JOURNAL OF PLANT PROTECTION RESEARCH
Vol. 42, No. 1 (2002)

PEGOMYA NIGRITARSIS ZTT. (*DIPTERA, ANTHOMYIIDAE*) AS AN INTERESTING OPTION FOR BIOLOGICAL CONTROL OF *RUMEX CONFERTUS* WILLD.

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Accepted: November 11, 2001

Abstract: There is currently a very favorable climate for biological control of pest weeds. Moreover, biological control plays a significant role in the Integrated Plant Protection Management. Traditional methods of weed control, such as cultivation and the use of herbicides are not practical or desirable for some stands of weeds, and biological control has become an attractive strategy for control of pest weeds. Control of *Rumex confertus* Willd. by natural enemies that reduce its density is the good example of utilizing biological control on the European and worldwide scale. The aim of the conducted studies was to evaluate the dynamic of population of *Pegomya nigritarsis* Ztt. (*Diptera, Anthomyiidae*) on *Rumex confertus* Willd. and to determine the impact of pest's injuries on the growth of a plant.

Key words: biological control of weeds, *Rumex confertus*, biological agent, *Pegomya nigritarsis*.

INTRODUCTION

Rumex confertus Willd. is the plant taking over more areas in our country every year and is considered as one of the most dangerous uncultivated plant in the world due to its features and very strong expansion. Abundant seed production favors capturing new stands (Cavers and Harper 1964). Sorrel contains high amounts of oxalic acid and is therefore hazardous to animals. When consumed in large amounts the lethal poisoning of animals can occur.

Chemical control is incapable to decrease the population density. The rich root system helps the plant to grow again sprouts. Applied chemical plant protection products kill aboveground parts of the plant but usually around 20 days later new leaves emerge (Piesik 2000; Piesik 2001). Besides, the risk of environment contamination should not be disregarded when applying chemical plant protection prod-

ucts. Unjustified use of chemical treatments can induce either the insect's resistance or activate other not known earlier agrophages (Boczek 1996; Jędruszczak 1998; Marocchi 1989).

The awareness of the environment and sympathy for 'natural' approach to agrophage control favors using biological techniques in plant protection (Kovalew and Zaitzew 1996; Watson and Wymore 1989).

Pegomya nigritarsis Ztt. is known from its high effectiveness in controlling unwanted weeds (Spencer 1980).

The determination of the usefulness of this species for biological control and the implementation of the methods into practice emphasize the importance of these studies. Living in harmony with nature and avoiding interference plays the significant role in plant protection in the world (Labrada 1996).

METHODS AND AREA OF THE STUDIES

The experiments were carried out in 1997–1999 on *R. confertus* growing in natural stands near Bydgoszcz – Fordon and Toruń at the Vistula River over the whole vegetation period.

The terrain experiments were divided into several group projects:

1. Studies allowing evaluating the composition and development of insect population were carried out over the whole experimental period from spring to autumn. The catching was performed once a week in 1998 and 1999, while in 1997 it was done once a fortnight. Each time 25 full strikes with entomological scoop were done (one full strike per one leaf rosette tuft), what resulted in testing 25 plants.
2. The caught insects were taken for furthers experiments. The material collected this way was analyzed in the laboratory and used for rearing. The sampling took place in 1997 and 1998. Observations of biology, the occurrence of insect and other species injuring the plants have been performed over the whole plant vegetation period (May–September). Moreover, development stages were determined, what gave a picture of the number of generations over vegetation.
3. The injuries (mines) caused by *P. nigritarsis* were recorded over the whole vegetation season in both years of studies. The observation was performed once a week. Each time 10 randomly chosen leaves from each plant (10 plants marked at the beginning of vegetation season) were assessed.

RESULTS

P. nigritarsis is a fly usually about 5–6 mm long with a gray thorax and reddish-yellow abdomen. Yellow-black antennas are the distinctive characteristics. The larvae feed mostly on leaves.

In Bydgoszcz region two generations of the species were recorded, however both prolonged the development time (Fig. 1). The first generation developed from 15–20 of May to the end of June. The maximum occurrence of adults was at the beginning of June in 1998 and in mid of June.

