

STUDIES ON OCCURRENCE AND HARMFULNESS
OF CELERY FLY *PHILOPHYLLA HERACLEI* L.
ON SOSNOWSKI'S HOGWEED *HERACLEUM*
SOSNOWSKYI MANDEN

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Abstract: Studies on occurrence and harmfulness of celery fly on Sosnowski's hogweed plants were performed in 1999–2002 in three plots at Minikowo, Mochełek and Topolno. At Mochełek, Minikowo and Topolno 40.65, 39.42 and 32.14% of leaves, respectively were occupied by generation I of the fly while 14.8, 18.12 and 10%, respectively by the generation II. Most mines were caused by generation I in 2000 and 2002 at Minikowo and Mochełek. Generation II was characterized by a low population density in all plots.

Key words: *Heracleum sosnowskyi* Manden., *Philophylla heraclei* L., Diptera, Trypetidae

INTRODUCTION

Sosnowski's hogweed, *Heracleum sosnowskyi* (Apiaceae = Umbelliferae) originating from wild Caucasian flora was introduced to Poland in the eighties of the past century as a potential fodder plant (Lutyńska 1980; Pasięka 1984). Presently, the plant is a persistent and difficult to control weed. The plant forms dense thickets along roads, railway subgrades, water reservoirs, in pastures, meadows, gardens, parks, idle land and around buildings (Korniak and Środa 1996; Stupnicka-Rodzynkiewicz 1996).

Heracleum sosnowskyi has been attacked by many pests, including a celery fly, *Philophylla heraclei* L. (Diptera, Trypetidae).

In the literature only a few reports are available on the celery fly's development and feeding on Sosnowski's hogweed. Therefore, the main objective of these studies was to observe developmental cycle of *Philophylla heraclei* on *Heracleum sosnowskyi* and to determine harmfulness of this species for the plant.

MATERIALS AND METHODS

The research was performed in 1999–2002 in Kujawsko-Pomorskie Province, at Minikowo and Mochełek, and Topolno in 2002 only.

Observations were made weekly on 10 randomly selected and marked Sosnowski's hogweed plants during the whole vegetation period. The following parameters concerning the celery fly development were taken into consideration: number of generations, dynamics of population, size of mines and Mines Density Factor, MDF calculated using a Segebade and Schaefer formula (1979):

$$\text{MDF} = \frac{z}{n} ad$$

in which:

z – number of plants with mines,

n – number of observed plants,

a – ratio of leaves with mines to all analyzed leaves

d – average number of mines per one infested leaf

RESULTS AND DISCUSSION

During the four-year period, it was found that celery fly had two generations per annum and the first one was most numerous. Females of the fly laid eggs mainly on well insolated, upper and middle leaves. The first generation did not develop on young leaves of the weed in the first year of vegetation, probably due to their small surface. However, these plants were occupied by the second generation.

In 1999–2002 at Mochełek 40.65% of leaves were occupied by the first generation of the fly, at Minikowo 39.42%, and Topolno 32.14% while the generation II infested 14.81, 18.12 and 10% of leaves, respectively.

First mines were noticed in all three plots in the first decade of June, except the warmest 2000, when they appeared at the end of the second decade of May. Larvae of generation I mined leaves of biennial plants forming on the surface characteristic mine plates of various shapes, whitish at the beginning and turning brown. Later inside each mine 1–3 larvae were observed.

Larvae of generation I feeding on the leaves occupied area from 4.9 to 17.2 cm². Average size of mines at Minikowo was 8.3, at Mochełek 7.8 and at Topolno 7.2 cm².

The larvae fed for 3 weeks. Feeding period of the first generation overlapped usually the period of intensive growth of leaf lamina and reached the budding and flowering. Before pupation mature larvae made a hole in the leaf and fell out into the soil.

In studied habitats single individuals of generation II were collected in August while first larvae of generation II appeared in the first and the second decade of August.

Most frequently 1–2 larvae were observed inside mines of generation II. Sizes of mines occupied by generation II were smaller compared to generation I and ranged from 4.1 to 6.17 cm². The size of mines at Minikowo, Mochełek and Topolno averaged 5.1, 5.02, 4.23 cm², respectively.

Most of mines formed by generation I of the celery fly were observed in 2000 and 2002 at Minikowo and Mochełek. In 2000 maximal frequency of mines was observed in the 1st and 2nd while in 2002 in 2nd and 3rd decade of June. At Topolno (Fig. 3) 50% fewer mines were noticed than at Minikowo at the same time while least of all mines were observed in both plots in 1999 and 2001 (Figs 1, 2).

