

# Correlation between flight activity of sawflies *Pristiphora abietina*, *P. saxesenii*, *P. gerula* and *P. leucopodia* (Hymenoptera: Tenthredinidae) and spruce (*Picea abies*) bud breaking in Eastern Czech Republic

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**ABSTRACT:** The flight activity of spruce tenthredinids were studied using Malaise traps and yellow sticky boards in young spruce forests in the Nížký Jeseník Hills during years 2005 and 2006. In most cases, studied species (*Pristiphora abietina*, *Pristiphora saxesenii*, *Pristiphora gerula*, *Pristiphora leucopodia*) showed a statistically significant correlation between numbers of specimens caught at two- or three-day periods and numbers of budded spruces in both years.

**Keywords:** *Pristiphora abietina*; *Pristiphora saxesenii*; *Pristiphora gerula*; *Pristiphora leucopodia*; Malaise trap; yellow sticky boards; flight activity; spruce bud breaking; correlation

At the end of the 20<sup>th</sup> century, the area of spruce forests damaged by tenthredinids reached the level about 4,000 ha per year in the Czech Republic. These damaged forests were placed at lower altitudes mainly in Northern Moravia and Silesia and Eastern Bohemia. Such a permanent outbreak is probably a result of (i) spruce forests stressed by drought at lower altitudes and (ii) strong coincidence between the peak of sawfly swarming and spruce bud breaking in these areas (HOLUŠA, HOLUŠA 2003). Spruce sawflies (Hymenoptera: Tenthredinidae: *Pachynematus* subgenus *Pikonema* and *Pristiphora* subgenus *Lygaeonematus*), lay eggs into buds after dropping of bud scales (PSCHORN-WALCHER 1982) and it is possible that the period of spruce bud breaking is shorter at lower altitudes and corresponds with flight activity of spruce tenthredinids, mainly *Pristiphora abietina* (Christ, 1791). The fact of strong

coincidence between the peak of sawfly swarming and spruce bud is also an important step in the integrated management model of *P. abietina* (HOLUŠA, DRÁPELA 2003). The flight activity of species *Pachynematus scutellatum* (Hartig, 1837), *Pristiphora abietina*, *Pristiphora decipiens* (Enslin, 1916), *Pristiphora leucopodia* (Hartig, 1837) and *Sharliphora nigella* (Förster, 1854) was already studied in Eastern Czech Republic (HOLUŠA 1999, 2002b; HOLUŠA, LUBOJACKÝ, in print). In this paper we focused on synchronization of spruce tenthredinids swarming with spruce buds breaking during years 2005 and 2006.

## MATERIAL AND METHODS

The study area is situated in the eastern part of the Czech Republic. The research was carried out

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in an intensively cultivated landscape of the Nízky Jeseník Hills (forest coverage 70%, dominance of Norway spruce 67.8%) (CULEK 1996). All spruce forests are of an artificial origin and were recently stressed by drought and honey fungus (HOLUŠA, LIŠKA 2002).

The flight activities of sawflies were studied by means of one Malaise trap of TOWNES (1972) type and five yellow sticky traps placed in each locality. The sticky traps consisted of yellow plastic boards 14.8 × 21 cm, coated with entomological glue (Chemstop®) on both sides and suspended from a branch approximately at 2 m above the ground. They were exposed on the south-eastern side of trees.

During years 2005 and 2006, the traps (Malaise traps as well as yellow sticky boards) were placed in five localities (Kyjovice: 49°49'30.17"N, 18°3'4.38"E, 390 m a.s.l.; Pustá Polom: 49°51'38.05"N, 18°0'16.99"E, 430 m a.s.l.; Podvihov: 49°51'36.47"N, 17°58'46.72"E, 460 m a.s.l.; Lesní Albrechtice: 49°48'21.09"N, 17°53'4.78"E, 460 m a.s.l.; Skřípov: 49°48'39.08"N, 17°52'59.02"E, 480 m a.s.l.) in very young closed spruce forests (10–20-year-old). They were exposed from the beginning of April to the end of June and were emptied every second or third day (J. Lubojacký leg.). All species were determined using the key by ZHELOKHOVTSEV (1988) (det. Lubojacký et Holuša) and scientific names are used pursuant to TAEGER et al. (2006).

