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# *Trichogramma danubiense* sp. n. (Hymenoptera: Trichogrammatidae), an egg parasitoid of *Macrothylacia rubi* (Lepidoptera: Lasiocampidae), with some data on its bionomics

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**Trichogrammatidae, new species, egg parasitoid, male genitalia, fecundity, longevity, *Mamestra brassicae*, *Ephestia kuehniella*, *Prunus cerasus*, Slovakia**

**Abstract.** *Trichogramma danubiense* sp.n., an ooparasitoid of eggs of *Macrothylacia rubi* is described, collected from *Prunus cerasus* in SW Slovakia. In the laboratory, the species could reproduce in eggs of *Mamestra brassicae* and *Ephestia kuehniella*. It can be distinguished from the related *T. lingulatum* Pang & Chen by an incision on the apex of the dorsal expansion of the gonobase. *T. danubiense* is arrhenotokous in laboratory conditions (22°C, 55% RH, 16 L : 8 D). The females obtained from eggs of *M. rubi* lived 2–14 days, their average fecundity was 262 (maximum 323) progeny and the percentage of males in progeny was between 13.4–42.6%, when eggs of the factitious host *M. brassicae* were used. The species had 8–9 generations per year in outdoor conditions of SW Slovakia, when reared in eggs of *M. brassicae*.

## INTRODUCTION

Species of the genus *Trichogramma* Westwood (Hymenoptera: Trichogrammatidae) are widespread minute parasitic wasps which attack eggs of various insects. Eggs of Lepidoptera are parasitised by 96.6% of the *Trichogramma* species. 46% of the *Trichogramma* species attacking Lepidoptera are parasitoids of species of the superfamily Noctuoidea, while only 5% parasitise Lasiocampidae (Sorokina, 1993).

In the course of taking an inventory of the *Trichogramma* species in orchards of Slovakia in 1988, eggs of *Macrothylacia rubi* (L.) (Lepidoptera: Lasiocampidae) were collected from sour cherry (*Prunus cerasus*, Rosaceae) twigs. From these eggs both sexes of a species of *Trichogramma* emerged and within a week a species of *Telenomus* (Hymenoptera: Scelionidae) followed. Many morphological characteristics of this *Trichogramma* species were found to be very similar to those of *Trichogramma lingulatum* Pang & Chen, 1974 from China. However, following a detailed investigation of Slovak specimens, it was discovered that they differ from the latter, mainly by an incision on the apex of the dorsal expansion of gonobase, and we describe those specimens below as a new species. Comparison was made with the descriptions of *T. lingulatum* by Pang & Chen (1974) and by Sorokina (1993) as the holotype of *T. lingulatum* was unavailable for examination.

*T. danubiense* sp. n. could be reared easily from eggs of the factitious hosts *Mamestra brassicae* (L.) (Lepidoptera: Noctuidae) and *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae). This provided data about longevity, type of reproduction, fecundity and the percentage of males in the progeny of the new species.

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## MATERIAL AND METHODS

Original material of the new species was obtained from parasitised eggs of *Macrothylacia rubi* (Lepidoptera: Lasiocampidae), collected on June 13, 1988 from a *Prunus cerasus* twig in a mixed orchard at Dunajská Lužná (17°15′E, 48°06′N, altitude 128 m) near Bratislava (Danubian plain, SW Slovakia). Emergence of wasps began in the laboratory (22 ± 2°C, 55 ± 5% RH, 16L : 8D, without artificial lighting) on June 26, 1988.

Morphological studies

*Trichogramma* specimens used for investigation under light (LM) and scanning electron microscope (SEM) were obtained from parasitised eggs of a laboratory strain of *M. brassicae*. These eggs were exposed to *Trichogramma* females obtained directly from *M. rubi* eggs. Rearing of the factitious host and its parasitisation were performed in the laboratory under conditions as mentioned above.

Freshly-emerged wasps were killed in 80% alcohol and treated with lactic acid. Either entire bodies or dissected male genitalia only were mounted in Swan's liquid and studied under LM. For SEM the wasps were freeze-dried and coated with gold.

