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RASPBERRY CANE MIDGE – *Resseliella theobaldi* (Barnes) – FLIGHT AND EGG LAYING DYNAMICS ON RASPBERRY FRUITING ON TWO YEAR OLD CANES

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A B S T R A C T

The raspberry cane midge, *Resseliella theobaldi* (Barnes), is a very important pest of raspberry plantations in Poland. Larvae of the pest damage primocanes on all of the raspberry cultivars, both these fruiting on two-year-old canes in June-July as well as those fruiting on primocanes in August – September. The larvae are feeding under the skin of primocane and cause damage to it. The canes are weak and dry up before harvest. The experiments were carried out during 2006-2007 in central Poland. The dynamics of midge's flight was monitored weekly in not protected, commercial raspberry plantation using standard pheromone traps. The standard white delta traps (20 x 20 cm base) with the raspberry cane midge sex pheromone "racemate" were placed at a height of 0.5 m above soil. Numbers of eggs and larvae were monitored in artificial splits on primocanes.

In Poland, the midge develops usually three generations a year. The flight starts at the end of April or at the beginning of May and lasts during the whole growing season, until beginning of October. On an unprotected raspberry plantation, cultivar 'Malling Promise', fruiting on two year old canes, intensive flight of the first generation of midges was noted in the first or second half of May, depending on the year. The most intensive flight of the pest's second generation was noted in the last decade of June and at the beginning of July, just before and during the harvest. The highest number of third generation males was noted on sticky traps in August, after 'Malling Promise' fruit harvest.

The best time to control the midges is early spring, before blossom of raspberry fruiting on two year old canes and in summer, after harvest of mentioned cultivars.

Key words: *Resseliella theobaldi*, *Rubus*, cultivar fruiting on two-year-old canes

INTRODUCTION

The raspberry cane midge, *Resseliella theobaldi* (Barnes), is a very important pest of raspberry plantations in Poland, especially on cultivars fruiting on two-year-old canes. However, larvae of the pest damage primocane on all of the raspberry cultivars, both these fruiting on two–year-old canes in June-July as well as cultivars fruiting on primocane in August – September (Łabanowska and Cross, in press). The larvae are feeding under the skin of primocane, and cause damage to it. The places where larvae are feeding are often infected by the fungi *Didimella applanata* and *Botritis cinerea,* causing raspberry stem diseases. The raspberry cane midge has been known in Poland as well as in other countries for many years, and is still a very dangerous pest in Great Britain, Switzerland, Hungary and other countries (Gordon et al., 2002 ab; Birch et al., 2004; Vetek et al., 2006; Cross et al., in press). This pest has to be controlled on many raspberry plantations. In order to get good results in chemical control, it is very important to know the right term of pest's flight (Gordon et al., 2002a). The treatment is recommended in the spring, at the beginning of the first generation's flight (Antonin et al., 1998). Very popular method to fix the correct time of control for some moth pests is using pheromone traps (Łabanowska, 2001; Płuciennik and Olszak, 2006). The time of controlling black currant stem midge (*Resseliella ribis*) was fixed by observation of the dynamic of egg laying in artificial injures on one year old shoots (Łabanowska, 1997, 2001).

The aim of this work was to monitor the population of the raspberry cane midge using pheromone traps (Cross and Hall, 2005) on raspberry fruiting on two-year-old canes and to fix the time of controlling this pest.

MATERIAL AND METHODS

The research study was a part of the "ring test" coordinated by East Malling Research.

Monitoring of the raspberry cane midge flight

The experiments were carried out during 2006-2007 on raspberry plantation 'Malling Promise' fruiting in June-July on two-year-old canes. The plantation, a few years old, was located in the Experimental Orchard in Dąbrowice, belonging to the Research Institute of Pomology and Floriculture in Skierniewice (central Poland). The standard pheromone white delta traps (20 x 20 cm base) were baited with a rubber septum lure containing 10 µg of the raspberry cane midge sex pheromone "racemate" and were placed at a height of 0.5 m above the soil. The flight of midges was monitored weekly. The pheromone was changed monthly during the season, but the trap's bases were changed weekly.