In each study plot, we took photos of 25 spruces per every control check. Consequently, numbers of newly budded spruces were counted. Buds were 1–2 cm long after scales dropping.

Data from all localities and both methods were counted together (values were not high). The num-

bers of newly budded trees and the numbers of caught sawflies obtained from every control check were correlated using the program Statistica 7.0 ( $\alpha = 0.01$ ) (StatSoft 1999). Sets of points included one zero point before and after the first and the last specific value. Numbers related to breaking spruces were used in a logarithmic format.

## RESULTS

In total, 77 and 22 adults of *P. abietina* were captured in 2005 and 2006, respectively. The majority of them were caught by yellow sticky boards (2005: 40 males (M)/32 females (F); 2006: 10 M/7 F). In 2005, the flight activity lasted from May 4 to June 3 (i.e. 31 days) with the peak on May 13. Males flew from May 4 to May 27 and females from May 4 to June 3. In 2006, the flight activity lasted from April 28 to the end of May but was interrupted and some adults were caught later, on June 24 (at total 58 days) with the peak between May 12 and 14 (Fig. 1).

In total, 59 and 39 adults of *Pristiphora gerula* (Konow 1898) were captured in 2005 and 2006. Numbers of sawflies caught were equal in methods (Malaise traps 2005: 22 M/9 F; 2006: 19 M/10 F). Flight activity of both sexes was found between May 10 and May 29 (i.e. 20 days) with the peak on May 15 in 2005. In 2006, flight activity lasted from April 28 to May 31 but the latest adults were caught even on June 24. It means that it lasted for 58 days with the peak on May 12 in 2006 (Fig. 2).

In total, 71 and 64 adults of *Pristiphora leucopodia* were captured in 2005 and 2006. The majority of them were caught by Malaise traps (2005: 31 M/14 F; 2006: 44 M/7 F). Sawflies were captured

