasp (cfr. infra), the historical situation is clearly described in literature for Germany, England/Wales and The Netherlands. The species was originally described in Germany by Klug, using specimens from Tegel (Berlin) in or before 1834. Nearly a century later (in 1931), one more sample was found near Ferch, Brandenburg. Finally, in 2007 a third report was made in East Brandenburg (LISTON, 2007). Concerning the United Kingdom, at least five records are known. The first one was recorded in the Royal Horticultural Society's ornamental gardens at Wisley in Surrey, in 1905. Thereafter, reports followed from Staffordshire (1953), Kew (1953) and Westmorland (1980). Lastly, one more record is known from Caernarfonshire in 1997 (KEY, 1998). In The Netherlands records are known from DE MEIJERE from 1911 to 1918 near Hilversum, Zeist and Overrijsel. In 1982 a female was caught near Leusden. Finally, from recent years reports are known from Boxtel (MOL, 2017).

Other countries where the presence of the species is confirmed are Switzerland (CHEVIN, 1993), Italy, Austria, Norway, Sweden, Finland, Denmark, Poland, Hungary, Ukraine and the western part of Russia (VAN ACHTERBERG & ALTENHOFER, 2013), and the Czech Republic (MACEK, 2010). In 1993, the species was confirmed as new to France, based on a specimen collected around 1945 near Isère (CHEVIN, 1993). In Ireland the first record was made in 2007 (BOWDREY, 2008). Still no records were made for Spain and more northern countries like Belgium and Luxembourg.

Results

Surrounded by countries where the species was known to live, it was clear the species could be expected in Belgium. In fact, this was already predicted and expected in 2002 (MOL, 2002).

On 23 July 2018 the second author of the article, Harm Alberts, noticed some foam on *A. filix-femina.* This was reported with pictures on the website www.waarnemingen.be as Hymenoptera indet. Luckily, the foam structure was quickly noticed and connected to the ecology of Blasticotomidae. Here, we confirm that this kind of foam can only come from *Blasticotoma filiceti.* The foam was found only 300 meters from the French border in Willerzie (Walloon Region), part of the Massif de la Croix-Scaille, located in Gedinne (GPS 49.954, 4.834; Lambert 1972 183391, 71464; Fig. 5). The surroundings were mainly woody with peat moors on some places. The ferns themselves were located next to a straightforward path which cuts through the woods.

On 12 August 2018, Ad Mol was able to locate the species in the Flemish Region near Hamont-Achel, 2.5 km from the Belgium–Netherlands border (GPS ca. 51.281, 5.501; Lambert 1972 ca. 228966, 219591; Fig. 5). This time no foam was reported. Around 20 mines were found on two different places, often with blackened stem and the typical two holes within it. The habitat resembled the one from Wallonia: the mines being found next to a long pathway cutting through a forest with shaded surroundings, although this time along a dike and stream (Fig. 4).

Fig. 2. Foam structure on *A. filix-femina*; Willerzie (Belgium), 23.VII.2018 (© Harm Alberts).

Fig. 3. Blackened rachis of *Athyrium filix-femina* with mines (and holes); Hamont-Achel, Warmbeek (Belgium), 12.VIII.2018 (© Tineke Cramer).

Fig. 4. Typical habitat where mines were found; Hamont-Achel, Warmbeek (Belgium), 12.VIII.2018 (© Tineke Cramer).

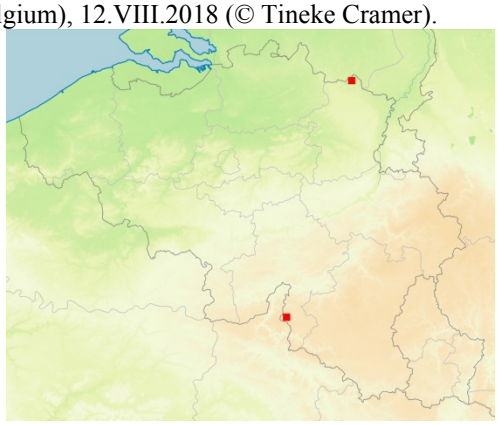

Fig. 5. Current recorded distribution of *B. filiceti* in Belgium.

Discussion

Two aspects have been proposed to determine the species' spreading: parasitism and the relation with ants. Parasitism on *Blasticotoma* has not yet been studied systematically. Presumably parasitoids can be found within the braconids, chalcids and ichneumonids. Their absence or presence, possibly irregular due to their specific life cycles, could certainly have an influence. At this moment known parasitic relations are only those with the braconid *Shawiana foveolator* (Thomson, 1892); SHCHERBAKOV, 2006 & LISTON, 2007 and the ichneumonids *Seleucus cuneiformis* Holmgren, 1860 and *Tetrastichus rasnitsyni* Kostjukov, 2001 (VAN ACHTERBERG & ALTENHOFER, 2013).