Monitoring the raspberry cane midge egg laying

Experiment was carried out during 2006-2007 on the raspberry plantation as above. Number of eggs

and larvae were monitored in artificial splits (injuries) on primocanes, which were made once a week throughout the whole vegetation season. The artificial splits (injuries) were made every week on 20 primocanes, on unprotected raspberry plants. After one week 10 primocanes were collected and taken to laboratory. Next 10 primocanes were collected two weeks after splits were made. These observations were repeated using the same methodology during the whole vegetation season. Numbers of eggs and larvae were counted in artificial splits on primocanes in laboratory under stereoscopic microscope.

RESULTS

Monitoring of the raspberry cane midge flight

On unprotected raspberry plantation cultivar 'Malling Promise' in 2006, the flight of the raspberry cane midge started in the first half of May and lasted for the whole vegetation season, until the end of September (Fig. 1). The first generation intensive flight and the highest number of males caught on pheromone sticky traps were noted in the second half of May and in the first days of June. The intensive flight of the second generation took place at the end of June and in the two first decades of July, during the harvest. Much lower number of males was noted in pheromone traps in August and September. We believe it might have been not very numerous third generation of the pest. Generally, the most intensive flight and the highest number of males caught in pheromone traps were noted in last days of June and in the first half of July, during the fruit harvest.

In 2007, on 'Malling Promise', the flight of midges started at the end of April and lasted until the last decade of September (Fig. 2). The most intensive flight of the first generation of midges was observed in the first half of May, but of the second generation during the second and the third decade of June, just during blossom and before or during the beginning of harvest. The intensive flight of the third generation of the pest were noted in the second half of July and the beginning of August. Generally, the most intensive flight and the highest number of males caught in pheromone traps were noted in the two last decades of June, during the flight of the second generation of midges, just before harvest.

Two years of observation on raspberry fruiting in June-July suggested that the raspberry cane midge in Poland has at least 3 generation a year. The imagines of midges of the first generation appear in the end of April and in May or even on first days of June, before blossom of raspberry cultivars fruiting on the two-year-old canes. The second generation appears just during the end of blossom or just before or during the harvest of mentioned cultivars. The third generation is active flying after harvest of cultivars fruiting on two–year-old canes.

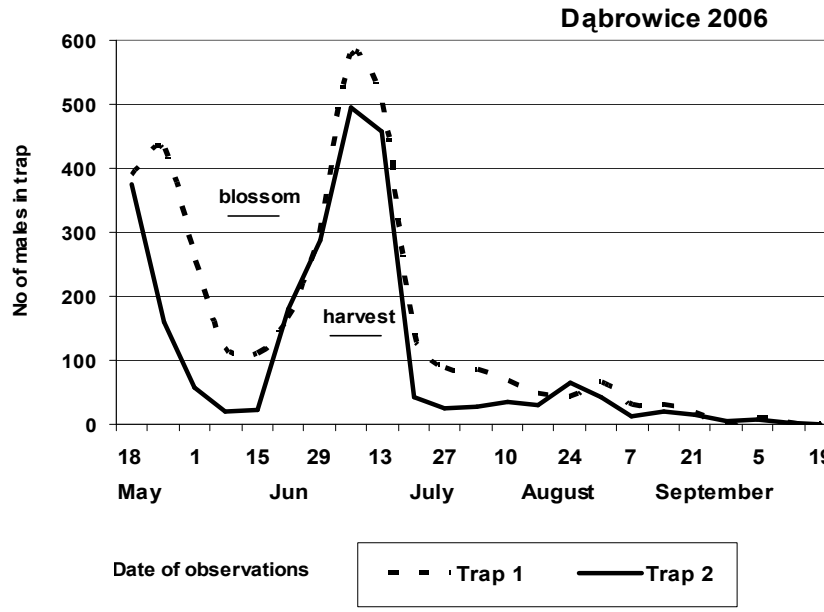

Figure 1. Dynamic of the raspberry cane midge (*Resseliella theobaldi*) flight in the year 2006