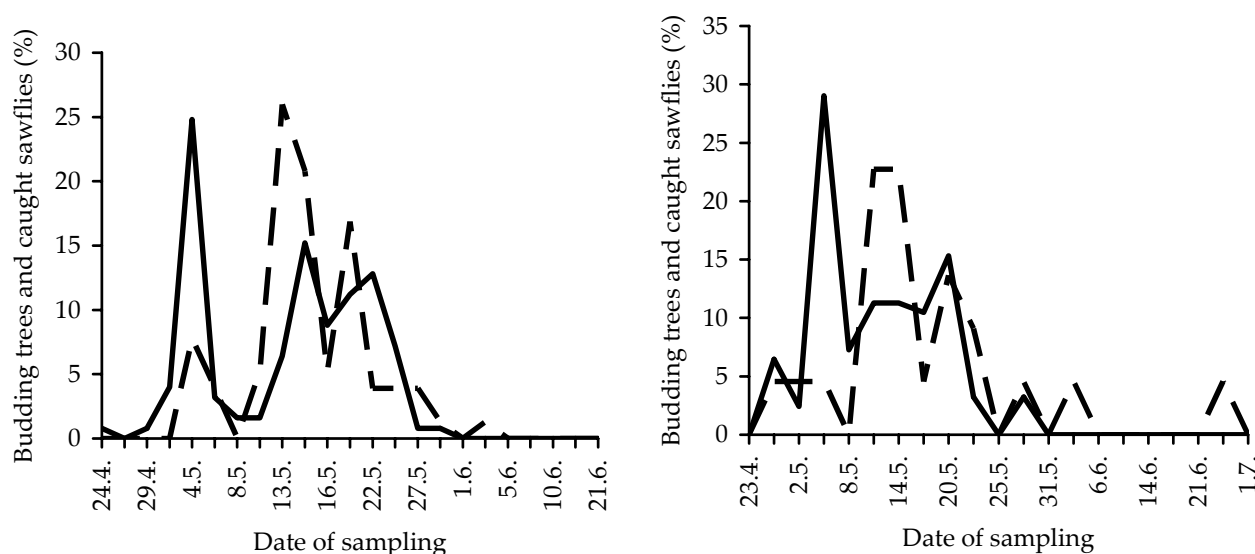


Fig. 1. Flight activity of *Pristiphora abietina* (dashed line) and breaking of spruce buds (in %) in 2005 (left) and 2006 (right)

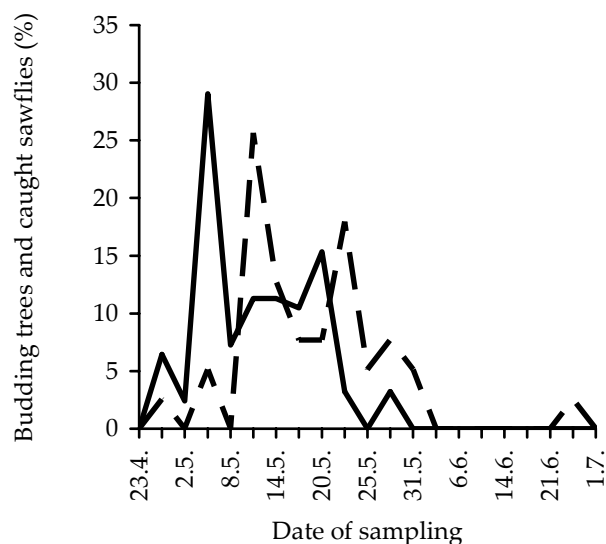
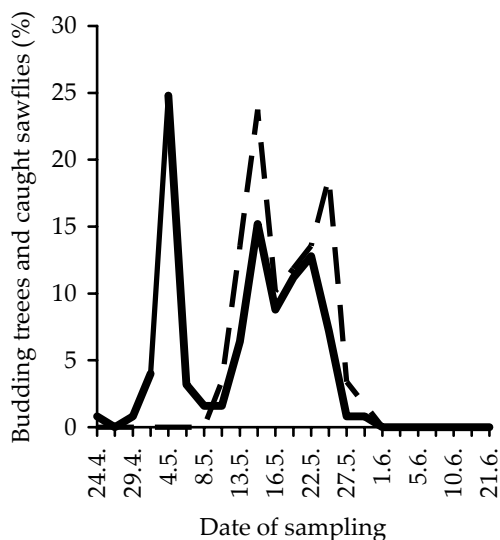


Fig. 2. Flight activity of *Pristiphora gerula* (dashed line) and breaking of spruce buds (in %) in 2005 (left) and 2006 (right)

in the period from April 29 to June 3 (i.e. 36 days) with the peak on May 15. The protandry was indicated by an early flight of males (between April 29 and May 27); followed by females recorded from May 6 to June 3. In 2006, the flight activity lasted 40 days from May 2 to June 10 with the peak on May 12. Males flew between May 2 and June 10; females between May 6 and June 3, 2006 (Fig. 3).

In total, 179 and 68 adults of *Pristiphora saxesenii* (Hartig 1837) were captured in 2005 and 2006. The majority of them were caught by Malaise traps (2005: 29 M/120 F; 2006: 27 M/32 F). Flight activity lasted from April 29 to June 3 (i.e. 36 days) with the peak on May 27 in 2005. The protandry was indicated

by an early flight of males (from April 29 to May 27) followed by females collected from May 15 to June 3. In 2006, the main period of flight activity lasted from May 6 to May 31 but the last adults were captured

Table 1. Correlation coefficients between numbers of spruce bud breaking and caught sawflies

Species/year	2005	2006
<i>Pristiphora abietina</i>	0.7733**	0.6473**
<i>Pristiphora gerula</i>	0.6861**	0.5531**
<i>Pristiphora leucopodia</i>	0.6205**	0.7136**
<i>Pristiphora saxesenii</i>	0.3268 n.s.	0.5788**