The following generation had similar but a little longer period of occurrence, e.i. 7 weeks. Collecting imagines started in July and ceased at the end of August. The

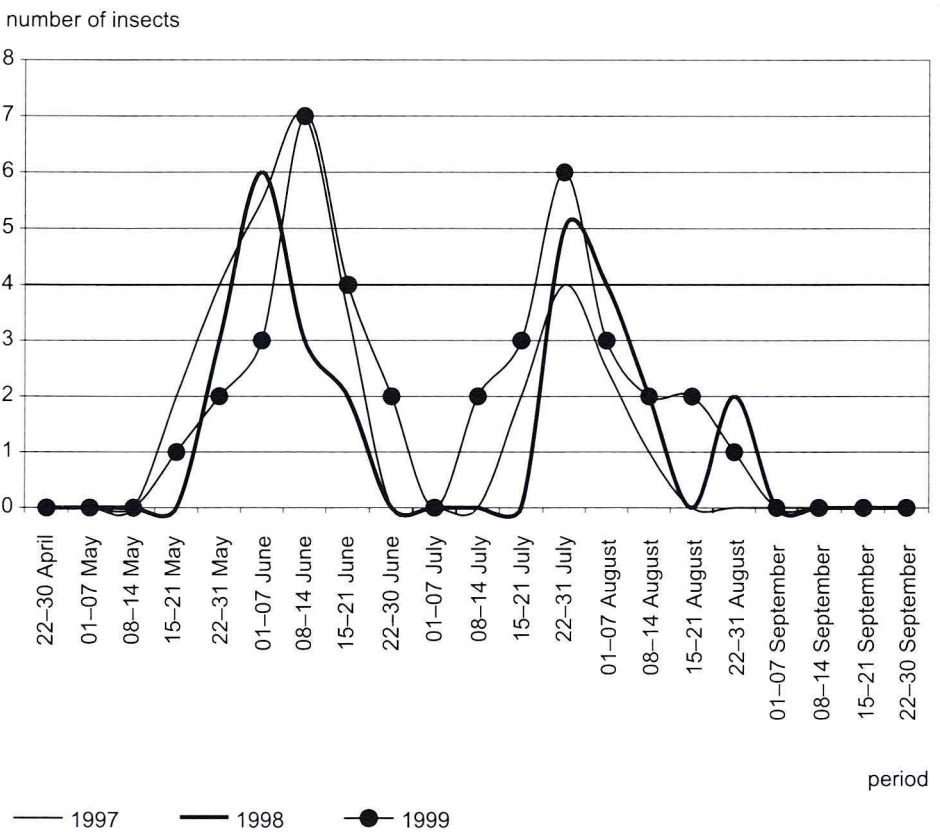

Fig. 1. Population dynamics of *P. nigritarsis* in Bydgoszcz region

highest density of the *P. nigritarsis* was observed in the year 1999 even though the species was observed in low numbers on the sorrel plants. Only the larvae are able to live in the interior of leaves since the adults are winged and therefore disperse, find host plants.

The analysis of the population dynamic of leafminers from *Pegomya* spp. in Toruń region (Fig. 2) showed the presence of two generations within the year. The first generation was observed after an overwitering of pupa. The imagines occurred at the beginning of May in 1999 and a little later in 1998. The second generation was partially found at the end of July (1999) and mostly in August.

At the beginning of September imagines of *P. nigritarsis* ceased the flight however, the larvae continued feeding intensively.

The numbers of caught species in both regions were similar. The first generation occurred a little bit later in Bydgoszcz region.

Over the whole vegetation season in both years the number of leaf mines on leaves caused by *P. nigritarsis* was recorded (Fig. 3). The number of mines increased on *R. confertus* from mid of May until mid of June. The development of first generation and the increasing number of leaf mines during this time were parallel.