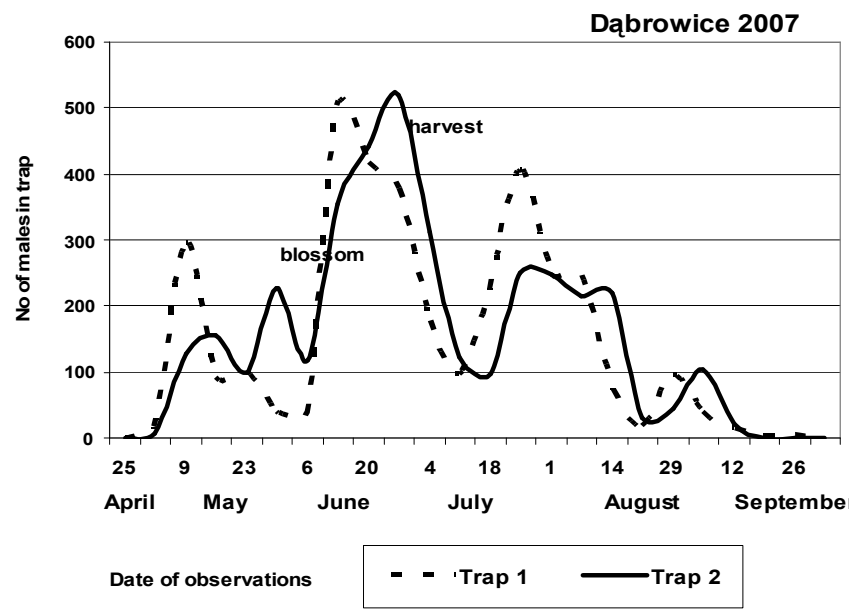

Figure 2. Dynamic of the raspberry cane midge (*Resseliella theobaldi*) flight in the year 2007

Dynamics of the laying eggs by the raspberry cane midge

On unprotected raspberry 'Malling Promise' plantation in 2006 the highest number of eggs and larvae of the first generation of the raspberry cane midge was observed before blossom, in the second half of May (in one week old splits) and at the beginning of June (in two weeks splits) (Fig. 3a,b). In this time the highest number, over 2 eggs and larvae per 1 cm of split was noted. The highest number of eggs and larvae of the second generation of the pest was noted at the end of June and until the middle of July, just before and during the harvest of 'Malling Promise'; per 1 cm of split even as many as 8 eggs and larvae were observed. Later on in the season the number of eggs and larvae decreased. In 2007, the highest number of eggs and larvae was noted in the second half of June, shortly before harvest (about 4 or over 4 eggs and larvae per 1 cm of a split) and after the harvest - almost 6 specimens per 1 cm of split (Fig. 4a,b). Later on in the season number of eggs and larvae was decreased.

Generally, during two years observations on raspberry fruiting on two-year-old canes, the eggs were laid to artificial splits on primocanes and larvae were feeding on shoots, just under the skin, from May until September.

The first generation appears in May, before blossom of 'Malling Promise' fruiting on two-year-old canes in the end of June and in July, but before blossom of the primocane fruiting cultivars (Łabanowska and Cross, in press). The second generation of the pest appears during the harvest of mentioned cultivar fruiting on two-year-old canes, but just before and during the blossom of the primocane fruiting cultivars as Polka or Polana. The last generations occurs after the harvest of cultivars fruiting on two-year-old canes ('M. Promise'), but during the harvest of the primocane fruiting cultivars as 'Polka' or 'Polana' (Łabanowska and Cross, in press).