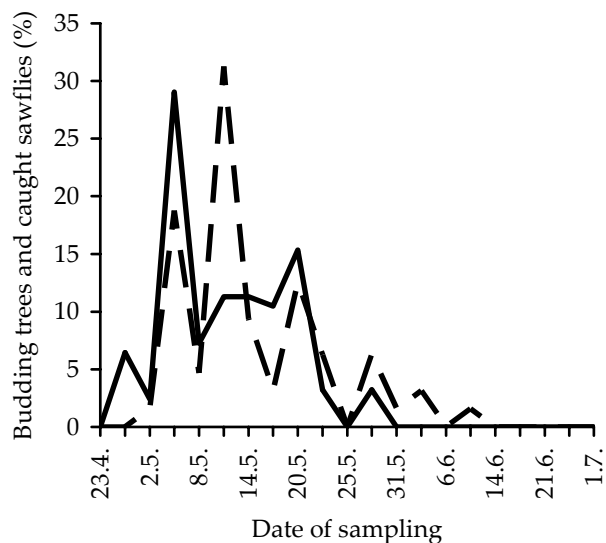
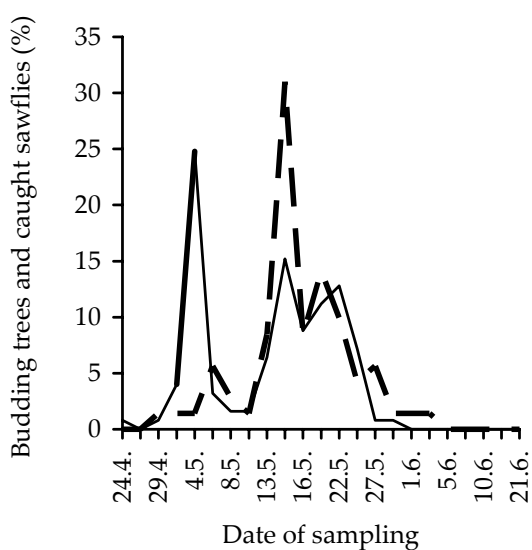


Fig. 3. Flight activity of *Pristiphora leucopodia* (dashed line) and breaking of spruce buds (in %) in 2005 (left) and 2006 (right)

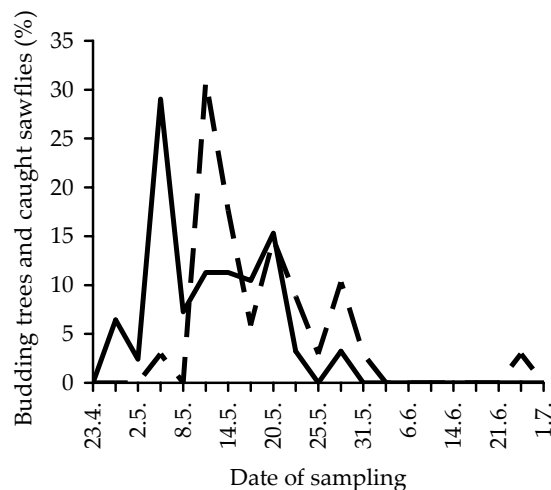
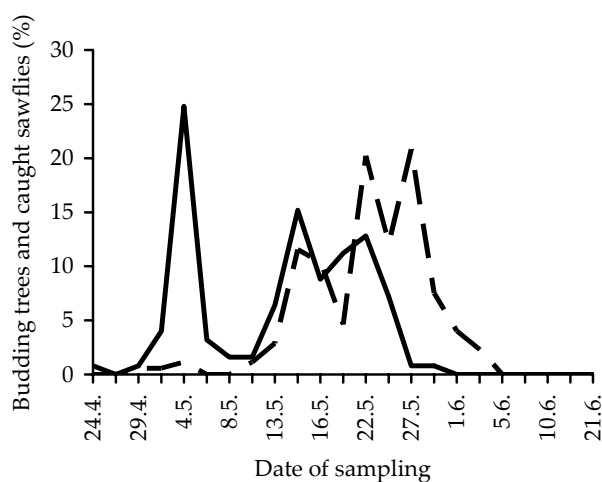


