

**First record of the parasitoid wasp  
*Tachinaephagus zealandicus* Ashmead, 1904  
(Hymenoptera: Chalcidoidea: Encyrtidae) in Germany**

**Ralph S. Peters**

*Zoologisches Forschungsmuseum A. Koenig, Adenauerallee 160, 53113 Bonn, Germany; E-mail: R.Peters@zfmk.de.*

**Abstract.** The first record of the parasitoid wasp *Tachinaephagus zealandicus* from Germany is presented. A total of twelve specimens were reared from a puparium of *Lucilia* sp. (Diptera: Calliphoridae), collected from compost in Ingelheim am Rhein (Rhineland-Palatinate). While probably originating from Australia, the species is now cosmopolitan with numerous records from all continents. Its hosts are mainly synanthropic flies, and it has been repeatedly used as biological control agent. Given its synanthropy and its uniqueness as one of very few encyrtid species that parasitize fly puparia, it is unlikely that it has been overlooked in the past. It is, however, unknown where it comes from and why it appears now for the first time. This perplexity demonstrates the need for more thorough studies on parasitoid wasps and other notoriously understudied taxa. Currently, monitoring appearance of invasive species and other potentially influencing faunal changes still relies mostly on chance findings. A combination of large DNA barcoding and collecting initiatives such as GBOL and digital accessibility of zoological collection data could help improving this problematic situation in the future.

**Keywords.** Parasitoids, Germany, faunistics.

## INTRODUCTION

*Tachinaephagus zealandicus* (Hymenoptera: Chalcidoidea: Encyrtidae) was first described from Australia (Ashmead 1904) and probably originates from the Southern Hemisphere (Olten 1971), but has been distributed by man over many parts of the world. Distribution records include New Zealand, Argentina, Brazil, Georgia, South Africa, Java, Caribbean Islands, Israel, Mauritius, New Caledonia, and USA (see Noyes 2012 and references therein). It is a larval-pupal parasitoid of cyclorrhaphous Diptera, including many synanthropic species such as *Musca domestica* (house fly), *Stomoxys calcitrans* (stable fly), *Fannia canicularis* (lesser house fly), and *Lucilia sericata* (common green bottle fly), and distribution by man is certainly associated with these likewise cosmopolitan hosts. Furthermore, it has repeatedly been evaluated and used as a biological control agent against its fly hosts (e.g., Olton & Legner 1974; Ferreira de Almeida et al. 2002; Geden & Moon 2009). In Europe, it was recorded only from France (Corse), UK (Wales) (Japoshvili & Noyes 2006), and Italy (Turchetti et al. 2003) with very few individuals. Additionally, there is a recent record from Belgium (Frederickx et al. 2012). Here, I report the first record of *T. zealandicus* from Germany and discuss, based on the available information on the biology and distribution of this species, why this record is puzzling, and how and why we should improve our knowledge on parasitoid wasps and other understudied taxa in the future.

## METHODS

One larva of *Lucilia* sp. was collected from a compost in Ingelheim am Rhein, Rhineland-Palatinate (49°58'11.63"N, 8°3'20.19"E) in September 2012 by K. and K. Mody, and kept in a vial for pupation. Parasitoid specimens that had emerged from the puparium were sent to me for identification, dead and in dried condition. Specimens were softened, card mounted, and identified. The parasitoids and the host are deposited at the Zoologisches Forschungsmuseum Alexander Koenig (ZFMK).

## RESULTS AND DISCUSSION

Twelve parasitoid specimens (eight females, four males) that had emerged from the puparium of *Lucilia* sp. (Diptera: Calliphoridae) were identified as *Tachinaephagus zealandicus* Ashmead, 1904 (Fig. 1) (for key to species and taxonomic revision of the genus see Subba Rao 1978). Consulting the checklists of Chalcidoidea for Germany (Chalcis-D, <http://www.zsm.mwn.de/hym/chal/>; Noyes 2012) revealed that it had not been listed so far. This first record from Germany raises the question whether (A) it is new to Germany or (B) it has been overlooked so far. Both options would require somewhat unlikely scenarios. If it was new, it would be hard to comprehend where it comes from and why it appears now, when it has already been reported over the last more than 100 years from such



**Fig. 1.** Female of *Tachinaephagus zealandicus* Ashmead, 1904; taken from the first recorded series of this species from Germany.

