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Parasitic Hymenoptera associated with *Thecodiplosis brachyntera* (Diptera: Cecidomyiidae) on the genus *Pinus* (Pinaceae) in the Czech Republic

V. Skuhravý[1], C. Thuróczy[2]

[1]*Prague, Czech Republic*
[2]*Koszeg, Hungary*

ABSTRACT: *Aprostocetus micantulus* (Thomson, 1878) (Chalcidoidea: Eulophidae), *Torymus heyeri* Wachtl, 1833 (Chalcidoidea: Torymidae), *Pseudencyrtus idmon* (Walker, 1848) (Chalcidoidea: Encyrtidae) and *Platygaster compressicornis* (Thomson, 1859) (Platygasteroidea: Platygasteridae) are four main parasitoids reared from galls of *Thecodiplosis brachyntera* (Schwägrichen, 1835) (Diptera: Cecidomyiidae) developing on *Pinus mugo* L., *P. rotundata* Link, *P. sylvestris* L. and *P.* × *pseudopumilio* (Willk.) G. Beck (Pinaceae) in the Czech Republic during outbreak 1967–1972. Of total 4,279 parasitoid specimens, *Platygaster compressicornis* (1,778 specimens, 41%) was the most abundant, *Aprostocetus micantulus* (1,047 specimens, 25%) and *Pseudencyrtus idmon* (1,020 specimens, 24%) less abundant and *Torymus heyeri* (434 specimens, 10%) was on the fourth place of abundance. In laboratory conditions, adults of *Platygaster compressicornis* emerged simultaneously with adults of *T. brachyntera*, adults of *Pseudencyrtus idmon* and *Torymus heyeri* 14–24 days after emergence of *T. brachyntera* and adults of *Aprostocetus micantulus* after 24–60 days. Behaviour of adult parasitoid during the process of building the opening hole to escape from gall is described. Larvae identified and figured by Fankhänel and Zeletzki (1964) as larval stage of *Misocyclops pini* are misidentification; in reality they are the salivary glands of larvae of *Thecodiplosis brachyntera*.

Keywords: Hymenoptera; parasitoids; Chalcidoidea; Eulophidae; Torymidae; Encyrtidae; Platygasteroidea; Diptera; Cecidomyiidae; *Thecodiplosis brachyntera*

A big outbreak of the needle shortening gall midge *Thecodiplosis brachyntera* (Schwägrichen, 1835) passed from 1967 to 1972, namely on the mountain pine (*Pinus mugo* L.) in the Krkonoše Mts. (Giant Mountains, Bohemia). At the same time the outbreak of this gall midge species was observed also on *Pinus rotundata* Link, *P.* × *pseudopumilio* (Willk.) G. Beck (= *Pinus mugo* × *P. rotundata*) at more than 15 peatbogs and also on *Pinus sylvestris* L. at many localities in the Czech Republic. The population density of *T. brachyntera* increased between the latent phase and outbreak periode 40,000 times. The outbreak of *T. brachyntera* and its reasons were studied in detail and results are given in the monograph of Skuhravý (1991). He investigated the process of gall formation and experimental induction of the shape of galls, long-term population dynamics, host plants of *T. brachyntera* and its damage to their host plants, the content of monoterpene in needles, the infestation of different *Pinus*-species and the attack on 60 provenances of *Pinus sylvestris* in the Arboretum Bolevec at Plzeň in western Bohemia.

Simultaneously with all these investigations attention was also devoted to the parasitoid complex reared from samples of *Thecodiplosis brachyntera* collected at various localities and different host trees and in connection with this, also to the degree of infestation – that is the relation between the attacked and not attacked needles by *T. brachyntera*.

In 1968 the excellent Czech hymenopterologist Zdeněk Bouček, who worked in the National Museum in Prague, was ask to cooperate on this problem and to identify parasitoids reared from samples of *T. brachyntera.* He identified first several parasitoid specimens. In 1969 he emigrated to England. Nobody after his leaving was able to identify the parasitoids of samples of *T. brachyntera*. Since the year 2000 Csaba Thuróczy started to identify parasitoids reared from

