Biodiversity & Environment, 2022
Vol. 14, No. 2, 29–31

Short note

The usability of beer traps for detecting *Xenos vesparum* parasitizing *Polistes dominula*

JOZEF OBOŇA*, KATARÍNA FOGAŠOVÁ, LAURA MLYNÁROVÁ & PETER MANKO

Department of Ecology, Faculty of Humanities and Natural Sciences, University of Prešov, 17. novembra 1, 081 16 Prešov, Slovakia

Abstract
The Strepsiptera species *Xenos vesparum* Rossi, 1793, is an endoparasite of wasps (genus *Polistes*) characterized by a specific lifecycle and significant sexual dimorphism. A total of 12 host specimens (*Polistes dominula* (Christ, 1791)) were caught using a beer trap – site Diviacka Nová Ves, period 25 July 2022 – 5 August 2022. The prevalence of *X. vesparum* were 83%. Overall, 33 parasites were present in 10 wasps (min. 1, max. 10, average 3.3). The highest number of parasites (13 specimens) was observed below terga T3 and T4. It appears that the parasite *X. vesparum* most commonly infects *P. dominula* on the dorsal side of the body under terga T3 and T4. In addition, beer traps seem to be a suitable mean of detecting and calculating the prevalence of this parasite.

Keywords: Strepsiptera, prevalence, European paper wasp, endoparasite, trapping, Slovakia

Introduction

Strepsiptera are among the smallest groups (male body size 1–7 mm, female body size 2–30 mm) of holometabolous insects, with approximately 600 species described so far (e.g., Pohl & Beutel 2013). The species *Xenos vesparum* Rossi, 1793 (Insecta: Strepsiptera: Xenidae), is a noteworthy organism representing an endoparasite of the European paper wasp – *Polistes dominula* (Christ, 1791) (Insecta: Hymenoptera). The species displays a peculiar lifecycle and demonstrates extensive sexual dimorphism (e.g., Beani et al. 2005; Cappa et al. 2014; Richter et al. 2017). Both sexes develop in their host. Males pupate as adults, subsequently leave the host and actively seek females. In contrast, females are obligatory and permanent endoparasites (e.g., Beani & Massolo 2007; Beani et al. 2018). Beer traps represent a passive method commonly used to capture a wide range of insects (e.g., Manko et al. 2018; Ruchin et al. 2020a; Touroult & Witté 2020). The method has been proven to be suitable for trapping rare insects as well as for monitoring selected invasive species and pests (e.g., Dvořák et al. 2019, 2020, 2022; Dvořáková et al. 2020; Hribar 2020; Albacete et al. 2020; Lioy et al. 2020; Mariychuk et al. 2020; Ruchin et al. 2020ab; Maceda-Veiga et al. 2021; Manko et al. 2021). To date, this method is not known to have been used for the detection of *X. vesparum* in the population of *P. dominula.*

The present study aims to analyse the suitability of the beer trap method for capturing and evaluating the prevalence of *X. vesparum* endoparasites parasitizing *P. dominula*.

Material and methods

The study was carried out between 25 July and 5 August 2022 in the village of Diviacka Nová Ves (48.749672, 18.492035). A single beer trap (for more details, see Manko et al. (2018)) was hung on *Parthenocissus* (up to a height of approx. 2 meters above the ground). After exposure, the caught specimens were removed from the trap, washed under clean water, and fixed with 96% ethanol. In the laboratory, they were determined after Richter et al. (2017). The *P. dominula* specimens were separated and subsequently examined under a Motic SMZ-168 microscope. In each of the sampled wasps, the abdomen (this parasite does not infect other parts of the body) was thoroughly examined and the position/presence of the endoparasites was recorded.

Results and Discussion

A total of 12 specimens of *P. dominula* were caught using the beer trap, 10 of which, were positive for *X. vesparum*. In addition, 25 specimens of the German Wasp (*Vespula germanica* (Fabricius, 1793)) were caught in the beer trap, but these were completely free of parasites.

Figure 1. Positive sample of *P. dominula* infected by *X. vesparum.*

* Corresponding author: J. Oboňa. E-mail: jozef.obona@unipo.sk

The prevalence of *X. vesparum* was 83%. A total of 33 parasites were present in 10 wasps (min. 1, max. 10, average 3.3). The highest number of parasites (13 specimens) was observed below terga T3 and T4. For more details, see Table 1 and Figure 2.