Fig. 4. Flight activity of *Pristiphora saxesenii* (dashed line) and breaking of spruce buds (in %) in 2005 (left) and 2006 (right)

after three-week pause (June 24, 2006) which lasted 50 days in total, with the peak on May 12. Males flew between May 6 and May 24 and females between May 12 and June 24, 2006 (Fig. 4).

The breaking of spruce buds lasted from the end of April or beginning of May in both years (Figs. 1 to 4). In most cases, species showed statistically significant correlation within both years (Table 1).

## DISCUSSION

The found flight activities of *P. abietina*, *P. gerula*, *P. leucopodia* and *P. saxesenii* correspond with already published data (PSCHORN-WALCHER, TAEGER 1995; HOLUŠA 1999, 2002b; KŘÍSTEK 1980; SCHEDL 1953; NIGITZ 1974). The flight activities were strongly influenced by rainy and cold weather that interrupted the swarming of sawflies mainly in 2006.

Although the spruce buds breaking started a bit earlier than the first sawflies emerged, statistically significant correlation between bud breaking and sawflies swarming was confirmed in almost all cases with the only exception of *P. saxesenii* in 2005. Despite our results confirmed the hypothesis of tight flight synchronization at lower altitudes, it is necessary to conduct a similar study in mountains. A permanent decreasing of spruce tenthrinid densities (LIŠKA, HOLUŠA 2006) in the whole Czech Republic hinders next studies. In spite of this fact, there was not found statistically significant decreasing of caught specimens in almost all cases (Mann-Whitney *U*-test,  $P > 0.01$ ) between 2005 and 2006. One exception was *P. saxesenii* caught in Malaise trap ( $P < 0.01$ ) which abundances were very low in comparison with former studies (HOLUŠA 2002a).

The best correlation was found in case of *P. abietina*. Its correlation coefficient was the highest and

the seasonal mode bud breaking and sawfly swarming was very similar. This might be the reason of high abundances and the outbreak potency of *P. abietina* in lower altitudes (HOLUŠA, HOLUŠA 2003; PSCHORN-WALCHER 1982). The synchronization is a consequence of climate and actual weather conditions that influence both the sawflies swarming and the spruce bud breaking.

Sex ratio was male biased or equal in almost all cases, however collected material represented a very small sample. The reason is higher activity of males that are caught in Malaise traps more frequently than females (see also ROLLER 1998). The exception was *P. saxesenii* in Malaise trap collections from 2005. The female biased sex ratio ( $\chi^2 = 33.24634$ ;  $P < 0.01$ ) could be influenced by various factors e.g. a trap location.

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## Korelace letové aktivity pilatek *Pristiphora abietina*, *P. saxesenii*, *P. gerula* a *P. leucopodia* (Hymenoptera: Tenthredinidae) s rašením smrku (*Picea abies*) na východě České republiky

**ABSTRAKT:** Letová aktivita smrkových pilatek byla studována pomocí Malaiseho lapače a žlutých lepových desek v mladých smrkových porostech Nízkého Jeseníku v letech 2005–2006. Ve většině případů jsme u druhů *Pristiphora abietina*, *Pristiphora saxesenii*, *Pristiphora gerula* a *Pristiphora leucopodia* v obou letech zjistili statisticky signifikantní korelaci mezi počty odchycených dospělců pilatek a počtem vyrašených smrků, zjišťovaných ve dvoudenních až tří denních intervalech.

**Klíčová slova:** *Pristiphora abietina*; *Pristiphora saxesenii*; *Pristiphora gerula*; *Pristiphora leucopodia*; Malaiseho lapač; žluté lepové desky; letová aktivita; rašení smrku; korelace

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