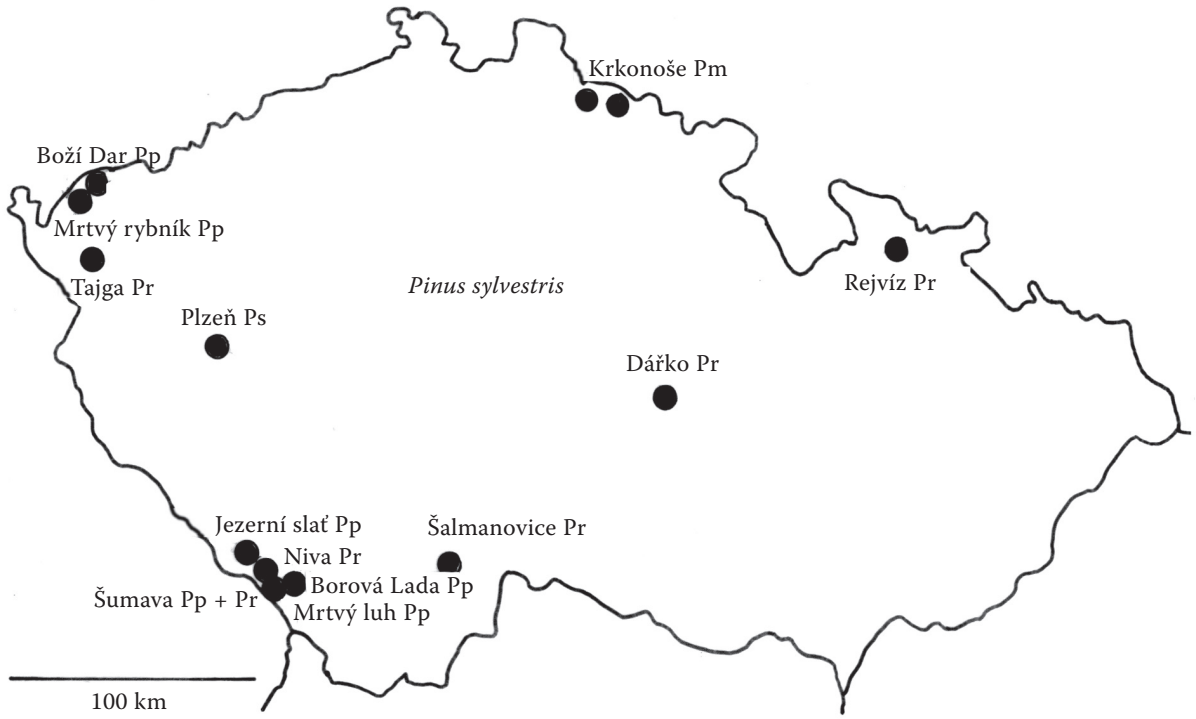

Fig. 1. Czech Republic with localities of different *Pinus*-species stands where *Thecodiplosis brachyntera* and its parasitoids were investigated. Pm – *Pinus mugo*, Pp – *Pinus* × *pseudopumilio*, Pr – *Pinus rotundata*, Ps – *Pinus sylvestris*

samples of *T. brachyntera*. The situation was not simple. Before this work, it was necessary to revise some parasitoid specimens in the collection of Dr. M. W. R. Graham at the Museum of Natural History in London and to compare these results with publications of Graham (1969, 1987), Graham and Gijswijt (1998), Domenichini (1966) and Trjapitzin and Sakhnov (1996). That is why the results of studies on parasitisation and on the parasitoid complex of *T. brachyntera* obtained during years 1967–1972 has not been published until now.

Study area, material and methods

The development of *Thecodiplosis brachyntera* on various *Pinus* species was investigated at several experimental plots which were selected in Bohemia and Moravia. The development of *T. brachyntera* on *Pinus mugo* was studied in the Krkonoše Mts. in north-eastern Bohemia at elevations of 1,000–1,300 m a.s.l., on *Pinus* × *pseudopumilio* at more than 15 localities in south-western, north-western and eastern Bohemia, on *Pinus rotundata* in south-western and southern Bohemia and northern Moravia. The incidence of infestation of *Pinus sylvestris* was followed at more than 30 localities throughout the central, western and southern Bohemia (Fig. 1).

The parasitoids were reared together with adults of *Thecodiplosis brachyntera* from attacked shoots and needles of several pine species in Petri dishes in laboratory conditions at 20°C. The rearings were repeated in each year several times from October to May of the following year. It was possible to follow the emergence time of parasitoids which were reared from two samples collected in October and May of each year. The gall midge *Thecodiplosis brachyntera* and its parasitoids have not a diapause in their development in the course of the year. They can develop after bringing attacked shoots into laboratory conditions with higher temperatures than in nature from since November.

RESULTS

More than 4,200 parasitoid specimens were reared and identified from samples of various *Pinus*-species with galls of *Thecodiplosis brachyntera* in the Czech Republic during the period 1967–1976.

Parasitoids of *Thecodiplosis brachyntera*

Calliceras (*Ceraphron*) *brachynteri* (Schwägr.) was the first parasitoid of *T. brachyntera* which was described. Later Gradojevič (1924) reported *Misocyclops pini* (Kieffer) that occurred in higher numbers in western Slovakia. Z. Bouček identified three parasitoids of *T. brachyntera* of that area in 1959, viz *Pseudencyrtus* sp., *Torymus abbreviatus* Boh. and *Tetrastichus roesellae* (Nees) (Skuhravá, Skuhravý 1960). Later Fulmek (1968) published

an overview of parasitoids of *T. brachyntera*. He gave the following species: *Elachertus sublaevis* Thn (= *Entedon geniculatus* Rtzb.) from Germany, *Pseudencyrtus* sp. and *Tetrastichus roesellae* from Czechoslovakia, *Torymus cyanimus* Boh. (= *abbreviatus* Boh., *difficilis* Nees) from Denmark and Germany (Chalcidoidea) and *Calliceras* (*Ceraphron*) *brachynteri* Schwägr. and *Calliceras vitripennis* Rtzb. from Germany and *Misocyclops pini* Kieffer from formerly Czechoslovakia, Germany and Lorraine (France) (Proctotrupoidea).