Study of biological characteristics

*Trichogramma* females and males, which had emerged from *M. rubi* eggs, were held in laboratory at 22 ± 2°C, 55 ± 5% RH, 16L : 8D (without artificial lighting). Longevity and fecundity were studied in 11 mated females, which were placed individually into glass tubes (20 $cm^3$) and fed with honey on the first day after emergence only. Approximately 100 eggs of a laboratory strain of *M. brassicae* were offered to each female and replaced every second day until the female died. Female longevity, egg parasitisation rate, the numbers of emerged adults and the percentage of males in progeny were recorded.

To determine the number of generations per year, the *Trichogramma* was reared in *M. brassicae* and *E. kuehniella* eggs in an outdoor cage placed at Ivanka pri Dunaji (17°15′E, 48°14′N, altitude 136 m) during a period of two years. The distance between the type locality Dunajská Lužná and Ivanka pri Dunaji is about 16 km.

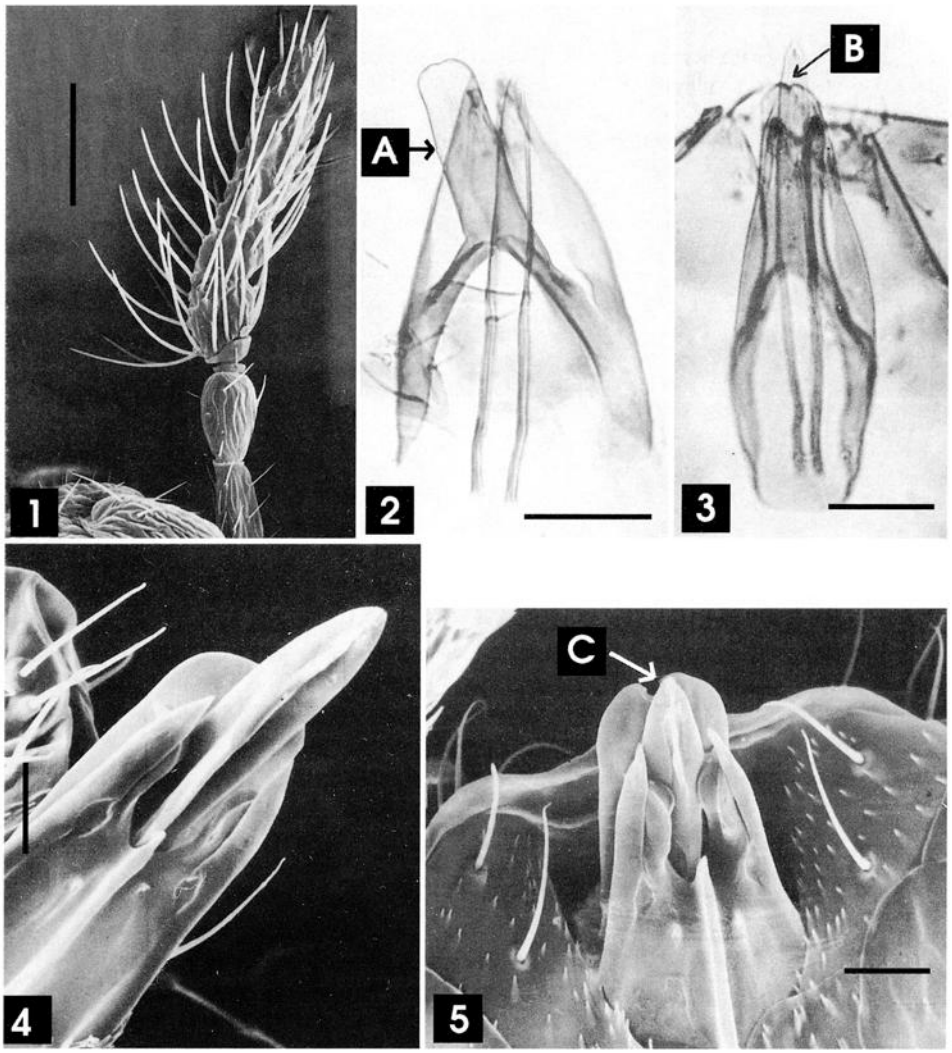
## *Trichogramma danubiense* sp. n.

