# Parasites of Thersamonia dispar Haw. and Lycaena helle Den. & Schiff. (Lep., Lycaenidae)

by

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Since 1960, studies on the Large Copper Butterfly, *Thersamonia dispar* Haw., and *Lycaena helle* Den. & Schiff. have produced considerable information on their parasites.

Egg parasite: *Trichogramma evanescens* Westwood (Hym., Chalcididae) (det. M. J. Gijswijt).

This parasite is found in the Netherlands every July and August in the eggs of *T. dispar*. Two to four wasps develop in a single egg. Normally the incidence is low, 5—10 %. Sometimes it may increase locally up to 25 %. Near Bordeaux, 44° 55′ N—0° 36′ W, the eggs of *T. dispar* are also infected by *Trichogramma* sp. On 27.VIII.1964 20 % of the eggs were found to be infected (number of eggs: 60).

Pupal parasite: *Anisobas bostilis* Grav. (Hym., Ichneumonidae) (det. G. den Hoed).

In the collection of the late J. H. E. Wittpen in Amsterdam are two specimens of *A. hostilis,* which were reared from *T. dispar* pupae collected in 1934 near Wolvega, 52° 51′ N—5° 55′ E (verbal communication by Mrs. Wittpen). In the collection of Mr. Den Hoed there is one specimen of *A. hostilis* obtained from N. W. Elfferich, who reared it on 21.VII.1948 from the Small Copper Butterfly, *Lycaena phlaeas* L. So it appears that *A. hostilis* parasitizes *T. dispar* only incidentally.

Larval parasites: *Phryxe vulgaris* L. (Dipt., Larvaevoridae) (det. Dr. W. J. Kabos).
*Hyposoter placidus* Desv. (Hym., Ichneumonidae) (det. G. den Hoed).

The parasitic fly *P. vulgaris* is only found as an endopredator of *T. dispar* at Woodwalton Fen in England, 52° 27′ N—0° 12′ W. It appaered after 1945 in the colony of the Large Copper Butterfly which had been introduced there in 1927. The incidence of *P. vulgaris* in Woodwalton Fen was as high as 17,6 % in 1962 (see Duffey 1968, p. 90).

*H. placidus* is the endopredator of *T. dispar* which is known to all lepidopterists who reared larvae of this Copper. Unfortunately it is necessary to point out first the nomenclatorial difficulties concerning this species. Dr. J. G. Betrem was the first to determine the Netherlands specimens of this wasp and he called it *Anilastus ebenimus* Desv. in 1955 (lapsus for *A. ebeninus* Grav., see Den Hoed, 1962). J. F. Perkins wrote in 1957 (Gerris, 1961) that "Desvignes described the species which was reared from the extinct *L. dispar dispar* in England as *A. placidus*. I have seen no recent specimens of *A. placidus,* but another undescribed

species (or form) has been reared in small numbers from *T. dispar batavus* in this country which agrees completely with specimens reared from *Heodes phlaeas*".

DEN HOED (1962), possessing a lot of specimens reared from larvae collected in the Netherlands, did not agree and called the species *A. vulgaris* Tschek. In 1957 R. HINZ, however, rejected the name *A. vulgaris,* because in the collection of TSCHEK there were under the name *vulgaris* more than one species. He wrote that very probably *Limneria vulgaris* Tschek, 1871, is a synonym of *Hyposoter* (syn: *Anilastus*) *ebeninus* Gravenhorst 1829. He confirmed this in 1961.

On 9.IV.1962 BETREM told me that he got 21 wasps from W. L. BLOM and that he had determined these as *Anilastus placidus*.

In 1964 PERKINS got some material from Dr. E. DUFFEY reared from *T. dispar* which originated from H. G. SHORT at Esher, Surrey, England. He stated again "These are a species of *Anilastus,* related to *placidus* Desv." DEN HOED sent some Netherlands material to PERKINS in 1968, and his answer was: "Your specimens do not agree with *placidus* Desv., which I have seen from Holland and only from *dispar.* They belong to the closely related species for which I have not yet succeeded in finding a name, which parasitizes also *phlaeas. H. placidus* differs from the species ex *phlaeas* in having the anterior lateral area of the propodeum coarsely rugose, not finely coreaceous and dull as in your specimens". We found that the species varies much in this character. The other characters agree with those mentioned in the description of THOMAS DESVIGNES, so we saw no reason to drop the name *Hyposoter placidus* Desv. for the species under discussion.

I found that *H. placidus* is wide-spread throughout Europe, from the middle of Sweden to Bordeaux in South-West France. Most of the specimens we have were reared from larvae of *T. dispar,* a few were obtained from larvae of *L. helle.* On 5 and 7.VI.1960 about 30 first to third instar larvae of *L. helle* were collected in Belgium in the valley of the Warche, 50° 58′ 30″ N—6° 03′ 00″ E, 400 m, and near Hockai, 50° 28′ 50″ N—5° 58′ 50″ E, 530 m. Six caterpillars turned out to be infected, one wasp emerged on 18.VII.1960. In Sweden, Sälen, 61° 10′ N—13° 15′ E, 300 m, about 50 first to third instar larvae were collected on 7.VII. 1961. 13 caterpillars were infected and unfortunately only one wasp emerged (on 7.VIII.1961).

