

## A new predator on pine processionary moth larvae in Bulgaria

GERGANA ZAEMDZHIKOVA<sup>1</sup>, DANAIL DOYCHEV<sup>2</sup>

<sup>1</sup>Forest Research Institute, Bulgarian Academy of Sciences, 132 St. Kliment Ohridski Blvd., 1756 Sofia, Bulgaria; E-mail: zaem.bg@abv.bg

<sup>2</sup>University of Forestry, 10 St. Kliment Ohridski Blvd., 1797 Sofia, Bulgaria; E-mail: ddoychev@abv.bg

**Abstract.** *Oecanthus pellucens* (Scopoli, 1763) (Gryllidae) is recorded for the first time as a predator on the larvae of *Thaumetopoea pityocampa* (Denis & Schiffermüller, 1775) (PPM) in Bulgaria. The Italian tree crickets were observed in black pine plantations (*Pinus nigra* Arn.), in the region of Fotinovo vill. (Eastern Rhodope Mts.), occupied by the PPM summer population.

**Key words:** new record, predator, pine processionary moth.

### Introduction

*Oecanthus pellucens* is common and widely distributed all over the Palearctic region, especially in the countries around the Mediterranean with a focus on Southern Europe (Labadessa & Todisco 2016, Sutton et al. 2017). In Bulgaria it is distributed in the Western and Eastern Rhodopes (Asenovgrad, Zlatograd, Kardjali, Madjarovo) (Popov & Chobanov 2004, Chobanov 2012). *O. pellucens* is thermophilic species. It prefers trees and tall shrubs is mostly confined above 300 m a.s.l. (Cordero et al. 2009). The adults can be encountered from July-October. These crickets are omnivorous and usually feed on leaves or delicate flower parts, but also on animals such as aphids, spiders and insect larvae (Bastiaan & Jackman 1998).

PPM is considered to be the most important pest in the pine ecosystem, also in Bulgaria. Along with conventional control methods regulating PPM attacks, the role of natural enemies, such as parasitoids, pathogens and predators is also considered important (Way et al. 1999, Mirchev 2005, Mirchev et al. 2019a). In Bulgaria, the role of predatory insects on PPM eggs has been studied by Mirchev & Tsankov (2005) and Mirchev et al. (2019a). Only two bushcrickets have been found in the country – *Ephippiger ephippiger* (Fiebig 1784) and *Pterolepis* (= *Rhacocleuis*) *germanica* (Herrich-Schäffer, 1840) (Orthoptera: Tettigoniidae), which destroyed PPM egg-batches.

The Rhodope Mts. have long been a known area of distribution of PPM (Tsankov 1960), where both summer and winter populations coexist (Mirchev et al. 2019b).

## Material and Methods

The identification of *O. pellucens* was done using publication of Cordero *et al.* (2009). In order to determine the extent of damage by predators at the sampling site, in laboratory conditions, the scales of the egg-batches (57 in number) were removed and the eggs were analysed under a stereomicroscope (x40).

## Results and discussion

Two female specimens of *O. pellucens* were observed in plantation of *Pinus nigra* Arn., feeding on first instar larvae of PPM in the region of Fotinovo vill. (N41°53'54.65", E24°20'52.72", 08.08.2020, 454 m a.s.l.).

In our research, all collected PPM egg-batches were checked for cricket gnawing damage. No damage from these predators was found. This is a preliminary result, from which it may be concluded that this cricket prefers to feed on PPM larvae. This is the first scientific report in which *O. pellucens* is reported as a natural enemy of PPM larvae. Until now, only in Portugal, the cricket has been reported as a predator on the eggs of PPM (Ferreira 1998). Known insect predators of the PPM (on eggs, larvae or adults) are: *Formica fusca* (Linnaeus, 1758), *Formica rufa* Linnaeus, 1761, *Crematogaster scutellaris* (Olivier, 1792), *Lasius emarginatus* (Olivier, 1792), *Lasius niger* (Linnaeus, 1758), *Tapinoma nigerrimum* (Nylander, 1856), *Linepithema humile* (Mayr, 1868) (Hymenoptera: Formicidae) (Way *et al.* 1999, Pimentel 2004, Zamoum *et al.* 2017); *Calosoma sycophanta* Linnaeus, 1758 (Kanat & Mol 2008), *Carabus graecus* Dejean, 1826 (Coleoptera, Carabidae) (Schmidt *et al.* 1990); *Dermestes lardarius* Linnaeus, 1758 (Coleoptera, Dermestidae) (Tsankov 1960); *Ephippiger ephippiger*, *Pterolepis germanica*, *Steropleurus andalusius* (Rambur, 1838), *Thyreonotus corsicus* Rambur, 1839, *Tettigonia viridissima* Linnaeus (1758) (Operophtera: Tettigoniidae) (Demolin & Delmos 1967, López-Sebastián *et al.* 2004, Mirchev & Tsankov 2005, Hódar *et al.* 2013, Zamoum *et al.* 2017); *Xanthandrus comtus* (Diptera, Syrphidae) (Branco *et al.* 2008); *Sphodromantis viridis* Forskal (1775) (Mantodea, Mantidae), *Coccinella septempunctata* Linnaeus (1758) (Coleoptera, Coccinellidae), *Vespa germanica* Fabricius (1793) (Hymenoptera, Vespidae) (Zamoum *et al.* 2017); *Forficula auricularia* Linnaeus, 1758 (Dermaptera: Forficulidae) (Kailidis 1962).