Table 1. Overview of the presence of *X. vesparum* under the terga of *P. dominula.*

Specimen n.	Tergite 1	Tergite 2	Tergite 3	Tergite 4	Tergite 5	Tergite 6	total
1		1	3	2	2		8
2				2			2
3			2	1			3
4				1			1
5							0
6			6	2	2		10
7					1		1
8				1			1
9				2			2
10							0
11			2	1	1		4
12				1			1
Total	0	1	13	13	6	0	

Below tergite T3, 7 parasites occurred dorsally and 6 laterally, while under tergite T4, 11 parasites were present dorsally and only 2 laterally. Below tergite T5, 6 parasites were observed dorsally, and under tergite T2 a single parasite was found dorsally. The frequency of occurrence of the studied parasite in relation to individual tergites is depicted in Figure 2. It appears that the parasite *X. vesparum* infects *P. dominula* most commonly on the dorsal side under terga T3 and T4.

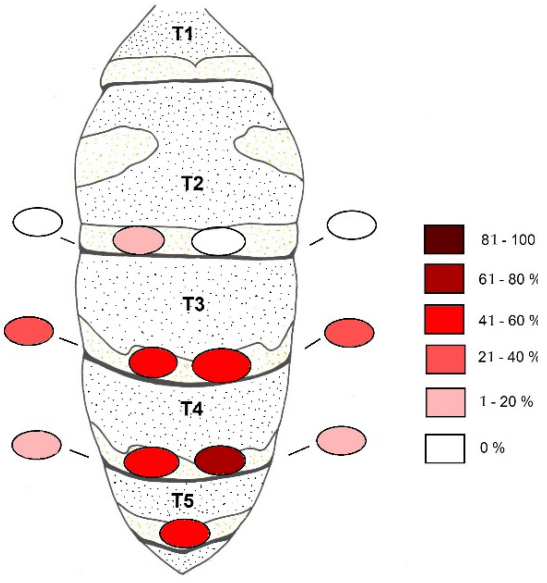

Figure 2. Scheme of infestation of *P. dominula* by *X. vesparum*. The colour scale indicates the position and frequency of occurrence in individual tergites (from 0 % to 100 %).

Note. Tergite 5 is relatively narrow, therefore only one point is used in the scheme to illustrate the occurrence of the parasite. In two cases there was one parasite, in two other cases two parasites closely packed together.

Findings similar to ours were reported by Reilly & McCarthy (1993), who investigated the attachment site selection in *Eylais* (Acari: Hydrachnellae) water mites, the larvae of which infect Corixidae (Hemiptera: Heteroptera). The species *Eylais* tended to attach to the abdominal terga of the hosts. While *E. infundibulifera* Koenike, 1897, infected the two anterior terga, *E. discreta* Koenike, 1897, infected terga three and four. Ramsey et al. (2019) investigated the location of *Varroa destructor* Anderson & Trueman, 2000, in honeybees. This work revealed that the parasite is not consuming haemolymph, as was previously accepted, but damages the host bees by consuming the fat body, a tissue roughly analogous to the mammalian liver.

Acknowledgements: We would especially like to thank the editor and the anonymous reviewers for their constructive comments and for improving the manuscript. This study was supported by the Slovak Scientific Grant Agency, contract No. VEGA-1/0012/20, and by the Slovak Research and Development Agency under contract No. APVV-20-0140.

References

Albacete S, Mac Nally R, Carles-Tolra M, Domenech M, Vives E, Espadaler X, Maceda-Veiga A. 2020. Stream distance and vegetation structure are among the major factors affecting various groups of arthropods in non-riparian chestnut forests. *Forest Ecology and Management* 460: 117860.

Beani L, Massolo A. 2007. *Polistes dominulus* wasps (Hymenoptera Vespidae), if parasitized by *Xenos vesparum* (Strepsiptera Stylopidae), wander among nests during the pre-emergence phase. *Redia* 90: 161–164.

Beani L, Cappa F, Manfredini F, Zaccaroni M. 2018. Preference of *Polistes dominula* wasps for trumpet creepers when infected by *Xenos vesparum*: A novel example of co-evolved traits between host and parasite. *PLOS One* 13(10): e0205201.

Beani L, Giusti F, Mercati D, Lupetti P, Paccagnini E, Turillazzi S, Dallai R. 2005. Mating of *Xenos vesparum* (Rossi) (Strepsiptera, Insecta) revisited. *Journal of Morphology* 265(3): 291–303.