This Ichneumonid has been obtained from *T. dispar* throughout the recent area of *T. dispar batavus* in the Netherlands, from De Lemmer to Zwartsluis, in France near Arbois, 46° 57′ N—5° 43′ E, 300 m and near Bordeaux, 44° 54′ 5″ N—0° 36′ 07″ W. Near Arbois 3 fourth and fifth instar larvae were collected on 27.VII.1968, one was parasitized and the wasp emerged on 10.VIII.1968. On 30.VIII.1968 about 20 first and second instar larvae were obtained at that place and they produced 5 wasps. At the locality near Bordeaux about 40 first and second, and one fifth instar larvae were found on 27.VIII.1964 and in September 7 turned out to be parasitized. The remaining larvae hibernated and in the spring there were no further parasitized larvae. On 10.VIII.1968 three fourth instar larvae were obtained at the same locality and one was parasitized. The wasp emerged on 28.VIII.1968. All this material was checked bij DEN HOED.

More details of the biology of this endopredator were obtained from a breeding experiment in 1967. Dr. P. A. VAN DER LAAN, director of the Laboratory of Applied

Entomology in Amsterdam, kindly granted me space in his laboratory. On 31.VII. 1967, 57 first, second, and a few third instar larvae of *T. dispar batavus* were collected at 52° 52′ 50″ N—5° 41′ 05″ E. Diapause was induced at 20° C and 10 hours light - 14 hours dark. Lightsource a 20 W fluorescent tube. 100 % diapause was obtained (20° C and 16 hours light - 8 hours dark induces 100 % nondiapause), and no larva appeared to be infected. After a diapause period of 7 weeks, the larvae were reactivated on 20.IX at 30° C and continuous light and reared at 25° C and 16 hours light. The first caterpillar became black on 3.X and was followed by others on 6.X. On 16.X the first five wasps emerged. So the pupal stage of *H. placidus* takes about 10 days under these circumstances. (The pupal stage of *T. dispar* lasts 9 days). About 40 larvae of the fourth instar were obtained and 15 were infected, i.e. a nearly 40 % incidence. Five pupae of this wasp were stored at 15° C in an attempt to prolong the pupal stage, but all pupae turned out to be dead after a fortnight. The pupae of this endopredator seem to be vulnerable. The sex ratio of the emerged wasps was normal 1 : 1. They were kept at 20°—28° C and fed with 10 % honeywater. The females could easily be kept alive for 4 weeks under these conditions. Mating took place one or two days after emerging and all males died within six days. After ten days a few first instar larvae and some eggs of *T. dispar* were offered to the females. The eggs were neglected completely and the larvae were stung only once. The wasp first found the feeding trail of the larva and followed this trail with the antennae to the very small caterpillar at the end which it stung immediately. A second wasp neglected this punctured larva, so there appears to be a mechanism to prevent double injection. However a second trial about 15 days later, when the wasps were very excited and apparently less selective, showed that triple injection can occur. The infected larvae were reared under nondiapause conditions (25° C and 16 hours light) and after 15 days they became black. The blacking of the larvae takes about six hours, the whole killing process about three days. At the beginning the caterpillar prepares itself for moulting (spinning a silk carpet) and becomes more cylindrical in shape. The wasp leaves the caterpillar by biting a hole, normally in the thoracic area of the host.

In the case of *T. dispar* the endopredator kills its host in the middle of the fourth instar, in the case of *L. helle* at the end of the last fifth larval instar. Both species of caterpillars are of the same length then, about 14—16 mm. So there is a relation between the volume of the host and the moment of pupation of the endopredator. It was once observed that an infected larva of *T. dispar* grew very fast and was killed at the end of the fifth instar (the larva mentioned under 3.X). The endopredator could not consume the complete body contents and the wasplarva in this case was probably not able to spin its cellophanelike cocoon within the host skin because too much haemolymph and tissue were left and so it died.

From these experiments it became clear that *H. placidus* is a single brooded species when its host is *T. dispar batavus*. The wasps are on the wing one or two weeks before the butterflies (the wasp larvae pupated in the fourth instar larvae!) and the female wasps cannot find the new first instar larvae of their host before three to four weeks or more after emerging. The species hibernates as egg or very young

larva in the third instar caterpillar. The latter starts its diapause normally in the middle or at the end of August (in unfavourable years even in October). The biology is synchronized to that of the host, although there is a big gap in time between the emergence of the wasps and the birth of the caterpillars. There is a tendency to decrease this gap by retarding the development of the host. The incidence of parasitism is in general very low. In the period 1960—68 I have found over 500 fourth and fifth instar larvae of *T. dispar batavus* in May and early June and found altogether 18 parasitized caterpillars, i.e. 3,5 % on the average. It never exceeded 15 % locally. Higher rates were found in the examples where young larvae were collected and up to nearly 40 % in the breeding experiment mentioned.