Generation II in all plots was characterized by a low number of flies in populations. Mines were observed from the first decade of August to the beginning of September (Figs 1, 2, 3). In the middle of September all mines were empty because larvae of generation II left the leaves and moved to the soil for overwintering as free pupae in a sort of cocoon.

At Minikowo (Tab. 1), on 10 randomly selected Sosnowski's hogweed plants with an average of 41 leaves damaged 235 mines were made. Generation I was responsible for 218 mines on 34 leaves. Generation II infested 7 leaves on average and formed 17 mines. The highest mines density factor was recorded for generation I (2.4701) and it was over 10 times lower for generation II (0.2281).

At Mochełek (Tab. 1) 192 mines were found on 40 leaves and again, generation I was most frequent: on average 179 mines were observed in 34 leaves. For generations I and II mine density factors were lower than at Minikowo and they reached 1.9624 and 0.1564, respectively.

At Topolno plot (Tab. 1) observations were made only in 2002. 170 Mines of the first generation of celery fly were found in 27 leaves. Much fewer leaves were mined by larvae of generation II. For generations I and II mine density factors equaled 1.1520 and 0.0600, respectively and were lower than at Minikowo and Mochełek.

According to Kabysz (1984; 1985) on plantation of *Heracleum sosnowskyi* in the Moscow district the number of mines per 100 leaves reached up to 450. Much fewer mines were found by Jurek (1989). The number of mines per 100 leaves in Kraków and Grodkowice ranged from several to a few dozen for generation I while for generation II they did not exceed 20. According to Kabysz (1985), after exceeding the

Table 1. Mining of *Heracleum sosnowskyi* Manden leaves by *Philophylla heraclei* L. larvae in 1999–2002

Station Generation	Number of mined plants*	Number of mined leaves		Number of mines in leaves		Mine Density Factor (MDF)
		total	average in veget. season	total	average in veget. season	
Minikowo						
generation I	39	136	34	874	218	2.4701
generation II	21	29	7	70	17	0.2281
Mochełek						
generation I	37	137	34	715	179	1.9624
generation II	19	24	6	53	13	0.1564
Topolno						
generation I	6	27	27	162	162	1.1520
generation II	3	4	4	8	8	0.0600

*per 10 analyzed plants in particular years of studies (at Minikowo and Mochełek, 40 plants; Topolno, 10 plants)

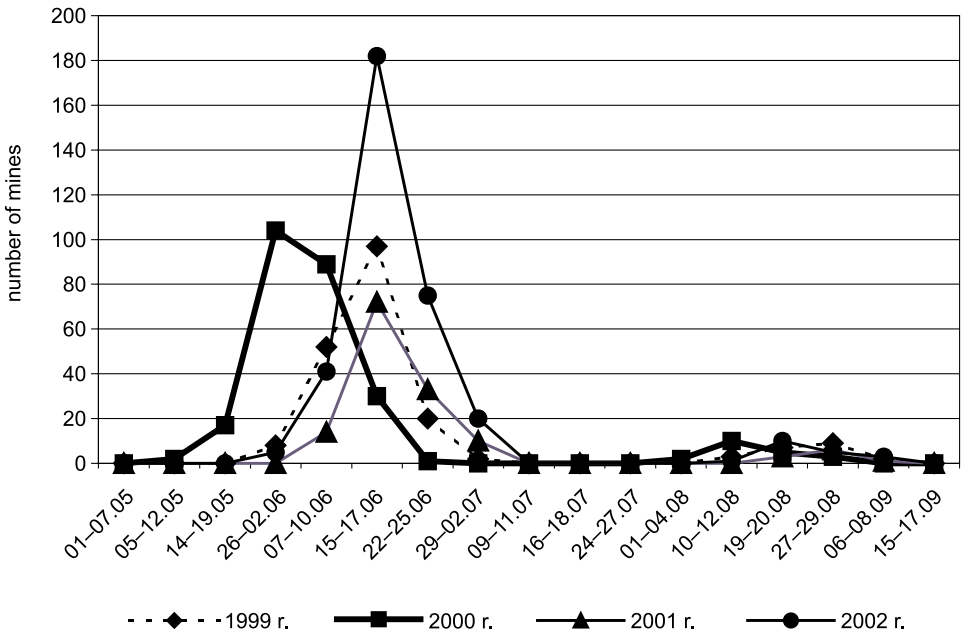


Fig. 1. Dynamics of *Philophylla heraclei* L. populations on leaves of *Heracleum sosnowskyi* Manden at Minikowo plot