MALE. Fairly dark with dark brown abdomen. Antennal flagellum containing about 45 somewhat blunt, short and thick sensilla (Fig. 1). Length of antennal sensilla about 1.5 times, the longest nearly 1.7 times the maximum width of flagellum. The longest forewing apical fringe about 1/6 of the wing width. Ratio between the width of forewings of males and females, 1 : 1.3.

Genitalia. Dorsal expansion of gonobase (DEG) spatulate with straight sides and rounded posterior extremity (Fig. 2), without lateral lobes. DEG apex with incision (Fig. 3). Aedeagus, when protruding, overlapping the apex of the posteriorly rounded DEG (Fig. 4). When aedeagus not protruding and not overlapping the broadened posterior part of DEG, oval incision in the middle of the bow is evident (Fig. 5 – ventral view, Fig. 6 – lateral view). Median ventral projection (MVP) relatively short; median central ridge (MCR) with clear groove in the middle extending along the whole length shown in Fig. 7. Chelate structures (CS) not reaching the apex of gonoforceps (GF). CS bent inwards in a sickle-shaped manner and placed beneath the apex of GF (Fig. 8). Aedeagus with apodeme as long or slightly longer than gonobase.

FEMALE. Colour as in male. Ovipositor and hind tibia almost equal in length. The longest forewing apical fringe about 1/10 of the wing width.

TYPE MATERIAL. Holotype: ♂, 3.vii.1988 from first generation in *M. brassicae* eggs, held at 22 ± 2°C, 55 ± 5% RH, 16L : 8D (without artificial lighting), mounted in Swan's liquid. No. of type catalogue: 621. Allotype: ♀, 3.vii.1988, same data as holotype, No. of type catalogue: 622. Paratypes: 7♂, 3.vii.1988 (No. of type catalogue: 623–629) and 8♀, 3.vii.1988 (No. of type catalogue: 630–637), same