In recent decades, the expansion of the range to the north of *O. pellucens* and PPM has been observed in central European countries, with global warming being the likely cause (Battisti *et al.* 2005, Robinet 2015, Sutton *et al.* 2017). The expansion of the PPM in Central Bulgaria is also recorded (Zaemdzhikova *et al.* 2018). This case can be considered as an example of synchronization in the extension of the host and predator range, in which the natural symbiotic relationship between them is preserved. An important circumstance is that our observations were made in an area inhabited by the summer population of PPM. As the vital activity of the Italian tree cricket ends in October, this species will be an effective regulator of the summer populations of PPM. Assuming that summer populations are rare, this may explain why the behavior we observed has not been reported in the available literature.

**Acknowledgements.** This study was supported by the project 'Expansion of pine processionary moth (*Thaumetopoea pityocampa* (Denis et Schiffermuller, 1775) (Lepidoptera: Thaumetopoeidae) in Bulgaria – a dangerous allergen and economically important pest in the pine ecosystems' funded by the National Scientific Fund (DN01/17, 22.12.2016).

**References**

- Bastiaan, D & Jackman, J. (1998) *"Tree cricket". A Field Guide to Common Texas Insects*. Lanham, MD: Gulf Publishing. ISBN 0-87719-263-4.
- Battisti, A., Stastny, M., Netherer, S., Robinet, C., Schopf, A., Roques, A. & Larsson, S. (2005) Expansion of geographic range in the pine processionary moth caused by increased winter temperatures. *Ecological applications*, 15 (6): 2084–2096.
- Branco, M., Santos, M., Calvão, T., Telfer, G. & Pavia, M. (2008) Arthropod diversity sheltered in *Thaumetopoea pityocampa* (Lepidoptera: Notodontidae) larval nests. *Insect Conservation and Diversity*, 1: 215–221.
- Chobanov, D.P. (2012) Dermaptera, Blattodea, Mantodea and Orthoptera of the Western Rhodopes (Bulgaria and Greece). – In: Beron, P. (Eds.). *Biodiversity of Bulgaria 4. Biodiversity of Western Rhodopes (Bulgaria and Greece) II*. Pensoft & National Museum of Natural History, Sofia, Sofia: 163-211.
- Cordero, P.J., Llorente, V., Cordero, P. & Ortego, J. (2009) Recognizing taxonomic units in the field – The case of the crickets *Oecanthus dulcisonans* Gorochoy 1993, and *O. pellucens* (Scopoli, 1763) (Orthoptera: Gryllidae): implications for their distribution and conservation in Southern Europe. *Zootaxa* 2284: 63-68.
- Demolin, G. & Delmos, J. C. (1967) Les Ephippigeres (Orthopteres, Tettigonidae) predateurs occasionnels, mails importants de, *Thaumetopoea pityocampa* Schiff. *Entomophaga*, 12 (4): 399-401.
- Ferreira, M. C. (1998) *Manual dos Insectos Nocivos às Plantações Florestais*. Plátano Edições Técnicas, Lisboa, 381 pp.
- Hódar, J., Torres-Muros, L. & Senhadji, K. (2013) Timing and intensity of bush cricket predation on egg batches of pine processionary moth: no evidence of population control. *Agricultural and Forest Entomology*, 15: 204–211.
- Kailidis, D. S. (1962) Bemerkungen über *Thaumetopoea pityocampa* Schiff. Und seine Feinde in Griechenland. *Zeitschrift für Angewandte Entomologie*, 51: 182-187.
- Kanat, M. & Mol, T. (2008) The Effect of *Calosoma sycophanta* L. (Coleoptera: Carabidae) feeding on the pine processionary moth, *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Thaumetopoeidae), in the Laboratory. *Turkish Journal of Zoology*, 32: 367-372.
- Labadessa, R. & Todisco S. (2016) Patterns of ecology and distribution of the tree crickets *Oecanthus dulcisonans* and *O. pellucens* (Orthoptera: Gryllidae; Oecanthinae) in southern Italy. *Zootaxa*, 4169 (3): 579–586.
- López-Sebastián, E., Garcia, M. & Selfa, J. (2004) *Thyreonotus corsicus corsicus* y *Steropleurus andalusius* (Orthoptera, Tettigoniidae) como depredadores de *Thaumetopoea pityocampa* (Lepidoptera, Notodontidae) en el noroeste de Valencia (España). *Anales de Biología*, 26: 29-34. (In Spanish, English summary).
- Mirchev, P. (2005) *Egg parasitoids on pine processionary moth Thaumetopoea pityocampa (Den. & Schiff.)* (Lepidoptera: Thaumetopoeidae) in countries of Balkan Peninsula. Thesis of DSci., 64 p. (In Bulgarian, English summary)
- Mirchev, P. & Tsankov, G. (2005) Checklist of the parasitoids and predators of *Thaumetopoea* spp. (Lepidoptera: Notodontidae). *Acta Entomologica Bulgarica*, 11: 82-96.
- Mirchev, P., Matova, M., Zaemdzhikova, G., Geotgiev, G. Georgieva, G. (2019a) Predators destroying the eggs of pine processionary moth. In: *Proceeding Papers "150 Years of Bulgarian Academy of Sciences"*, Professor Marin Drinov Academic Publishing House, Sofia, 7-16.
- Mirchev, P., Georgieva, M., Zaemdzhikova, G., Matova, M., Hlebarska, S., Filipova, E., Geotgiev, G. (2019b) Phenological form diversity of *Thaumetopoea pityocampa* in Bulgaria. *Poplar*, 203: 65-69.