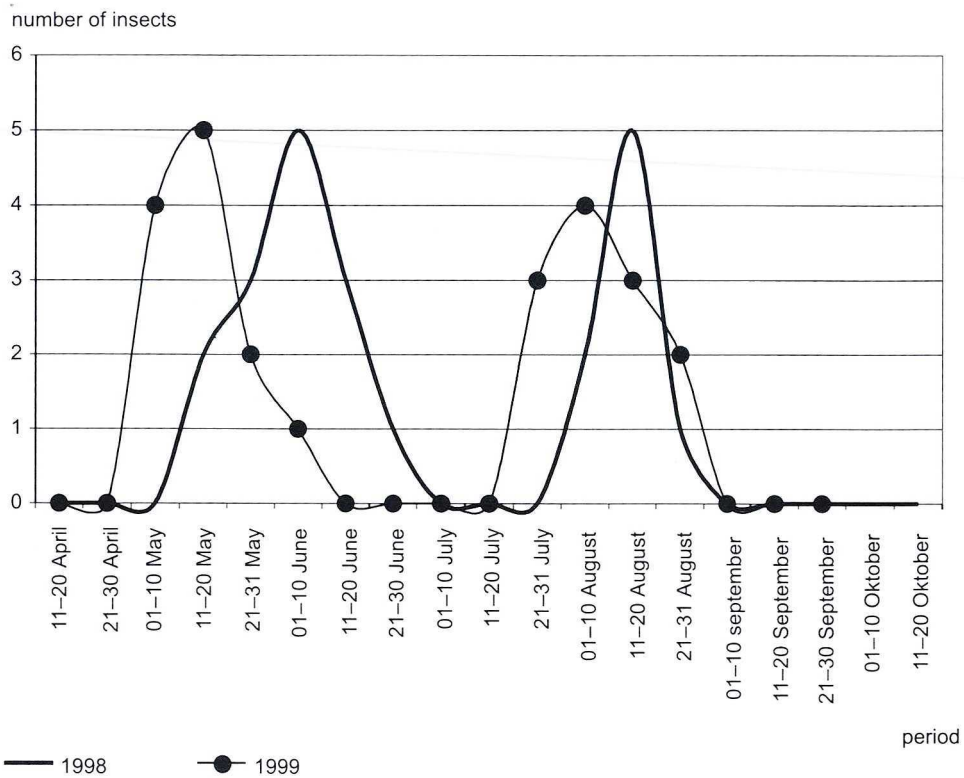

Fig. 2. Population dynamics of *P. nigritarsis* in Toruń region

As the maximum occurrence of larvae of second generation was in mid-August in consequences the number of mines was the largest as well. However, the value representing the injuries did not exceed 10% that meant that each time one leaf with mines was observed. The period of development of the second generation was significantly longer (about 2 months).

Large mines on leaves often 20 cm in length and 15 cm wide were found. The larvae feeding reduced the assimilation surface and occasionally plants with strong injuries dried out. The larvae were found in-groups or single in small mines. Once the larvae finished the development stage they drop to the ground to pupate and to overwinter. For the full development the larvae needed the amount of food equaled ¾ surface of the leaf. Generally the mines were not observed in the second part of September.

DISCUSSION

P. nigritarsis was the species reducing the growth of *R. confertus*. The larvae of this species making long, slender, winding, white tunnels in leaves caused serious injuries. At the stands where the research was conducted over 50% of plants was often attacked. Stomas near the injuries did not work correctly. The mines contained one