Bouček identified the following parasitoids of *T. brachyntera* reared from *T. brachyntera* collected in Krkonoše Mts. in 1969: *Torymus spilopterus* Boh. and *Tetrastichus* sp. near *lycidus* (Walker).

The following four main parasitoid species were identified among more than 13,000 parasitoid specimens reared during an outbreak of *Thecodiplosis brachyntera* in the period 1967–1972, viz. *Aprostocetus micantulus* (Thomson, 1878) (Chalcidoidea: Eulophidae), *Torymus heyeri* Wachtl, 1833 (Chalcidoidea: Torymidae), *Pseudencyrtus idmon* (Walker, 1848) (Chalcidoidea: Encyrtidae) and *Platygaster compressicornis* (Thomson, 1859) (Platygasteroidea: Platygasteridae).

Larvae of *Torymus heyeri* are ectoparasitoids that attack larvae of *Thecodiplosis brachyntera* in their galls, feed by sucking sap from gall midge larval bodies and their attack leads to the death of the gall midge larva. Larvae of *Platygaster compressicornis* are endoparasitoids that develop inside larvae of *T. brachyntera* in galls and feed on the inner decomposed content of the larval body. The attack of *P. compressicornis* leads to the death of gall midge larvae.

All these parasitoid species were abundant during outbreak of *Thecodiplosis brachyntera* in 1967–1972 and influenced importantly its course. They occurred in larger numbers at localities where the number of gall midge galls increased. Parasitoids attacked larvae of gall midges, contributed to reducing the population density of gall midges and to the rapid decrease of this outbreak.

The four main parasitoid species were reared from samples of galls of *Thecodiplosis brachyntera* developing on four *Pinus*-species during 1967–1972 in different amounts. Summary results are given in Table 1.

Of all parasitoids reared during the outbreak in 1967–1972 amounting 4,279 specimens, *Platygaster*

Table 1. Number of parasitoid specimens reared from galls of *Thecodiplosis brachyntera* developing on four *Pinus* species

A. On *Pinus mugo* in the Krkonoše Mts. at elevations of 1,100 and 1,300 m a.s.l. Localities on the transect of 400 m in distances of 50 m

Number of locality	1	2	3	4	5	6	7	8	Total
A. micantulus	1	1	0	80	0	0	3	10	95
T. heyeri									
P. compressicornis	13	62	635	16	237	42	229	53	1,287
P. idmon	9	2	72	0	39	17	105	194	438

B. On *Pinus* × *pseudopumilio* in the Šumava Mts. at elevations of 650–730 m a.s.l.

Locality	Churáňov	Jezerní slať	Borová Lada	Mrtvý luh	Šumava (1)	Šumava (2)	Šumava (3)	Total
A. micantulus	15	6	89	127	81	162	86	566
T. heyeri		2	3	1	1	13	129	149
P. compressicornis		5		1		138		144
P. idmon		4				118	2	124

C. On *Pinus rotundata, P.* × *pseudopumilio* and *P. sylvestris* at various localities in the Czech Republic

Locality	*Pinus rotundata*				*Pinus* × *pseudopumilio*			*Pinus sylvestris*	Total
	Rejvíz	Dářko	Niva	Šalmanovice	Mrtvý rybník	Boží Dar	Tajga	Bolevec	
A. micantulus	9	1	281	5	2	5	83	0	386
T. heyeri	1	265	1	0	1	7	10	0	285
P. compressicornis		0	0	1	3	5	0	338	347
P. idmon	0	0	0	0	398	35	0	25	458