Pheromone traps are very useful in monitoring the flight of the raspberry cane midge. The optimum term for controlling the pest is the peak of the flight and the time when females of first generation lay eggs, before blossom of raspberry fruiting on two year old canes as well as after fruit harvest. The method of egg laying monitoring was effectively used to fix the optimal time to control the black currant stem midge on black currant (Łabanowska, 1997). However, using the sex pheromone traps made monitoring of the moth fly in apple orchard (Płuciennik and Olszak 2006) or on the black currant plantation (Łabanowska, 2001) much easier.

CONCLUSIONS

In central Poland there are three generations of the raspberry cane midge per year, therefore flies, eggs and larvae are present on the plantation during the whole growing season, from spring until autumn.

On cultivars fruiting on the two-year-old canes the chemical control

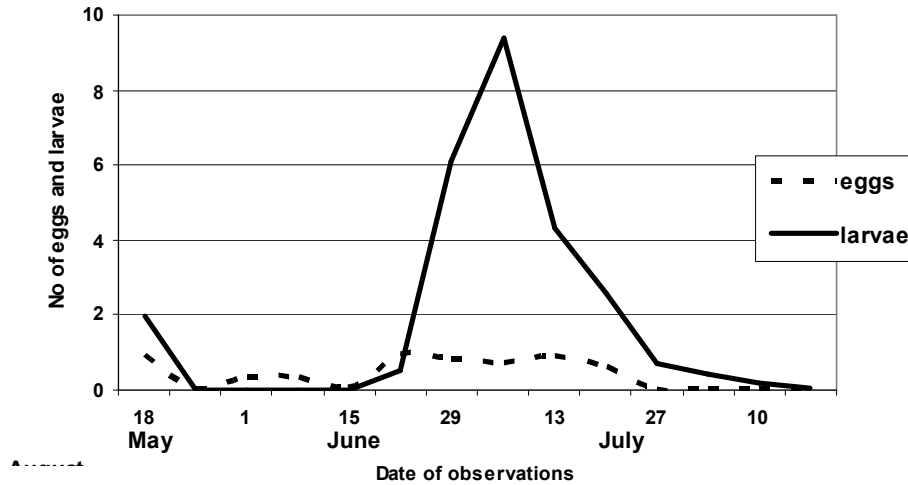

Figure 3a. Number of eggs and larvae of raspberry cane midge per 1 cm of one-week-old split in the year 2006

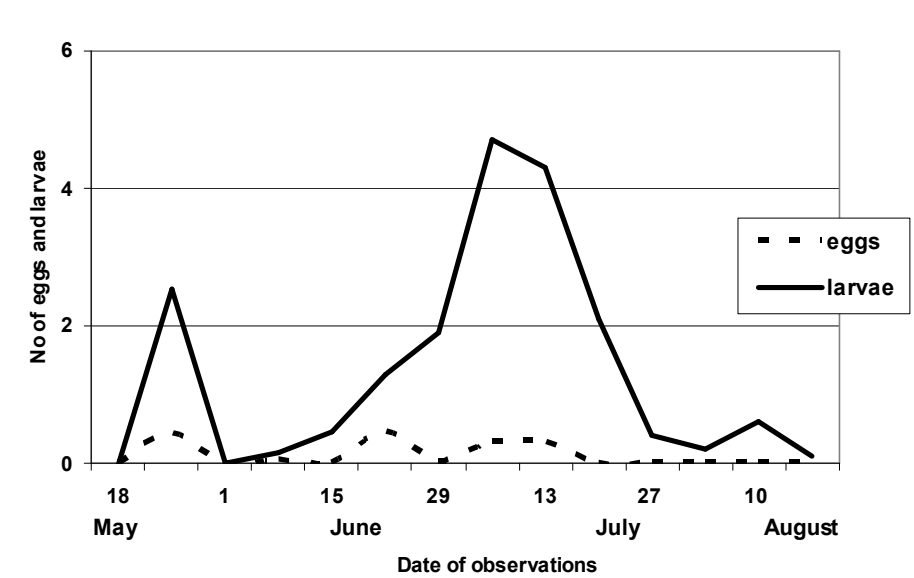

Figure 3b. Number of eggs and larvae of raspberry cane midge per 1 cm of two-week-old split in the year 2006