Cappa F, Manfredini F, Dallai R, Gottardo M, Beani L. 2014. Parasitic castration by *Xenos vesparum* depends on host gender. *Parasitology* 141(8): 1080–1087.

Dvořák L, Dvořáková K, Oboňa J, Ruchin AB. 2020. Selected Diptera families caught with beer traps in the Republic of Mordovia (Russia). *Nature Conservation Research* 5(4): 65–77.

Dvořák L, Dvořáková K, Oboňa J, Ruchin AB. 2022. Some Diptera families from beer traps in the Volga region (Russia). *Caucasian Entomological Bulletin* 18(1): 130–138

Dvořák L, Haenni JP, Dvořáková K, Kameneva EP, Mariychuk R, Manko P, Oboňa J, Korneyev VA 2019. Some insects from beer traps in Westernmost Ukraine. *Ukrainska Entomofaunistyka* 10(2): 1–6.

Dvořáková D, Dvořák L, Kukaniia A, Oboňa J. 2020. Selected Diptera from beer traps in three biotopes at Klyucharky village near Mukachevo town (Western Ukraine). *Biodiversity & Environment* 12: 11–18.

Hribar LJ. 2020. Differential collections of *Drosophila* flies in traps baited with two different styles of beer. *Fly Times* 64: 39–40.

Lioy S, Laurino D, Capello M, Romano A, Manino A, Porporato M. 2020. Effectiveness and selectiveness of traps and baits for catching the invasive hornet *Vespa velutina*. *Insects* 11(10): 706.

Maceda-Veiga A, Albacete S, Carles-Tolrá M, Pujade-Villar J, Máca J, Mac Nally R. 2021. Streams and rural abandonment are related to the summer activity of the invasive pest *Drosophila suzukii* in protected European forests. *Forest Ecology and Management* 485: 118942.

Manko P, de Figueroa JMT, Oboňa J. 2021. Responses of the pest *Drosophila suzukii* population to environmental variables in southern Spain (Granada, Andalusia)–results of a pilot study. *Acta Musei Silesiae, Scientiae Naturales* 70: 65–74.

Manko P, Demková L, Kohútová M, Oboňa J. 2018. Efficiency of traps in collecting selected Diptera families according to the used bait: comparison of baits and mixtures in a field experiment. *European Journal of Ecology* 4(2): 92–99.

Mariychuk R, Kozeretska I, Serga S, Manko P, Oboňa J. 2020. Current state of invasion of *Drosophila suzukii* (Matsumura, 1931) in Ukraine. *European Journal of Ecology* 6(1): 51–57.

Pohl H, Beutel RG. 2013. The Strepsiptera-Odyssey: the history of the systematic placement of an enigmatic parasitic insect order. *Entomologia* 1: e4.

Ramsey SD, Ochoa R, Bauchan G, Gulbronson C, Mowery JD, Cohen A, Lim D, Joklik J, Cicero JM, Ellis JD, Hawthorne D. 2019. *Varroa destructor* feeds primarily on honey bee fat body tissue and not hemolymph. *Proceedings of the National Academy of Sciences* 116(5): 1792–1801.

Reilly P, McCarthy TK. 1993. Attachment site selection of *Hydrachna* and *Eylais* (Acari: hydrachnellae) watermite larvae infecting Corixidae (Hemiptera: heteroptera). *Journal of natural history* 27(3): 599–607.

Richter A, Wipfler B, Beutel RG, Pohl H. 2017. The female cephalothorax *of Xenos vesparum* Rossi, 1793 (Strepsiptera: Xenidae). *Arthropod Systematics and Phylogeny* 75(2): 327–347.

Ruchin AB, Carr JF, Dvořák L, Esin MN, Khapugin AA. 2020b. *Pseudotephritis millepunctata* (Hennig, 1939) (Diptera Ulidiidae) – new species in European fauna. *Redia* 103: 25–27.

Ruchin AB, Egorov LV, Khapugin AA, Vikhrev NE, Esin MN. 2020a. The use of simple crown traps for the insects collection. *Nature Conservation Research* 5(1): 87–108.

Touroult J, Witté I. 2020. Beer, wine, or fruit juice: Which is best? A case study of bait efficiency to sample saproxylic beetles (Coleoptera) in an oak woodland. *The Coleopterists Bulletin* 74(4): 763–771.