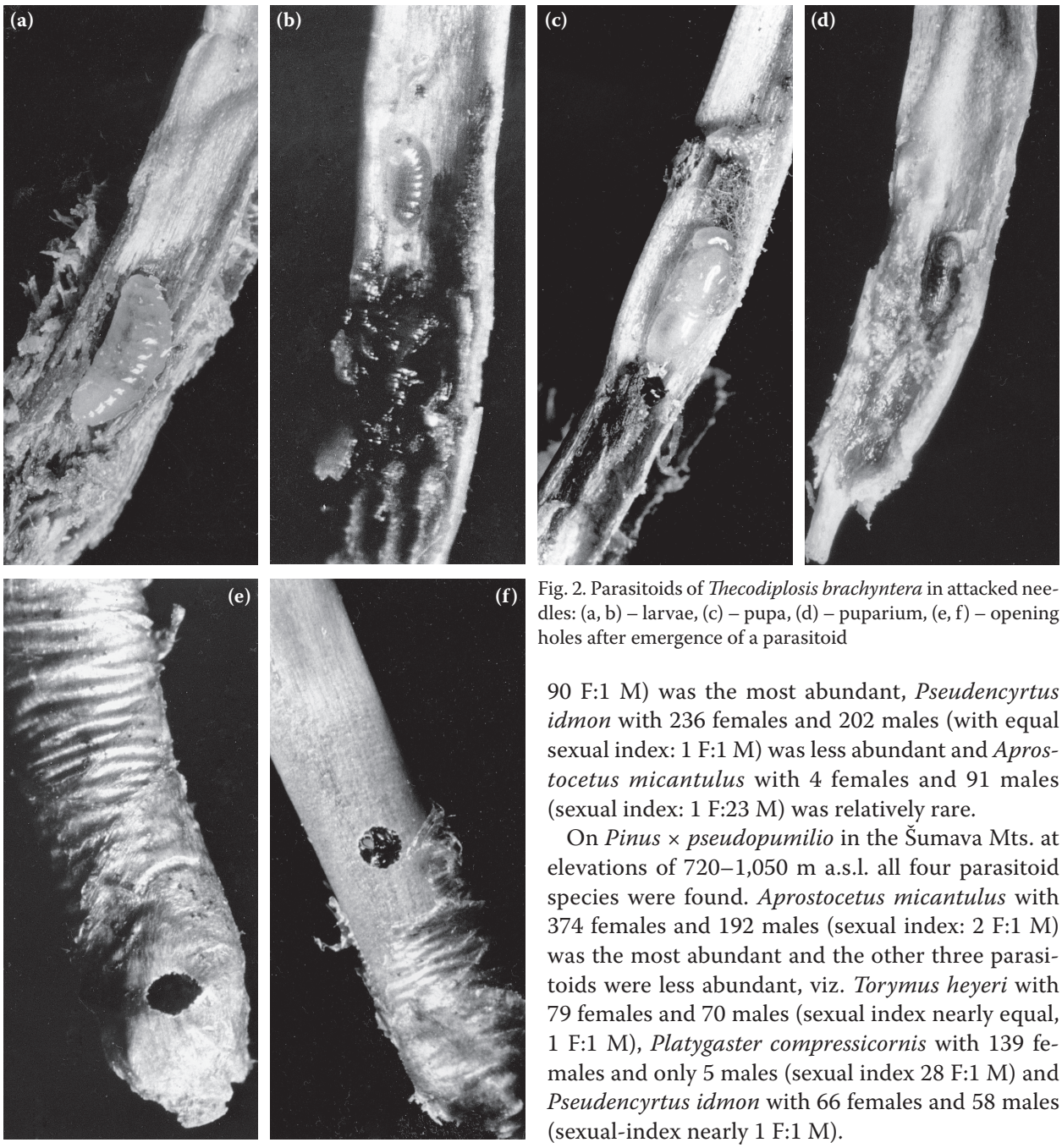

Fig. 2. Parasitoids of *Thecodiplosis brachyntera* in attacked needles: (a, b) – larvae, (c) – pupa, (d) – puparium, (e, f) – opening holes after emergence of a parasitoid

compressicornis with 1,778 specimens (41%) was the most abundant species, *Aprostocetus micantulus* with 1,047 specimens (25%) and *Pseudencyrtus idmon* with 1,020 specimens (24%) were less abundant and *Torymus heyeri* with 434 specimens (10%) was in fourth place of abundance. These four parasitoid species represented the highest number of parasitoids that were identified during an outbreak of *Thecodiplosis brachyntera* on *Pinus mugo* L., *P.* × *pseudopumilio, P. rotundata* and *P. sylvestris*.

On *Pinus mugo* in the Krkonoše Mts. at elevations of 1,100 to 1,300 m a.s.l. only three parasitoid species were found. *Platygaster compressicornis* with 1,273 females and only 14 males (sexual index: 90 F:1 M) was the most abundant, *Pseudencyrtus idmon* with 236 females and 202 males (with equal sexual index: 1 F:1 M) was less abundant and *Aprostocetus micantulus* with 4 females and 91 males (sexual index: 1 F:23 M) was relatively rare.

On *Pinus* × *pseudopumilio* in the Šumava Mts. at elevations of 720–1,050 m a.s.l. all four parasitoid species were found. *Aprostocetus micantulus* with 374 females and 192 males (sexual index: 2 F:1 M) was the most abundant and the other three parasitoids were less abundant, viz. *Torymus heyeri* with 79 females and 70 males (sexual index nearly equal, 1 F:1 M), *Platygaster compressicornis* with 139 females and only 5 males (sexual index 28 F:1 M) and *Pseudencyrtus idmon* with 66 females and 58 males (sexual-index nearly 1 F:1 M).

The composition of parasitoid species in the Šumava Mts. differs from those of the Krkonoše Mts. mainly by the occurrence of *Torymus heyeri*, by a high occurrence of *Aprostocetus micantulus*, by lower occurrence of *Platygaster compressicornis* and *Pseudencyrtus idmon*. The high occurrence of *Aprostocetus micantulus* and *Torymus heyeri* is here evident.