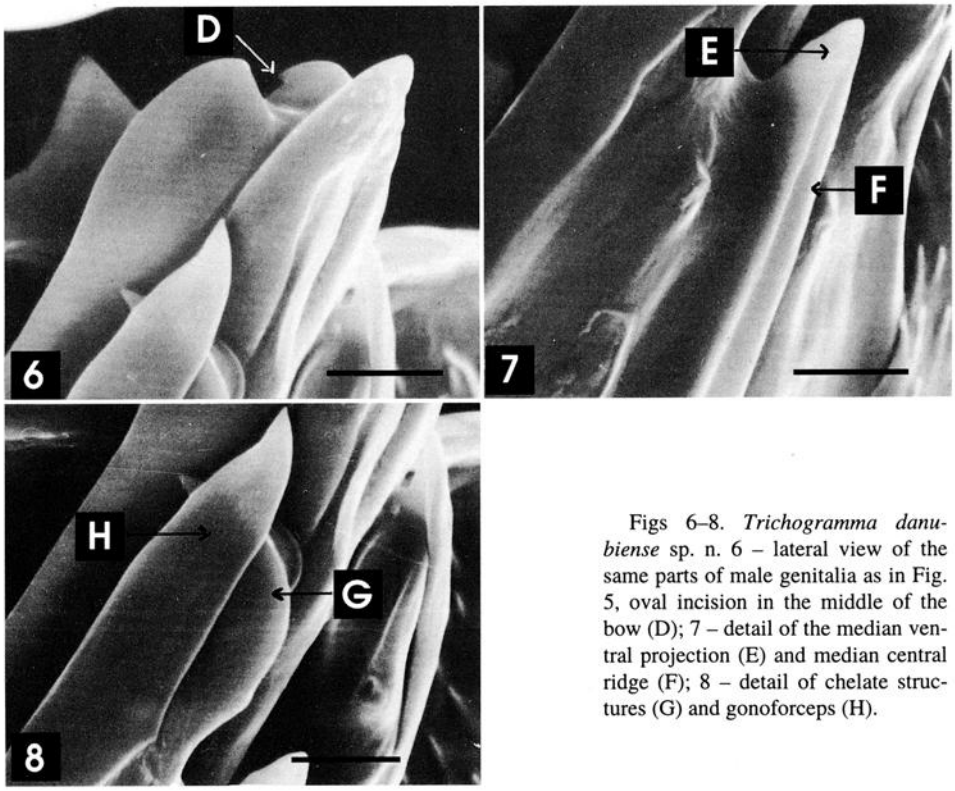



Figs 1–5. *Trichogramma danubiense* sp. n. 1 – male antennal flagellum; 2 – dorsal expansion of gonobase with rounded posterior extremity with straight sides (A); 3 – dorsal expansion of gonobase with an incision (B) in the apex; 4 – ventral view of male genitalia, aedeagus overlapping the apex of the dorsal expansion of gonobase; 5 – ventral view, aedeagus does not overlap the apex of the dorsal expansion of gonobase, incision in the middle of the bow evident (C).

data as holotype. All deposited in the collection of the Slovak National Museum (Bratislava, Slovakia). Original material 13.vi.1988, Slovakia m., Dunajská Lužná near Bratislava, parasitized eggs of *Macrothylacia rubi* (Lasiocampidae) on a twig of *Prunus cerasus*.

Distribution. South-West Slovakia (Central Europe). Known from the type locality only.

Etymology. Name derived from the latinised name of the type locality Dunajská Lužná, which is located in the Danubian plain and close to the river Danube.




Figs 6–8. *Trichogramma danubiense* sp. n. 6 – lateral view of the same parts of male genitalia as in Fig. 5, oval incision in the middle of the bow (D); 7 – detail of the median ventral projection (E) and median central ridge (F); 8 – detail of chelate structures (G) and gonoforceps (H).

DIFFERENTIAL DIAGNOSIS. Strongly resembling *Trichogramma lingulatum* Pang & Chen, 1974, which was placed among the *flandersi* group of *Trichogramma* species (Nagarkatti & Nagaraja, 1977; Voegelé & Pintureau, 1982). The two species differ in the characteristics as shown in Table 1.

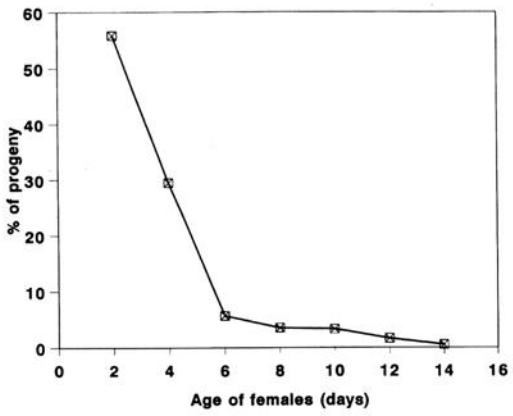



Fig. 9. Age-specific fecundity (percentage of progeny) of *Trichogramma danubiense* females from *Macrothylacia rubi* eggs followed at 22 ± 2°C, 55 ± 5% RH, 16L : 8D using eggs of *Mamestra brassicae*.

BIONOMICS, FECUNDITY, LONGEVITY AND PERCENTAGE OF MALES. Females of *T. danubiense* sp. n. readily accepted *M. brassicae* eggs. Out of 11 females examined in the laboratory, 7 lived more than 8 days and 4 lived less than 5 days. Mean fecundity of females was 231 progeny (Table 2). Actual fecundity was relatively high, although it was not linear-dependent on longevity. The highest fecundity (323 progeny) has been found in a female living for 13 days. Oviposition curve was steep (Fig. 9) with maximum parasitisation activity

on the first two days after emergence. *T. danubiense* belongs to species with arrhenotokous parthenogenesis. The average percentage of males in progeny was 23.9% (range 13.4–42.6%).

In an outdoor cage, 8–9 generations of this species developed in the course of one year. Apart from eggs of *M. brassicae* females also parasitised eggs of another factitious host, *E. kuehniella*.

