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Web-spinning sawflies of the genus *Cephalcia* Panzer (Hymenoptera, Pamphiliidae) in the *Picea abies* forests of the Beskidy Mountains (Poland)

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ABSTRACT: This article presents a review of data and results of investigations from the period 1958–2006 regarding the occurrence of insects of the genus *Cephalcia* Panzer (Hymenoptera, Pamphiliidae) in Norway spruce stands of the Beskidy Mountains (Western Carpathians, southern Poland). Currently, eight species are known for the area: *C. abietis, C. alashanica, C. alpina, C. annulicornis, C. arvensis, C. erythrogaster, C. fulva* and *C. masuttii*. Information regarding each species is given, with details on identification, local occurrence and importance.

Keywords: web-spinning sawfly; *Picea abies*; *Cephalcia*; Beskidy Mountains; Poland

The increased level of the occurrence of web spinning sawflies associated with spruce in the Polish part of the Beskidy Mts. is mentioned since the fifties of the previous century. Koehler et al. (1958) described a few, known for years, outbreaks of *Cephalcia abietis* in the Sudetes, and indicate its occurrence in those times in Beskid Śląski and Mały, within the Forest Inspectorates Szczyrk and Wapienica. During the following years, the occurrence of *Cephalcia abietis* was recorded in the Forest Inspectorate Porąbka (actually – Forest Inspectorate Andrychów) in Beskid Mały (Kapuściński, Capecki 1963). In the collections of the Forest Research Institute, Department of Forest Management in Mountain Regions in Cracow (FRI DFMMR), there are more than one thousand specimens of the genus *Cephalcia*, caught since the beginning of the eighties, mainly during periods of mass outbreaks in the Beskidy Mts. In the while, studies were conducted to recognize and describe the populations of individual species of web-spinning sawflies, their economic importance and biology (Ćwikliński 1986), as well as to propose methods of assessment of risk caused by these insects (Kosibowicz, Kozioł 1995; Jachym 1999). This paper presents the current state of knowledge about the occurrence of individual species of the genus *Cephalcia* in Norway spruces stands of the Beskidy Mts., located in the Carpathians (southern Poland).

MATERIAL AND METHODS

In order to describe the occurrence of the sawflies of the genus *Cephalcia*, a review of literature and available results of scientific research conducted in the Polish part of the Beskidy Mts. was done. This work presents data concerning the species occurrence and outbreaks in Beskid Śląski, Beskid Sądecki, and Gorce (Fig. 1) in the eighties and nineties (Table 1), and the results of preliminary study done in 2006.

The adults of *Cephalcia* were caught during the flight or by the use of an entomological net, as well as in collar traps mounted on tree trunks (Kosibowicz, Kozioł 1995). The ground-based emergence traps capturing insects swarming from the soil were also used, and the laboratory rearing of larvae was conducted (Figs. 2 and 3). In 2006 the studies were started in Beskid Śląski (Skrzyczne – 1,275 m a.s.l.), Beskid Sądecki (Radziejowa –

1,262 m a.s.l.) as well as in the Gorce Mts. (Kudłoń – 1,276 m a.s.l., Jaworzyna Kamienicka – 1,288 m a.s.l. and Mostownica – 1,244 m a.s.l.). The study plots were selected in Norway spruce stands on the areas affected by former outbreaks from 1980s. The collection of insects was conducted by collar traps (grouped by three or four traps, two groups in Skrzyczne, three groups in Gorce and two groups in Radziejowa), placed on study plots, and using an entomological net.

The species caught in Beskid Śląski, Beskid Sądecki and the Gorce in the eighties and nineties, which are available in the collection in Cracow, were determined mainly by Tomasz Huflejt (Polish Academy of Sciences, Zoology Museum and Institute, Warsaw) and sometimes by Leszek Ćwikliński (FRI DFMMR). The species occurring more rarely, like *C. alashanica* and *C. masuttii*, were also determined by Tomasz Huflejt. *C. fulva* and C. *annulicornis* were labelled by the author, in cooperation with Andrea Battisti (University of Padova, Italy).