On *Pinus rotundata* only two parasitoid species, viz. *Aprostocetus micantulus* and *Torymus heyeri*, and on *Pinus* × *pseudopumilio* only one parasitoid species, *Pseudencyrtus idmon,* occurred more abundantly.

The higher occurrence of *Pseudencyrtus idmon* at higher elevations of 1,000 m a.s.l. in the Šumava Mts. is similar to its occurrence in the Krkonoše Mts. Very

interesting is the occurrence of *Pseudencyrtus idmon* and *Platygaster compressicornis* at very similar elevations in the Krkonoše Mts. on *Pinus mugo* and elevations round 200 m.a.s.l. on *Pinus sylvestris*.

***Torymus heyeri** Wachtl, 1833*
(Chalcidoidea: Torymidae)

This species is known as a parasitoid of *Dasineura abietiperda* (Henschel) on *Picea abies* and of *Thecodiplosis* sp. on *Pinus nigra* (Graham, Gijswijt 1998). Larvae of *T. heyeri* feed on gall midge larvae as ectoparasitoids.

We identified 434 specimens of this species reared from galls of *Thecodiplosis brachyntera* during outbreak 1967–1972. Of them, 149 specimens developed in galls of *T. brachyntera* on *Pinus* × *pseudopumilio* at seven localities in the Šumava Mts., 265 specimens in galls of *T. brachyntera* on *Pinus rotundata* at the locality Dářko, one specimen at the locality Rejvíz and one specimen at the locality Niva; 18 specimens in galls of *T. brachyntera* on *Pinus* × *pseudopumilio* at localities Mrtvý rybník, Boží Dar and Tajga. Interesting is the absence of this species in samples of *T. brachyntera* on *Pinus sylvestris* at Bolevec.

Distribution: Croatia, Czech Republic, Germany, Italy, the Netherlands, Spain, Switzerland.

***Aprostocetus micantulus** (Thomson, 1878)*
(Chalcidoidea: Eulophidae)

Bouček identified *Tetrastichus rosellae* (Nees) (Skuhravá, Skuhravý 1960), later as *Tetrastichus nr. lycidus* (Walker), as parasitoid of *Thecodiplosis brachyntera*. Graham's revision on European Tetrastichinae (1987) let us believe, that those specimens identified by Bouček also belong to this species. Several morphological differences can be discerned in our reared serial, so there is the necessity of further studies for accurate identification. By Graham's description and key, and also having information of confirmed host plants, it proved to be *micantulus* (Thomson) as part of the *lycidas* species group.

Larvae feed as ectoparasitoids. We identified 1,047 specimens of this species reared from galls of *Thecodiplosis brachyntera* during outbreak 1967 to 1972. Of them, 95 specimens developed in galls of *T. brachyntera* on *Pinus mugo* at five localities in Krkonoše Mts. at elevations of 1,100 and 1,300 m a.s.l., 566 specimens in galls of *T. brachyntera* on *Pinus* × *pseudopumilio* at seven localities in Šumava Mts. at elevations of 650–730 m a.s.l., 90 specimens on *Pinus* × *pseudopumilio* (of them 83 at Tajga), 296 specimens in galls of *T. brachyntera* on *Pinus rotundata* (of them 281 specimens at the locality Niva). None parasitoid specimen were found in galls on *Pinus sylvestris* at the locality Bolevec.

Distribution: France, Great Britain, Italy, Sweden.

***Pseudencyrtus idmon** (Walker, 1848)*
(Chalcidoidea: Encyrtidae)

We identified 1,020 specimens of this species reared from galls of *Thecodiplosis brachyntera* during the 1967–1972 outbreak. Of them, 438 specimens developed in galls of *T. brachyntera* on *Pinus mugo* at eight localities in Krkonoše Mts. at elevations of 1,100 and 1,300 m a.s.l., 124 specimens in galls of *T. brachyntera* on *Pinus* × *pseudopumilio* at three localities in Šumava Mts. at elevations of 650–730 m, 398 specimens on *Pinus* × *pseudopumilio* at the locality Mrtvý rybník and 35 specimens at the locality Boží Dar and 25 specimens in galls of *T. brachyntera* on *Pinus sylvestris*. The absence of this species in galls on *Pinus rotundata is* interesting.

Distribution: Finland, Great Britain, Norway, Sweden.