People who likewise found a low percentage of parasitized larvae are R. A. POLAK (who found no parasites at all in the period 1916—30), Ir. G. A. Graaf BENTINCK, G. DIJKSTRA Hzn., and H. J. L. T. STAMMESHAUS. On the other hand W. L. BLOM claims a high mortality due to this endopredator and M. W. CAMPING and J. R. CARON rather had the same experience.

But the biology as outlined here, is not yet complete. Very rarely there are also found young larvae of *T. dispar batavus* starting a second brood in July or August. GERRIS (1961) got three specimens from a locality near Zwartsluis in August 1960, which did not turn into hibernation. These were all parasitized. I found one third instar larva on 15.VII.1960 in the nature reserve "Rottige Meenthe", 52° 51′ N—5° 56′ E, and obtained a wasp from it on 10.VIII. Also the young larvae collected in 1964 near Bordeaux showed that parasitized larvae do not hibernate. This phenomenon is rare. Probably parasitized larvae may have a somewhat higher diapause threshold than normal ones. *T. dispar* in the southern part of its European area has a partial second brood, perhaps 10—30 %. This has no special consequence for the endopredator. In addition in most habitats of *T. dispar, L. phlaeas* and *Heodes tityrus* Poda occur too. These hibernate as young larvae (third or fourth instar), so if *H. placidus* is restricted to Lycaenid larvae, it will find hosts throughout the whole summer. When *H. placidus* parasitizes *L. helle* (examples in Belgium and Sweden) the endopredator needs an alternative host, because *L. helle* hibernates as a pupa. In the *L. helle* habitat the Purple-edged Copper Butterfly, *Palaeochrysophanus hippothoe* L., nearly always occurs. This species hibernates as third instar larva and when it is in the fourth to fifth instar (the time of pupating of the endopredator), *L. helle* is just on the wing. When the latter is in the fifth larval instar, there are new first instar larvae of *P. hippothoe*. Only once a hyperparasite of *H. placidus* was found. On 10.VI.1968 a female *Mesochorus* sp. (Ichneumonidae) was reared from a caterpillar collected on 29.V.1968 at 52° 47′ N—5° 54′ E, in the nature reserve "De Weerribben".

*T. dispar* and *L. helle* are the only Coppers which have larvae which are easy to find. This is due to the kind of foodplant: *T. dispar* feeds nearly always on *Rumex hydrolapathum* Huds. in the northern part of its European area, in the southern part on *R. hydrolapathum* and *R. crispus* L., very rarely on *R. sanguineus* L., *R. conglomeratus* Murr. and *R. obtusifolius* L. *L. helle* feeds on *Polygonum bistorta* L. and *P. vivipara* L. The other Lycaeninae mostly feed on *R. acetosa* L. and *R. acetosella* L. and it is very difficult to look for caterpillars on these plants.

Therefore it will be difficult to produce more information about the parasites of the related Coppers.

## Samenvatting

Een onderzoek naar de grote vuurvlinder, *T. dispar* en de kleine vuurvlinder, *L. helle,* leverde veel gegevens over de parasieten (endopredatoren) van deze soorten. De belangrijkste parasiet is de sluipwesp *Hyposoter placidus,* die bij de grote vuurvlinder gemiddeld een sterfte van 3,5 % veroorzaakt. Eénmaal werd gevonden, dat bijna 40 % van de jonge vuurvlinderrupsen geïnfekteerd was. In het artikel wordt ingegaan op de moeilijkheden, die er waren bij de determinatie van de sluipwesp. De heer G. DEN HOED ontving gedurende vele jaren het merendeel van de sluipwespen, welke door de lepidopterologen uit de vuurvlinders gekweekt werden. Pas nadat een flinke serie van deze wespen bijeengebracht was, konden de systematische problemen opgelost worden. Bij het onderzoek is de biologie van de sluipwesp in grote trekken bekend geworden. De wesp legt één ei in een eerste of tweede stadium rupsje en de ontwikkeling van de wespelarf loopt synchroon met die van de gastheer. De larf moet zijn gastheer doden voordat deze groter is dan ongeveer 16 mm, daar hij anders niet meer op de juiste wijze verpoppen kan binnen de rupsehuid. Wanneer de wesp op de grote vuurvlinder parasiteert, komt hij ongeveer één tot twee weken voor de vliegtijd van de vlinders uit en moet dus tenminste drie à vier weken of nog langer wachten voor er weer jonge rupsjes beschikbaar zijn om zijn cyclus te kunnen voltooien. *H. placidus* werd gevonden van Midden-Zweden tot Zuidwest-Frankrijk. Wanneer deze soort leeft op *L. helle* (België en Zweden) zal er een tweede gastheer nodig zijn, omdat *L. helle* als pop overwintert. Dit zou de rode vuurvlinder, *P. hippothoe,* kunnen zijn, die evenals de grote vuurvlinder als derde stadium rups overwintert.

## Literature

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† M. N. Nikolskaya. Eind oktober 1969 is de grote Russische chalcidologe Dr. Maria Nikolaevna NIKOLSKAYA op 73-jarige leeftijd overleden. Daar toegepaste entomologen nog wel eens contact met haar hadden, is het wel gewenst hen hiervan in kennis te stellen.

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