diverse and partly remote places such as New Caledonia, Canary Islands, Mauritius, South Africa, USA, etc. (Noyes 2012). If it had been overlooked, it would be hard to comprehend why almost 2,000 chalcidoid species are listed from Germany (Noyes 2012), and this one that uses the most common flies and can now be found at a garden compost, was not among them. However, in comparison to other cosmopolitan parasitoid species that parasitize man-associated hosts, *T. zealandicus* is rather exceptional. These other species have been collected and reported much more often. Exemplarily, I compared the distribution and host records of four parasitoids (*Pachycrepoideus vindemmiae*, *Nasonia vitripennis*, *Muscidifurax raptor* and *Spalangia cameroni* (all: Chalcidoidea: Pteromalidae)) with those of *T. zealandicus*, using the database of Noyes (2012): 159 distribution records and 244 host records are listed for *Pachycrepoideus vindemmiae*; 150 distribution and 355 host records are listed for *Nasonia vitripennis*. 130 distribution and 173 host records are listed for *Muscidifurax raptor*. Finally, 153 distribution and 162 host records are listed for *Spalangia cameroni*. In contrast, only 78 distribution and 100 host records are listed for *T. zealandicus*, i.e., approximately half as many records as for the others. This is rather surprising, because *T.*

*zealandicus* is a conspicuous species, as one of very few encyrtids living on flies, it is not distinctly smaller than the other species, and its host list is a “who is who” of man-, cattle-, and poultry-associated flies. Looking at the records more closely reveals some more surprising results: The first specimens from Europe (UK, Wales) were collected in 1921 (Japoshvili & Noyes 2006). The next record from Europe is dated 1990 (first and only record from France, Corse; Japoshvili & Noyes 2006), and there has been only one additional record from Europe (Italy 2003 (Turchetti et al. 2003)) until very recently the species was recorded from Belgium (Frederickx et al. 2012). Belgium is close to Germany and these two records can possibly be seen as one. This record from Belgium gives further evidence that the record reported here is not a singular event but most probably represents establishment of the species in Germany and central Europe. Still, it is puzzling why this species that lives on various common flies and had apparently been introduced to Europe 90 years ago should need decades to establish. However, since we do not know its ecological demands and its distribution in detail, any attempted explanation would be pure speculation.

The second option to explain this first record is that *T. zealandicus* has been overlooked so far. Parasitoid wasps

usually do not get much attention, are notoriously understudied, and they are easily overlooked, but in case of *T. zealandicus*, it is unlikely that it has been present in Germany for a considerable time without being recorded. As pointed out above, species that use synanthropic flies are comparatively well studied and regularly collected, even the somewhat enigmatic species *T. zealandicus*. Over the last 100+ years, 1,900 species of Chalcidoidea have been recorded for Germany (Chalcis-D: 1,889 species; Noyes 2012: 1,956 species), and it is very likely that *T. zealandicus* would have been among them, if present in Germany. For example, several forensic entomology studies and monitoring studies of parasitoids in cattle flies and birds nests were carried out in Germany and neighboring countries (Germany: Klunker 1994; Amendt et al. 2000; Peters & Abraham 2010; Denmark: Skovgard & Jespersen 1999; Austria: Grassberger & Frank 2004). None of them recorded *T. zealandicus*. Additionally, a query for unpublished specimens from Germany in entomological collections (Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt; Senckenberg Deutsches Entomologisches Institut; Museum für Naturkunde Berlin; Zoologische Staatssammlung München; Staatliches Museum für Naturkunde Stuttgart; Zoologisches Museum Hamburg (all Germany); Naturhistorisches Museum Bern (Switzerland)) resulted in no hits. Accordingly, the more likely option to explain this first record is that it is in fact new to Germany.

So, *T. zealandicus* might be one of the latest invasive species in Germany. The species could have a strong impact on Diptera-centered food webs, and potentially represents a newly accessible potent biological control agent (e.g., Geden & Moon 2009) and forensically important species (Voss et al. 2010). The record of this important species, however, was caused only by chance. What is clearly needed for targeted monitoring of invasive species and other faunal changes are more intensive collectings of parasitoid species and other understudied taxa, and easier means to identify them. Furthermore, we need digital accessibility to the comprehensive scientific collection data. In this single case of a single species in a single country, it was possible to ask the curators at the German scientific collections for help, but for thorough monitoring of insect species in Germany and other countries this approach is clearly inappropriate.

Projects such as GBOL ([www.bolgermany.de](http://www.bolgermany.de)) will be very valuable to achieve the aim of more collecting and easier identification, but are hampered by the lack of parasitoid specialists and the enormous parasitoid diversity. Nevertheless, barcoding and metagenomics projects will potentially provide new identification tools (via barcode databases or identification keys), trigger taxonomic and faunistic research, and help generating new distribution maps, checklists, and biological data for more parasitoid species than ever before.