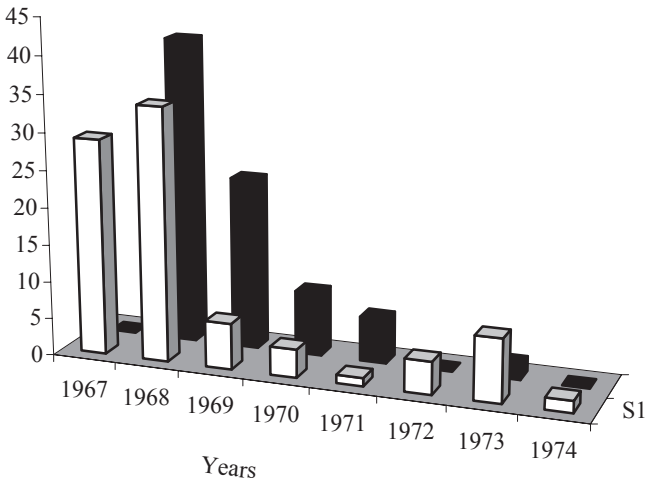

Fig. 3. Occurrence of *Thecodiplosis brachyntera* and occurrence of its parasitoids in the period 1967–1974. 1st row – percentage of needles attacked by *Thecodiplosis brachyntera*, 2nd row – percentage of larvae of *T. brachyntera* attacked by parasitoids

Platygaster compressicornis *(Thomson, 1859) (Platygasteroidea: Platygasteridae)*

Larvae feed as endoparasitoids inside body of the host.

We identified 1,778 specimens of this species reared from galls of *Thecodiplosis brachyntera* during the 1967–1972 outbreak. Of them, 1,287 developed in galls of *T. brachyntera* on *Pinus mugo* at eight localities in Krkonoše Mts. at elevations of 1,100 and 1,300 m a.s.l., 144 specimens in galls of *T. brachyntera* on *Pinus* × *pseudopumilio* at three localities in Šumava Mts. at elevations of 650–730 m a.s.l., 3 specimens at the locality Mrtvý rybník, 5 specimens at the locality Boží Dar; 1 specimen was reared from galls of *T. brachyntera* on *Pinus rotundata* at the locality Šalmanovice and 338 specimens from galls of *T. brachyntera* on *Pinus sylvestris* at the Arboretum Bolevec.

In addition to the above mentioned main parasitoid species, the following species of parasitoids were identified in low numbers from our samples.

Aprostocetus epicharmus (Walker, 1939) (Chalcidoidea: Eulophidae): 1 f, Šumava Mts., *Pinus pseudopumilio*,

Baryscapus sp. (Chalcidoidea: Eulophidae): 1 f, 1 m, Šumava Mts., *Pinus pseudopumilio,*

Capellia sp.: 1 m, Boží Dar, *Pinus* × *pseudopumilio*,

Ceraphronidae (Ceraphronoidea): 1 f, 1 m, Šumava Mts., *Pinus pseudopumilio*,

Cyclogastrella deplanata (Thompson, 1959) (Chalcidoidea: Pteromalidae): 6 f, 2 m, Krkonoše Mts., *Pinus mugo*,

Homoporus sp. (Chalcidoidea: Pteromalidae): 1 f, Šumava Mts., *Pinus pseudopumilio*,

Megaspilidae sp.: 21 f & m,

Psilonotus achaeus (Walker, 1848) (Chalcidoidea: Pteromalidae): 1 m, Boží Dar, *Pinus pseudopumilio*,

Scelionidae (Scelionoidea): 1, Šumava Mts., *Pinus pseudopumilio*,

Scepthrothelys sp. (Chalcidoidea: Pteromalidae): 13 f, 4 m, Dářko, Šumava Mts., *Pinus pseudopumilio*; Krkonoše Mts. 8 f, 7 m,

Trichomalus sp. (Chalcidoidea: Pteromalidae): 1 f (known as parasitoid of *Contarinia baeri*): Dářko, *Pinus rotundata,* 5 f, 17 m,

Trichomalus sp. (Chalcidoidea: Pteromalidae): 5 f, 17 m.

Parasitoid-host relationship

In the course of the outbreak of *Thecodiplosis brachyntera*, which was investigated by means of counting the unattacked (healthy) and galled needles on branches of *Pinus mugo* and *Pinus* × *pseudopumilio*, the emergence and number of parasitoids was also followed and the parasitoid-host relationship was determined (Table 2).

The number of galled needles increased from 1966 to 1968. In the Krkonoše Mts. the peak of outbreak was observed in 1968 when 34% of needles attacked by *Thecodiplosis brachyntera* were found. Since 1969 the number of galled needles has decreased rapidly. These results are based on control and evaluation of more than 65,000 unattacked and attacked needles.

Simultaneously with increasing number of needles attacked by *T. brachyntera* parasitation rate also increased. In the Krkonoše Mts. the highest parasitisation was observed in 1968 (41%) and it remained relatively high also in 1969 (23%), then it fell. In the Šumava Mts. the highest parasitation (40%) was observed a year later, in 1969, with similar decrease to 24% in 1970 and fall since 1971. In the Krušné hory Mts. the high level of parasitation (34%) was observed in 1968, relatively high (29%) in 1969 decreased since 1970.

The parasitoids can be discussed as a factor in reducing the population of *Thecodiplosis brachyntera* during its outbreaks.