RESULTS AND DISCUSSION

During the study in 2006, five species of *Cephalcia* were caught in the spruce stands in former outbreak areas (Table 2).

The mass occurrence of web-spinning sawflies (*C. abietis*, *C. alpina*, *C. arvensis*) in Beskid Śląski and Beskid Żywiecki was recorded since 1976, as described in details by Dudik (1992, 1996) and Kosibowicz and Jachym (1998). In the Skrzyczne Mountain, *C. alpina* was often accompanied by *C. erythrogaster* (Dudik 1996).

Table 1. Threat and control by *Cephalcia* spp. in Beskidy Mountains in 1976–1998 period

Years	Beskid Śląski			Beskid Sądecki			Gorce		
	threat	species	control	threat	species	control	threat	species	control
1976	75	*C. abietis*	0	0		0			
1977	0		0	0		0			
1978	79	*C. abietis*	0	0		0			
1979	196	*C. abietis*	0	0		0			
1980	76	*C. abietis/alpina*	0	175	*C. alpina*	0	1,092	*C. alpina*	0
1981	294	*C. abietis/alpina*	0	117	*C. alpina*	0	646	*C. alpina*	0
1982	382	*C. abietis/alpina*	421	131	*C. alpina*	0	1,150	*C. alpina*	0
1983	428	*C. abietis/alpina*	890	342	*C. alpina*	330	1,589	*C. alpina*	0
1984	181	*C. abietis/alpina*	1,042	296	*C. alpina*	430	1,368	*C. alpina*	0
1985	416	*C. abietis/alpina*	2,149	202	*C. alpina*	402	1,077	*C. alpina*	0
1986	349	*C. abietis/alpina*	1,245						
1987	142	*C. abietis/alpina*	546						
1988	79	*C. abietis*	307						
1989	18	*C. abietis*	442						
1990	737	*C. abietis*	1,522						
1991	0		115						
1992	29	*C. abietis*	155						
1993	0		0						
1994	245	*C. abietis*	545						
1995	581	*C. abietis*	1,184						
1996	12	*C. abietis/alpina*	147						
1997	488	*C. abietis/alpina*	772						
1998	1,009	*C. abietis*	741						
1999	0		0						

Table 2. *Cephalcia* specimens caught by entomological net and collar traps in 2006 and other *Cephalcia* found in the Beskidy Mountains

No.	Species name	Beskid Sądecki	Gorce	Beskid Śląski
1	*C. annulicornis* (Hartig, 1837)	22	10	5
2	*C. alpina* (Klug, 1808) (= *fallenii* Dalman)	40	26	53
3	*C. arvensis* Panzer, 1805	54	5	7
4	*C. abietis* (Linné, 1758)	2		
5	*C. erythrogaster* (Hartig, 1837)	1	2	2
6	*C. alashanica* Gussakovskij, 1935			Celary et al. (1997)
7	*C. fulva* Battisti & Zanocco, 1994			Shinohara and Zombori (2003)
8	*C. masuttii* Battisti & Boato, 1998			Jachym et al. (2005)

The development of the *C. alpina* outbreak between 1976 and 1985 in Gorce Mts. (formerly – Limanowa and Krościenko Forest Inspectorates, currently the area of the Gorce National Park) was described by Capecki (1982) and Honowski and Huflejt (1988). This work was done during the peak of mass occurrence, previously not observed anywhere at such a large scale. The occurrence of the same web-spinning sawfly species during the same period (1976–1984) in Beskid Sądecki (Radziejowa) was also described by Huflejt (1984) and Jasica (1985).