The relation with ants is quite extraordinary and was first examined and coined 'trophobiosis' by SHCHERBAKOV (2006). Trophobiosis can be defined as a mutualistic relation between different species, one receiving food, another protection. However, this kind of relation can be defined more specifically here. The liquid from the larva is used directly by the ants, therefore it can be considered as a direct (not plant-mediated) hymenopteran-hymenopteran relation, which is unique as far as we know. From 2006 to 2008 investigations were carried out in Siberia by Novgorodova & Biryukova. Their conclusions refine our knowledge, especially about behavioural aspects with this interrelation. For example, depending on the ant species, behaviour differs in relation to the larva. Generally speaking, the larva carefully tries to avoid any contact with the ants when leaving his tunnel. When there is contact, the ants on their part actively stroke the larva with their antennae, and even scrape off plant remains from the abdomen of the leaving larva, the opening on the rachis or the empty tunnels. Furthermore, within the investigated area, the number of ants collecting larval excreta correlated positively with the number of sawfly larva (NOVGORODOVA & BIRYUKOVA, 2011a, b).

More research is needed to assess the importance of this relation in other areas. At this moment it seems to go too far to recognise this relation as (completely) obligatory (cf. VAN ACHTERBERG &

ALTENHOFER, 2013, following MOL, 2017), for example as an explanation of the species' rarity. Future findings, possibly on the same citizen science portals, will also have to show if the species can be found further inwards of the country and if more information about the species ecology and behaviour can be derived.

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Bibliography

BENSON R. B., 1951. - *Hymenoptera 2. Symphyta - Section A. Handbooks for the identification of British insects. Vol. 6. Pt. 2 (a)*. Royal Entomological Society, London, 49 pp.

BOWDREY J., 2008. - *Blasticotoma filiceti* Klug, 1834 (Sym. Blasticotomidae): a sawfly new to Ireland. *The entomologist's record and journal of variation,* 120(3): 123-124.

CHEVIN H., 1993. - Note sur les Hyménoptères Tenthredoïdes (XIII). 27. – Tenthrèdes rares ou nouvelles pour la France. *Bulletin mensuel de la Société Linnéenne de Lyon,* 62(8): 297-304.

DE MEIJERE J.C.H., 1911. - Über in Farnen parasitierende Hymenopteren- und Dipteren- Larven. *Tijdschrift voor Entomologie,* 54: 80-127, pl. v-vii.

DE MEIJERE J.C.H., 1918. - [Mededeling over verschillende onderwerpen]. *Tijdschrift voor Entomologie*, 60: 36-39.

KEY R. S., 1998. - The sawfly *Blasticotoma filiceti* Klug, 1834 (Hym: Blasticotomidae) new to Wales – only the fifth British record. *The entomologist's record and journal of variation,* 110(1): 34-35.

LISTON A.D., 2007. - Zur Biologie und Vorkommen von *Blasticotoma filiceti* Klug, 1834 (Hymenoptera, Blasticotomidae) in Brandenburg und Berlin. *Entomologische Nachrichten und Berichte,* 51(2): 95-99.

LORENZ H. & KRAUS M., 1957. - *Die Larvalsystematik der Blattwespen (Tenthredinoidae und Megalodontoidea)*. Akademie Verlag, Berlin, 339 pp.

MACEK J., 2010. - Taxonomy, distribution and biology of selected European *Dinax*, *Strongylogaster* and *Taxonus* species (Hymenoptera: Symphyta). *Acta Entomologica Musei Nationalis Pragae,* 50(1): 253-271.

MOL A., 2002. - Overzicht van de families en genera van de Nederlandse bladwespen (Hymenoptera: Symphyta) I. *Nieuwsbrief sectie Hymenoptera,* 15: 9-26.

MOL A., 2017. - De bladwesp *Blasticotoma filiceti* en de relatie met mieren. *Forum Formicidarum,* 18(1): 5-13.

NOVGORODOVA T.A. & BIRYUKOVA O.B., 2011a. - Some ethological aspects of the trophobiotic interrelations between ants (Hymenoptera: Formicidae) and larvae of the sawfly *Blasticotoma filiceti* (Hymenoptera: Blasticotomidae). *European Journal of Entomology,* 108: 47-52.

NOVGORODOVA T.A. & BIRYUKOVA O.B., 2011b. - Behavior of Red Wood Ants (Hymenoptera, Formicidae) during Interaction with Different Symbiont Partners. *Entomological Review,* 91 (2): 231-240.

RONQUIST F., KLOPFSTEIN S., VILHELMSEN L., SCHULMEISTER S., MURRAY D.L. & RASNITSYN A.P., 2012. - A total-evidence approach to dating with fossils, applied to the early radiation of the Hymenoptera. *Systematic Biology,* 61(6): 973-999.

SCHMIDT S., TAEGER A., MORINIÈRE J. , LISTON A., BLANK S.M., KRAMP K., KRAUS M., SCHMIDT O., HEIBO E., PROUS M., NYMAN T., MALM T. & STAHLHUT J., 2017. - Identification of sawflies and horntails (Hymenoptera, 'Symphyta') through DNA barcodes: successes and caveats. *Molecular Ecology Resources,* 17: 670-685.

SHCHERBAKOV D.E., 2006. - Fern sawfly larvae *Blasticotoma filiceti* Klug, 1834 (Hymenoptera: Blasticotomidae) are visited by ants: a new kind of trophobiosis. *Russian Entomological Journal* ,15: 67-72.

TAEGER A., BLANK S.M., LISTON A., 2010. - World Catalog of Symphyta (Hymenoptera). *Zootaxa,* 2580: 1-1064.

VAN ACHTERBERG C. & ALTENHOFER E., 2013. - Notes on the biology of *Seleucus cuneiformis* Holmgren (Hymenoptera, Ichneumonidae, Ctenopelmatinae). *Journal of Hymenoptera Research*, 31: 97-104.