Development of parasitoids in rearings

The emergence of adults of *T. brachyntera* and its parasitoids was followed in laboratory conditions. Needles attacked by *T. brachyntera* or short terminal parts of *Pinus*-shoots were placed in plastic Petri dishes and emergence of specimens was controlled in 3–7 days intervals under temperature of 20°C. The development of parasitoids depends on the day, at which the experiment was started. Parasitoids, similarly as *T. brachyntera*, have not a diapause and the duration of their development depends only on the temperature.

Platygaster compressicornis was the first parasitoid species the specimens of which emerged simultaneously with adults of *T. brachyntera*. Parasitoid specimens started to emerge from galls collected in October at a temperature of 20°C after of 13 to 20 days.

Pseudencyrtus idmon and *Torymus heyeri* are second and third in succession of emergence. Specimens of both species emerged from galls after 14 to 24 days, in average 16–19 days after emergence of adults of *T. brachyntera*.

Aprostocetus micantulus is the fourth parasitoid with the longest time of development. Specimens started to emerge after 24 days and their emergence was prolonged – it lasted till 60 days.

Table 2. Rate of parasitism of *Thecodiplosis brachyntera* galls during the 1967–1968 outbreak and in years after that outbreak (shown as % of galled needles) in three main localities in the Czech Republic

Locality		1967	1968	1969	1970	1971	1972	1973	1974	1975
Krkonoše Mts. (P. m.)	% galled needles	29	34	6.2	3.8	1.1	4.4	8.5	1.6	1.3
Krkonoše Mts. (P. m.)	% rate of parasitism	*	41	23	8.5	6.0	*	2.0	0.0	3.0
Šumava Mts. (P. p.)	% rate of parasitism	*	20	40	24.0	7.0	4	8.0	2.0	7.0
Krušné hory Mts. (P. p.)	% rate of parasitism	*	34	29	5.6	4.0	3	5.0	7.0	2.0

P. m. = *Pinus mugo*; P. p. = *Pinus* × *pseudopumilio*; *parasitoids were not investigated

In October the galls of *T. brachyntera*, collected in nature and containing fully developed larvae in cocoons, were brought to laboratory conditions where they were kept in a refrigerator at 0°C until May. Subsequently in intervals of several weeks, starting with November to May, the samples were placed in emergence cages to follow emergence of gall midges and their parasitoids and duration of their development. Adults (gall midges and their parasitoids) emerged from galls brought from 0°C in 20°C at the end of November and at the beginning of December after longer time than from galls brought in 20°C in May and April. In the first case the development and emergence were prolonged and lasted much longer than in the second case. Interesting is the fact, that parasitoids emerged also after holding galls at 0°C from April to November.

Behaviour of adult parasitoid during process of building the opening hole

It was difficult to observe the process of building the opening hole by a parasitoid (Fig. 2). The opening is usually made in the inner part of the base of a galled needle. It was possible to observe this action successfully only in three cases of many. The process of construction of an opening hole lasts 15–18 hours. It is even possible to hear this action! The adult parasitoid, which is closed inside the gall, strikes bit by bit using its mandibles small pieces of inner matter of the needle. The biting lasts about one minute and then the parasitoid has a rest. It uses its midlegs and hindlegs to remove material which it was able to bite. After a long time the parasitoid opens a small hole in the wall of the galled needle. It gradually enlarges the hole. After 2–3 hours the opening hole is finished up to the upper side of the needle wall. Then the adult parasitoid attempts with the head to come out and if it is possible, it crawls through the opening. Then the parasitoid starts to clean its antennal segments with fore legs, at first one antenna and then the second one. Then the parasitoid takes off all small pieces of bittten needles from its body to be clean and after all these actions it is ready to fly out. Each parasitoid specimen always makes the emergence opening, even in the case if the galled needle pair is separated in the upper part to form a natural opening through which the parasitoid could leave the gall.

Correction of misidentification of *Misocyclops pini* (Kieffer, 1916), syn. of *Platygaster compressicornis* (Thomson, 1859)

Fankhänel (1962) and Fankhänel and Zeletzki (1964) published papers on the development and influence of the platygasteroid-parasitoid *Misocyclops pini* on the population density of *Thecodiplosis brachyntera*. They found in bodies of young and fully developed larvae of *T. brachyntera* small formations which they considered to be young larvae and apodal larvae of the parasitoid *Misocyclops pini.* These formations consist of a line of cells, on the proximal part of which lay two big cells, which are coalescend in the proximal part of the larval body with the oesophagus of the larva of *T. brachyntera*. These formations grow successively, in their posterior part. These authors also published data on the growth of these formations. They found these formations in a high number – up to 90% of larvae of *T. brachyntera* had them in their bodies. These authors considered these formations to be larvae of the pararasitoid *Misocyclops pini*.