In summary, the occurrence of *Tachinaephagus zealandicus* is a prime example of the still existing enigmas in the German fauna that are currently still unraveled only by chance. We will have to find ways to substitute chance for strategy to cope with issues such as faunal changes and their impacts, and to expand our knowledge on the biodiversity that is present right on our door step.

**Acknowledgement.** Thanks to Karsten and Konstantin Mody for collecting the parasitized larva and rearing the parasitoids, and for providing collecting details, and to Thomas Schmitt for forwarding the parasitoid specimens to me. Thanks also to Julia Schwarzer for helpful comments on an earlier version of this manuscript.

## REFERENCES

- Amendt J, Krettek R, Mess C, Zehner R, Bratzke H (2000) Forensic entomology in Germany. *Forensic Science International* 113: 309–314
- Ashmead WH (1904) Classification of the chalcid flies of the superfamily Chalcidoidea, with descriptions of new species in the Carnegie Museum, collected in South America by Herbert H. Smith. *Memoirs of the Carnegie Museum* 1: 225–533
- Ferreira de Almeida MA, Pires do Prado A, Geden CJ (2002) Influence of Temperature on Development Time and Longevity of *Tachinaephagus zealandicus* (Hymenoptera: Encyrtidae), and Effects of Nutrition and Emergence Order on Longevity. *Environmental Entomology* 31: 375–380
- Frederickx C, Dekeirsschieterb J, Verheggenc FJ, Haubruged E (2012) The community of Hymenoptera parasitizing necrophagous Diptera in an urban biotope. *Journal of Insect Science* 13: 1–14
- Geden CJ, Moon RD (2009) Host ranges of gregarious muscoid fly parasitoids: *Muscidifurax raptorellus* (Hymenoptera: Pteromalidae), *Tachinaephagus zealandicus* (Hymenoptera: Encyrtidae), and *Trichopria nigra* (Hymenoptera: Diapriidae). *Environmental Entomology* 38: 700–707
- Grassberger M, Frank C (2004) Initial study of arthropod succession on pig carrion in a central European urban habitat. *Journal of Medical Entomology* 41: 511–523
- Japoshvili GO, Noyes JS (2006) New data on the European fauna of encyrtid wasps (Hymenoptera, Chalcidoidea, Encyrtidae). *Entomologicheskoe Obozrenie* 85: 218–225
- Noyes JS (2012) Universal Chalcidoidea Database. World Wide Web electronic publication. <http://www.nhm.ac.uk/chalcidoids>
- Klunker R (1994) [The occurrence of puparium parasitoids as natural enemies of house flies]. *Applied Parasitology* 35: 36–50

- Olton GS (1971) Bioecological studies of *Tachinaephagus zealandicus* Ashmead (Hymenoptera, Encyrtidae), parasitoid of synanthropic Diptera. PhD dissertation, University of California, Riverside, CA
- Olton GS, Legner EF (1974) Biology of *Tachinaephagus zealandicus* (Hymenoptera: Encyrtidae), parasitoid of synanthropic Diptera. Canadian Entomologist 106: 785–800
- Peters RS, Abraham R (2010) The food web of parasitoid wasps and their non-phytophagous fly hosts in birds' nests (Hymenoptera: Chalcidoidea, and Diptera: Cyclorhapha). Journal of Natural History 44: 613–626
- Skovgård H, Jespersen JB (1999) Activity and relative abundance of hymenopterous parasitoids that attack puparia of *Musca domestica* and *Stomoxys calcitrans* (Diptera: Muscidae) on confined pig and cattle farms in Denmark. Bulletin of Entomological Research 89: 263–269
- Subba Rao BR (1978) A revision of *Tachinaephagus* Ashmead (Hymenoptera: Encyrtidae) with descriptions of four new species. Bulletin of Entomological Research 68: 65–73
- Turchetto M, Villemant-Aït Lemkaden C, Vanin S (2003) Two fly parasitoids collected during an entomo-forensic investigation: the widespread *Nasonia vitripennis* (Hymenoptera Pteromalidae) and the newly recorded *Tachinaephagus zealandicus* (Hymenoptera Encyrtidae). Bollettino della Società Entomologica Italiana 135: 112–113
- Voss SC, Spafford H, Dadour IR (2010) Temperature-dependent development of the parasitoid *Tachinaephagus zealandicus* on five forensically important carrion fly species. Medical and Veterinary Entomology 24: 189–198