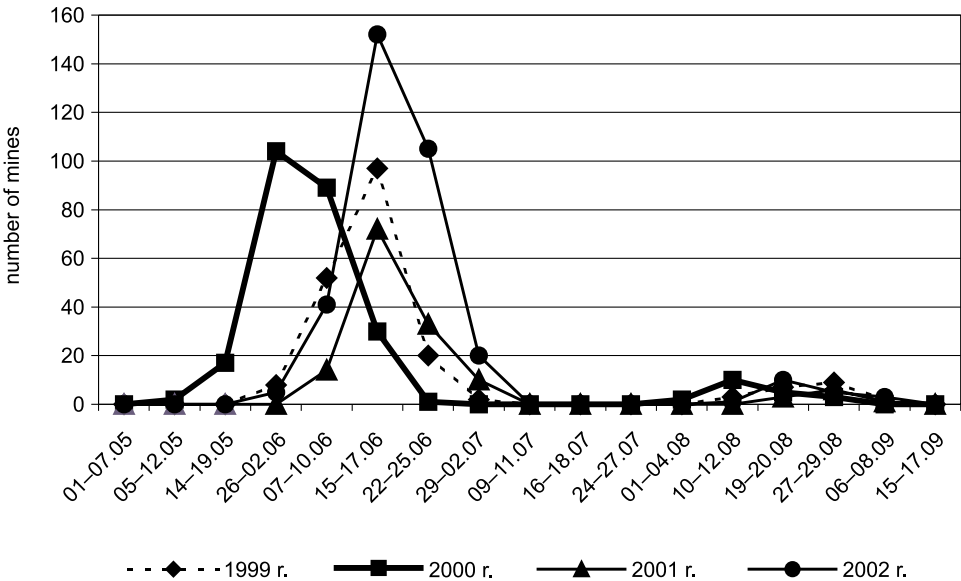


Fig. 2. Dynamics of *Philophylla heraclei* L. populations on leaves of *Heracleum sosnowskyi* Manden at Mochełek plot

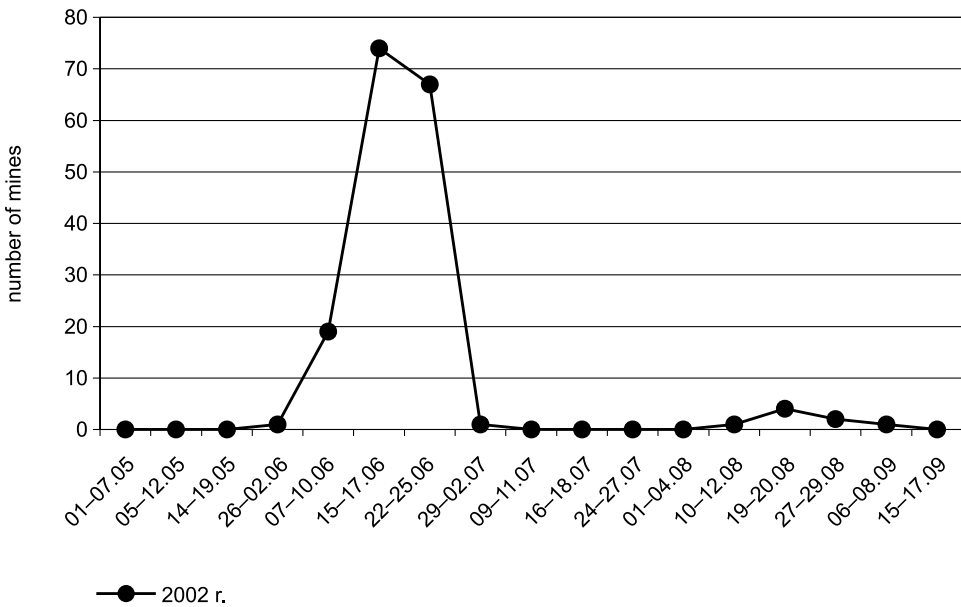


Fig. 3. Dynamics of *Philophylla heraclei* L. populations on leaves of *Heracleum sosnowskyi* Manden at Topolno plot

harmfulness threshold (for Sosnowski's hogweed plants cultivated for fodder the threshold ranged from 200–400 mines per 100 leaves), deterioration in quality of silage took place due to a decrease in protein and carotene content. At analyzed plots higher numbers of mines per 100 leaves were found: at Minikowo, Mochełek and Topolno, 576, 480 and 548, respectively.