- Pimentel, C. (2004) *Pine processionary moth (Thaumetopoea pityocampa) and great tit (Parus major) in Portugal: population dynamics and interactions*. Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, Faculdade de Ciências e Tecnologia, 152 pp.
- Popov, A. & Chobanov, D. (2004). Dermaptera, Mantodea, Blattodea, Isoptera and Orthoptera of the Eastern Rhodopes (Bulgaria and Greece). – In: Beron, P. & Popov, A. (Eds.). *Biodiversity of Bulgaria 2. Biodiversity of Eastern Rhodopes (Bulgaria and Greece)*. Pensoft & National Museum of Natural History, Sofia, 241-309.
- Robinet, C., Laparie, M. & Rousselet, J. (2015) Looking beyond the large scale effects of global change: local phenologies can result in critical heterogeneity in the Pine Processionary Moth. *Frontiers in Physiology*, 6: 334.
- Schmidt, G. H., Breuer, M., Devkota, B. & Bellin, S. (1990) Life cycle and natural enemies of *Thaumetopoea pityocampa* (Den. & Schiff.) in Greece. *Proceedings of the Thaumetopoea-Symposium*, 5-7 July 1989, 36-40.
- Sutton, P., Beckmann, B. & Nelson, B. (2017) The current status of orthopteroid insects in Britain and Ireland. *Atropos*, 59: 6-35.
- Tsankov, G. (1960) Untersuchungen über einige Merkmale aus der Biologie und Oekologie Kiefernprozessionsspinner (*Thaumetopoea pityocampa* Schiff.) bei uns in Verbindung mit den Methoden zu seiner Bekämpfung. *Ministerium für Land und Forstwirtschaft, Forschungsinstitut für Forst und Forstwirtschaft, Wissenschaftliche Arbeiten*, Bd. VIII: 231–262.
- Way, M.J., Paiva, M.R. & Cammell, M.E. (1999) Natural biological control of the pine processionary moth *Thaumetopoea pityocampa* (Den. & Schiff.) by the Argentine ant *Linepithema humile* (Mayr) in Portugal. *Agricultural and Forest Entomology*, 1 (1): 27-31.
- Zaemdzhikova, G., Markoff, I., Mirchev, P., Georgiev, G., Georgieva, M., Nachev, R., Zaiakova, M. & Dobрева, M. (2018) Zone and rate of pine processionary moth (*Thaumetopoea pityocampa*) expansion in Bulgaria. *Silva Balcanica*, 19(3):13-20.
- Zamoum, M., Bouragba-Brague, N., Noureddine, R., Khemici, M., Gachi, M., Battisti, A., Martin, Jean Claude & Briki, A. (2017) Structure of the natural enemies' community composition to *Thaumetopoea pityocampa* and *Thaumetopoea bonjeani* (Lepidoptera Thaumetopoeidae) in the Algerian cedar forests. *Journal and entomology and ecology studies*, 5(4): 1536-1542.