TABLE 1. Comparison of some morphological characteristics of *Trichogramma danubiense* sp. n. with the description of *T. lingulatum* by Pang & Chen (1974).

| | *T. lingulatum* | *T. danubiense* sp. n. |
|---|---|---|
| Colour of both sexes | yellow with dark brown abdomen | fairly dark with dark brown abdomen |
| Male | | |
| No. of antennal flagellum sensilla | 35–40 | 40–45 |
| Antennal sensilla length : maximum flagellum width | 2 : 1 | 1.5 : 1 |
| MCR | paired | unpaired, with groove |
| DEG | linguiform, incision on apex absent | linguiform with incision on apex |
| Female | | |
| Ovipositor | as long as hind tibia | as long as (44.5%), slightly longer (21%) or shorter (34.5%) as hind tibia (n = 16)* |

* n indicates the number of measured individuals.

TABLE. 2. Fecundity of 11 *Trichogramma danubiense* females reared from eggs of *Macrothylacia rubi* and percentage of males in their progeny reared in *Mamestra brassicae* eggs in laboratory at 22 ± 2°C, 55 ± 5% RH, 16L : 8D.

| Female No. | Actual fecundity (number of female/male progeny, F/M) in individual days of life | | | | | | | Total (F/M) | Total | % of males |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1–2 | 3–4 | 5–6 | 7–8 | 9–10 | 11–12 | 13–14 | | | |
| 1 | 140/32 | 32/13 | 11/1 | 8/3 | 5/13 | 0/10 | 0/2 | 196/74 | 270 | 27.41 |
| 2 | 76/16 | 69/19 | 33/8 | 7/0 | 13/6 | 6/4 | 0/4 | 204/57 | 261 | 21.84 |
| 3 | 155/25 | 40/20 | 0/22 | 0/17 | 0/21 | 0/16 | 0/7 | 195/128 | 323 | 39.63 |
| 4 | 96/13 | 82/52 | 0/24 | 0/21 | 0/16 | 0/6 | — | 178/132 | 310 | 42.58 |
| 5 | 103/11 | 73/16 | 15/1 | 9/3 | 1/0 | — | — | 201/31 | 232 | 13.36 |
| 6 | 97/19 | 55/12 | 9/3 | 7/7 | 0/9 | — | — | 168/50 | 218 | 22.94 |
| 7 | 105/20 | 59/11 | 10/7 | 2/6 | — | — | — | 176/44 | 220 | 20.00 |
| 8 | 108/22 | 26/8 | — | — | — | — | — | 134/30 | 164 | 18.29 |
| 9 | 108/20 | 57/31 | — | — | — | — | — | 165/51 | 216 | 23.61 |
| 10 | 107/13 | 53/21 | — | — | — | — | — | 160/33 | 193 | 17.10 |
| 11 | 110/21 | — | — | — | — | — | — | 110/21 | 131 | 16.03 |

## DISCUSSION

Based on the shape of male genitalia, Nagarkatti & Nagaraja (1977) and Voegelé & Pintureau (1982) grouped *Trichogramma* species into 9 and 14 groups, respectively. The species *T. lingulatum* was included by the aforementioned authors into the *flandersi* group, the main morphological characteristics of which are: spatulate, distally elongated DEG, minute MVP and short aedeagus (except *T. lingulatum*). According to the shape of male genitalia and their similarity to those in *T. lingulatum*, *T. danubiense* sp. n. may be placed among the *flandersi* group of *Trichogramma*.

While Pang & Chen (1974) obtained *T. lingulatum* from eggs of an unknown lepidopteran species, Sorokina (1993) mentioned eggs of *Dendrolimus sibiricus* (Chetverikov) (Lepidoptera: Lasiocampidae) as its host. This indicates similar host specialisation (eggs of lasiocampids) of both *T. lingulatum* and *T. danubiense* in nature. The record of parasitised *M. rubi* eggs extends the range of *Trichogramma* hosts within the family Lasiocampidae.

In laboratory, *T. danubiense* females readily parasitised eggs of other lepidopteran species, such as *M. brassicae* or *E. kuehniella*. Their actual fecundity (262 progeny/female) exceeded, e.g., that of *T. evanescens* Westwood (141 progeny/female) in *M. brassicae* eggs (Bírová, 1989). The percentage of males in progeny of this bisexual species with arrhenotokous parthenogenesis was similar to species with the same type of reproduction. For example, the mean percentage of males in *T. evanescens* reared in *M. brassicae* eggs at laboratory conditions similar to those used in our study was 24.9% (Bírová, 1966).

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