Studies on feeding of the fly on leaves of celery in France were performed by Leroi (1975; 1977). It was found that generation I did not develop on celery but on wild *Apiaceae* because in spring-summer season celery leaves were too small. Therefore, only generation II appeared on the plant.

Celery fly was also found in other species of *Heracleum* (Beiger 1981; Michalska 1981; Sampson 1994).

REFERENCES

- Beiger M. 1981. Studia nad owadami minującymi Tatrzańskiego Parku Narodowego. Prace Kom. Biol. PTPN, 57: 3–68.
- Jurek M. 1989. Wpływ fitofagów na plon zielonej masy barszczu Sosnowskiego (*Heracleum sosnowskyi* Manden). Biul. IHAR 169: 85–94.
- Kabysz T.A. 1984. Czynność miniruszczich much i ich parazytów w posiewach borszczewika Sosnowskiego w zależności od sroków ukosów. Zaszcz. Rast., 6: 128–135.
- Kabysz T.A. 1985. Ukosy borszczewika a entomofauna. Zaszcz. Rast., 7: 25–26.
- Korniak T., Środa M. 1996. Występowanie *Heracleum sosnowskyi* Manden w północno-wschodniej Polsce. Zesz. Nauk. ATR Bydgoszcz – 196, Rolnictwo (38): 157–163.

- Leroi B. 1975. Influence d'une plante-hôte des larves (*Apium graveolens* L.) sur la stimulation de la ponte et de la production ovarienne de *Philophylla heraclei* L. (Diptera, Tephritidae). Compt. Rend. Hebd. Seanc., D: Scien. Natur., 281(14): 1015–1018.
- Leroi B. 1977. Compozt, insect, et milien tzophique. Collog. Tours: 443–454.
- Lutyńska R. 1980. Badania nad aklimatyzacją i wykorzystaniem barszczu Sosnowskiego (*Heracleum sosnowskyi* Manden) jako rośliny pastewnej. Biul. IHAR 139: 1–35.
- Michalska Z. 1981. Materiały do znajomości owadów minujących Górnego Śląska. Prace Kom. Biol. PTPN, 57: 89–100.
- Pasieka E. 1984. Wyniki badań nad *Heracleum sosnowskyi*. Zesz. Prob. Post. Nauk Rol., 257: 257–271.
- Sampson C. 1994. Cost and impact of current control methods used against *Heracleum mantegazzinum* (Giant hogweed) an the case for instigating a biological control programme. p. 55–65. In: "Ecology and management of invasive riverside plants (L.C. de Waal, L.E. Child, P.M. Wade, J.H. Brock, eds). Wiley, Chichester.
- Segebad R., Schaefer M. 1979. Zur Ökologie der Arthropodenfauna einer Stadtlandschaft und ihrer Umgebung. II. Pflanzengallen und Pflanzenminen, Anz. Schädl. Pflanz. Umwelt., 52: 117–121.
- Stupnicka-Rodzinkiewicz E., Klima K. 1996. Ekspansja *Heracleum sosnowskyi* Manden na terenie stacji doświadczalnej oraz okolicznych polach w Czyrnej k/Krynicy. Zesz. Nauk. ATR Bydgoszcz, 196 – Rolnictwo (38): 165–172.

POLISH SUMARY

BADANIA NAD WYSTĘPOWANIEM I SZKODLIWOŚCIĄ LIŚCIOLUBKI SELEROWEJ *PHILOPHYLLA HERACLEI* L. NA BARSZCZU SOSNOWSKIEGO *HERACLEUM SOSNOWSKYI* MANDEN

W latach 1999–2002 na trzech stanowiskach: w Minikowie, Mochelku i Topolnie przeprowadzono badania nad występowaniem i szkodliwością liściolubki selerowej na barszczu Sosnowskiego. W Mochelku obserwowano 40,65% liści zasiedlonych przez I pokolenie liściolubki, w Minikowie 39,42%, w Topolnie 32,14%, a przez II pokolenie kolejno: 14,81%, 18,12%, 10%. Najwięcej min powodowanych przez I pokolenie stwierdzono w latach 2000 i 2002 w Minikowie i Mochelku. Na wszystkich stanowiskach druga generacja charakteryzowała się niewielką liczebnością.