Based on our microscope observation (Skuhravý 2007), these formations are not larvae of *Misocyclops pini,* they are in reality the salivary glands of larvae of *Thecodiplosis brachyntera*. The salivary glands of *T. brachyntera* also change their shape during development. In the course of studies of the larval anatomy of 190 gall midge species belonging to 70 genera (Skuhravý 2007), it was found that salivary glands of larvae of *Thecodiplosis brachyntera* belong to the *Contarinia*-type. These larval salivary glands have 2–4 giant cells on their proximal part. The posterior part of the salivary glands starts to be longer during larval development and the number of cells of the posterior line increases. The proximal part does not grow in such a manner

as in the early developmental stages of the larva of *T. brachyntera*.

It is necessary to conclude that the larvae identified and figured by Fankhänel and Zeletzki (1964: p. 710–711, Figs. 1 to 3) as larval stages of *Misocyclops pini* are in reality the salivary glands of larvae of *Thecodiplosis brachyntera***.** This confusion and serious misidentification deteriorate all results and their interpretation given in the paper of Fankhänel and Zeletzki (1964).

DISCUSSION

A large number of parasitoids of *Thecodiplosis brachyntera* were recorded up to the date of this paper. Four main parasitoids were found occurring on trees of four *Pinus* species in the mountains and in the lowlands of the Czech Republic. The abundance of parasitoids differed not only between the trees of a *Pinus*-species, but also between the different localities. The results have shown that the distribution of all parasitoid species is irregular in *Pinus* stands and is probably affected by the irregular distribution of larvae of *Thecodiplosis brachyntera*. Experiments were made in Vrkoč et al. (1973) in which the content of monoterpenes was analysed in needles of heavily and lightly attacked trees. No correlation was found. The effectiveness of the parasitoid may also depend on the sexual ratio. Large differences among the sexes were observed for *Platygaster compressicornis* – 90 females: l male (1,273 females to 1 male in the Krkonoše Mts., and 28 females to l male in the Šumava Mts.). This parasitoid, developing through polyembryony and producing more females than males, has a much greater effect on the population density of *Thecodiplosis brachyntera* than *Aprostocetus micantulus*. The correlation between the percentage of needles attacked by *Thecodiplosis brachyntera* and the percentage of larvae attacked by parasitoids is given in Fig. 3. The number of parasitoids peaks a year later than the peak of attacked needles. This is the most common case of correlation between the host and its parasitoids in nature.

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Cizopasní blanokřídlí (Hymenoptera) vázaní na bejlomorku borovou *Thecodiplosis brachyntera* (Diptera: Cecidomyiidae), škodící na borovici (*Pinus*) v České republice

ABSTRAKT: *Aprostocetus micantulus* (Thomson, 1878) (Chalcidoidea: Eulophidae), *Torymus heyeri* Wachtl, 1833 (Chalcidoidea: Torymidae), *Pseudencyrtus idmon* (Walker 1848) (Chalcidoidea: Encyrtidae) a *Platygaster compressicornis* (Thomson, 1859) (Platygasteroidea: Platygasteridae) jsou čtyři hlavní parazitoidi vychovaní z hálek bejlomorky borové *Thecodiplosis brachyntera* (Schwägrichen, 1835) (Diptera: Cecidomyiidae) na borovici kleči (*Pinus mugo* L.), borovici blatce (*P. rotundata* Link), borovici lesní (*P. sylvestris* L.) a borovici rašelinné (*P.* × *pseudopumilio* (Willk.) G. Beck) z čeledi borovicovitých (Pinaceae) v České republice v průběhu kalamity v letech 1967–1972. V celkovém množství 4 279 jedinců parazitoidů byl nejhojnější *Platygaster compressicornis* (1 778 jedinců, 41 %). *Aprostocetus micantulus* (1 047 jedinců, 25 %) a *Pseudencyrtus idmon* (1 020 jedinců, 24 %) byli méně hojní a *Torymus heyeri* (434 jedinců, 10 %) byl nejméně početný. V laboratorních podmínkách vylétli dospělci *Platygaster compressicornis* zároveň s dospělci *T. brachyntera*, dospělci *Pseudencyrtus idmon* a *Torymus heyeri* 14–24 dní po výletu imag *T. brachyntera* a dospělci *Aprostocetus micantulus* až po 24–60 dnech. Je popsáno chování imag parazitoida v průběhu tvorby výletového otvoru ve stěně hálky. Larvy, které určili a vyobrazili ve své práci Fankhänel a Zeletzki (1964) jako larvální stadia parazitoida druhu *Misocyclops pini*, jsou omyl; ve skutečnosti jde o slinné žlázy larev bejlomorky borové *Thecodiplosis brachyntera*.

Klíčová slova: blanokřídlí; parazitoidi; Chalcidoidea; Eulophidae; Torymidae; Encyrtidae; Platygasteroidea; Diptera; Cecidomyiidae; bejlomorka borová

Corresponding author:

Dr. Václav Skuhravý, CSc., Bítovská 1227, 140 00 Praha 4, Česká republika
tel.: + 420 261 261 684, e-mail: skuhrava@quick.cz