Due to weak taxonomic revision of the genus *Cephalcia* and the inaccurate or erroneous descriptions, the species *C. fallenii* was not distinguished for a long time from *C. lariciphila* (Wachtl), and both were mentioned from areas of Europe as *C. alpina*. Beneš (1976) finally stated the autonomy of these species, separated them and cleared the terminology. In relation to the revision by Beneš (1976), who solved the taxonomic problem by finding appropriate traits differentiating *C. fallenii* and *C. lariciphila,* and treated the other connected names of web-spinning sawflies as synonyms, the name *C. alpina* was not indicated as a younger synonym of *C. abietis* (as interpreted by Beneš), but as an older synonym of *C. fallenii*. Consequently, the name *C. alpina* should become obligatory for *C. fallenii* (Blank et al. 1998). In past Polish litera-

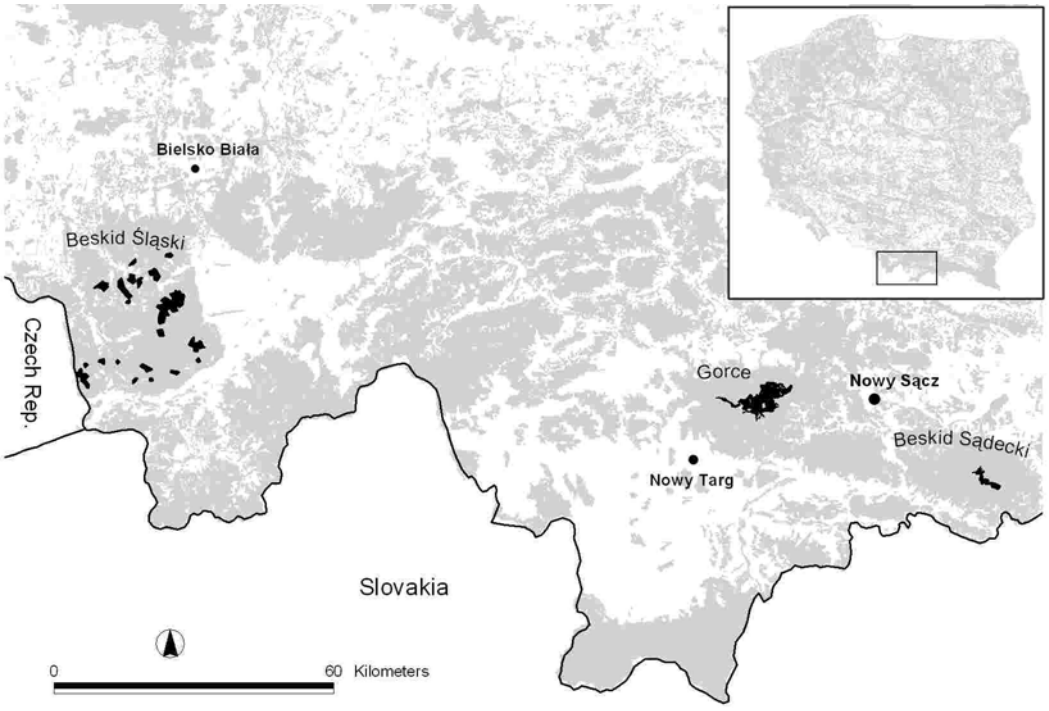

Fig. 1. Range of the area of interest. Occurrence and outbreaks in Beskid Śląski, Sądecki, and Gorce in the eighties and nineties

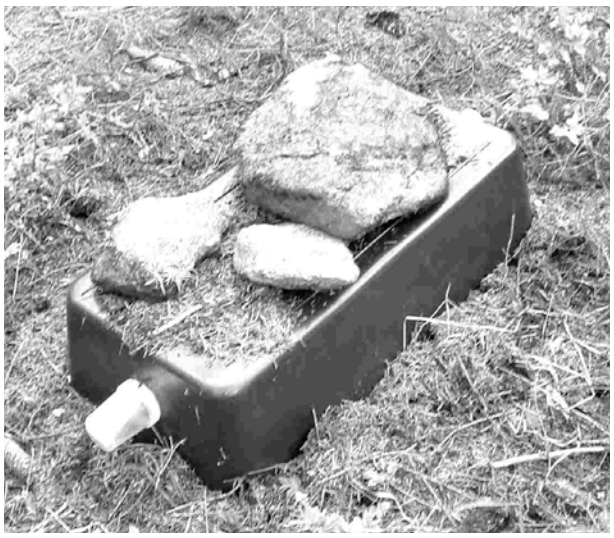

Fig. 2. Ground-based emergence trap capturing insects swarming from the ground (photo M. Kosibowicz)