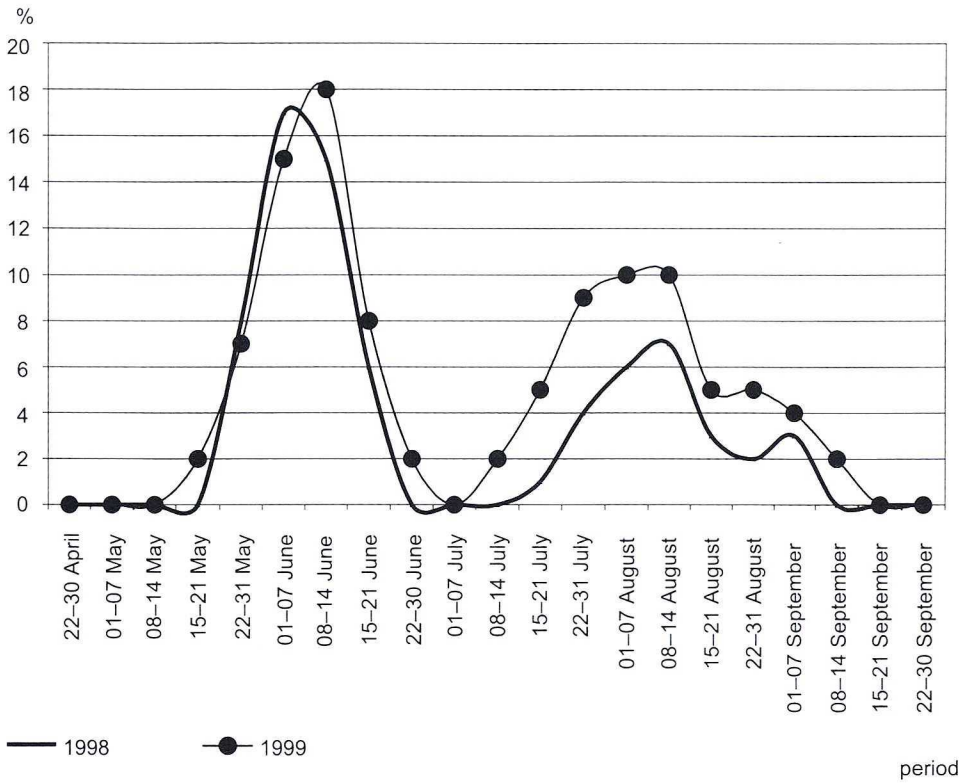

Fig. 3. The mines caused by *P. nigritarsis*

or few larvae. The size of injuries amounted to 75% of blade surface caused usually death of leaf. This sort of damages led to two different losses, i.e. reduction of the assimilation surface and disturbance of balance water stability. Zimmermann and Topp (1991) and Whittaker (1992) as well as Godfray (1986) have indicated the negative effects on plant's water balance resulting from leafminers injuries. According to Whittaker (1994) stomas in small mines show a tendency to stay close while in old open. Godfray (1986) is full of hopes that there is the future for research on other flies from *Pegomya* ssp., such as *P. steini* Hendel, *P. setaria* Meigen and *P. hyoscyani* Panzer as biological agents.

CONCLUSIONS

1. *R. confertus* a weed from the *Polygonacea* family was heavily injured by *P. nigritarsis*. The losses of vegetation mass were observed throughout the whole vegetation season staring from the rosette growth stage.
2. The number of generations settled the *R. confertus* growing in Bydgoszcz (1997–1999) and Toruń (1998–1999) was the same.
3. Larvae feeding decreased the assimilation surface and lead to drying out of leaves.

4. As the results show that *P. nigritarsis* feeds intensively on *R. confertus* the further research might be undertaken to investigate the effectiveness of control and other aspects important in introduction the species to control pest weeds.

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POLISH SUMMARY

PEGOMYA NIGRITARSIS ZTT. (*DIPTERA, ANTHOMYIIDAE*) JAKO INTERESUJĄCY GATUNEK DLA BIOLOGICZNEJ REGULACJI ROZWOJEM *RUMEX CONFERTUS* WILLD

Intensyfikacja produkcji roślinnej zmusza do poszukiwania coraz to nowszych sposobów walki z agrofagami. Metody biologiczne są znane od wielu lat. Cały czas jednak odkrywa się nowe owady mogące odegrać pewną rolę w redukowaniu zachwaszczenia.

Introdukcja nowych organizmów nie ma na celu wyeliminowania z ochrony roślin metod chemicznych. Jednak środki chemiczne są często mało selektywne, skażają środowisko oraz szybko stają się nieskuteczne, ponieważ organizmy nabywają odporności.

Pegomya nigriarsis Ztt. to gatunek mogący odegrać pewną rolę w biologicznej walce z tym chwastem. Larwy żerując w liściach silnie redukują powierzchnię asymilacyjną chwastu. Tak uszkodzone rośliny zasychają.