Fig. 3. Collar trap mounted on tree trunks (photo M. Kosibowicz)

ture, however, *C. alpina* was treated as *C. fallenii* and thus all former publications related to *C. fallenii* have to be considered valid for the species nowadays called *C. alpina*.

The observations done during the strong swarming of adults, that occurred in the Skrzyczne massif in the eighties, indicated the probability of the occurrence of several *C. alpina* types (Ćwikliński 1986, 2000). The detailed studies allowing the separation of two species were conducted in 1990–1995 in Italy (Battisti et al. 1998). The material for their studies on species biology were obtained from the Czech Republic, Poland, and Italy. The results allowed to separate populations between two species formerly known from literature and called *C. alpina* and *C. annulicornis*.

The analysis of entomological materials from the mass occurrence areas of *C. alpina* (Beskid Śląski – 1976–1984, Gorce – 1978–1985, Beskid Sądecki – 1976–1984, Sudeten – 1982–1984, Gdańsk – 1993–1996), done by Italian scientists showed that a high percentage (up to 90%) of web spinning sawflies labelled as *C. alpina* showed morphological traits of *C. annulicornis*. Both species occurred together within outbreak areas, but their proportions varied drastically among locations, with no clear relationships to environmental factors, forest characteristics (type of stand, altitude), and local climate.

C. alashanica is known from Beskid Śląski. A few specimens were caught in Skrzyczne Mountain already in the eighties, they were placed in collections of FRI DFMMR in Cracow (Celary et al. 1997). A specimen from the same area from 1985 was also found in the Hymenoptera Collection of the Hungarian Natural History Museum in Budapest (Shinohara, Zombori 2003). Some species of *C. alashanica* from the collection in Cracow have been relabelled as *C. masuttii* (Jachym et al. 2005).

C. fulva was also described from Beskid Śląski, based on a specimen caught in 1985 (Shinohara, Zombori 2003) and repeatedly in spruce stands near Skrzyczne Mountain in 2004. A pair, male and female, was placed in the collections of FRI DFMMR in Cracow (Table 2).

Taeger et al. (2006) mentioned 7 species of the 8 that occur in Poland: *C. abietis*, *C. alashanica*, *C. alpina*, *C. annulicornis*, *C. arvensis*, *C. erythrogaster* and *C. fulva*, but *C. masuttii* was not indicated there. Celary et al. (1997) reported 5 species on spruce in Beskidy Mts. forests: *C. abietis, C. alashanica, C. alpina, C. arvensis, C. erythrogaster*; this author indicated also the occurrence of *C. pallidula* in north eastern Poland.

As considerable variation was observed among specimens, more research and new genetic methods of work will allow to improve knowledge about this genus and possibly help to recognize new species.

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Ploskohřbetky rodu *Cephalcia* Panzer (Hymenoptera, Pamphiliidae) v porostech smrku ztepilého v Beskydech (Polsko)

ABSTRAKT: Článek prezentuje zhodnocení dat a výsledků výzkumů z období 1958–2006, týkajících se výskytu hmyzu rodu *Cephalcia* Panzer (Hymenoptera, Pamphiliidae) na smrkových stanovištích v Beskydech (západní Karpaty, jižní Polsko). Aktuálně je z této oblasti známo osm druhů: *C. abietis, C. alashanica, C. alpina, C. annuli-*

cornis, C. arvensis, C. erythrogaster, C. fulva a *C. masuttii*. Předkládají se informace o všech těchto druzích s detaily o identifikaci, lokálním výskytu a významu.

Klíčová slova: ploskohřbetky; *Picea abies*; *Cephalcia*; Beskydy; Polsko

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