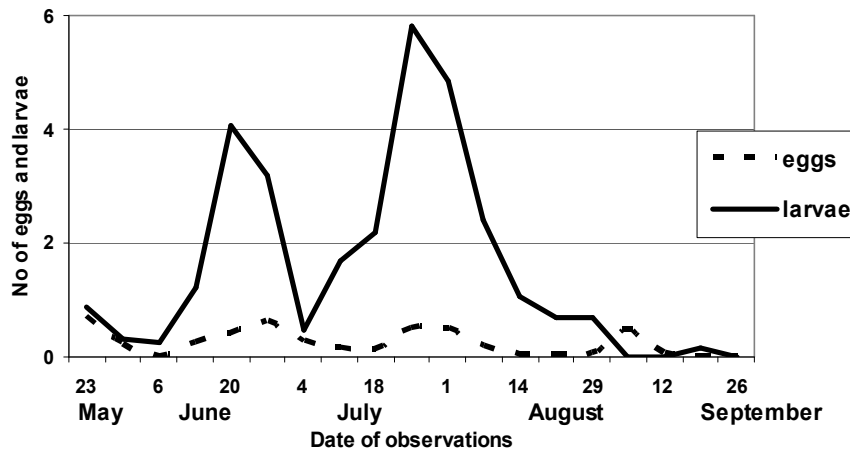

Figure 4a. Number of eggs and larvae of raspberry cane midge per 1 cm of one-week-old split in the year 2007

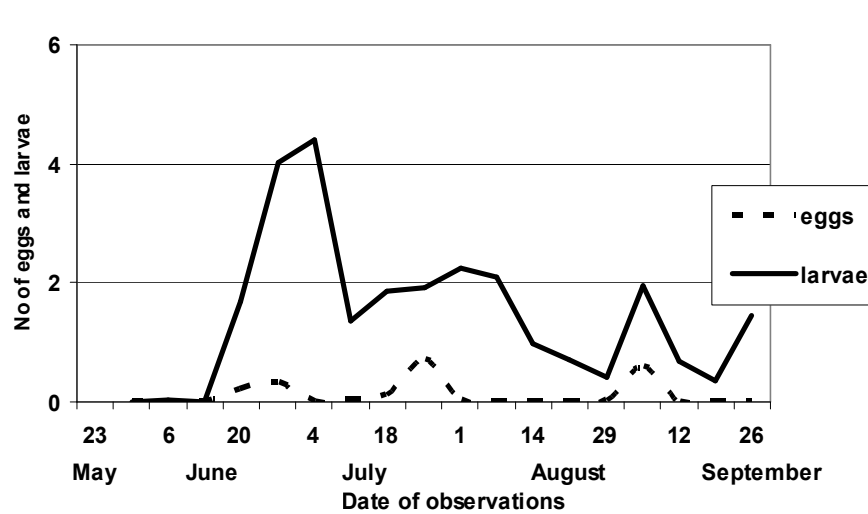

Figure 4b. Number of eggs and larvae of raspberry cane midge per 1 cm of two-week-old split in the year 2007

is possible during the flight of the first generation, before harvest and third generation, after fruits harvest.

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PRYSZCZAREK NAMALINEK ŁODYGOWY – *Resseliella theobaldi* (Barnes) – DYNAMIKA LOTU MUCHÓWEK I SKŁADANIA JAJ NA MALINIE OWOCUJĄCEJ NA PĘDACH DWULETNICH

Barbara H. Łabanowska i Jerry Cross

S T R E S Z C Z E N I E

Pryszczarek namalinek łodygowy *Resseliella theobaldi* (Barnes) jest bardzo ważnym szkodnikiem maliny w Polsce. Jego larwy żerują pod skórką pędów jednorocznych wszystkich odmian, zarówno owocujących na pędach dwuletnich w czerwcu – lipcu, jak i owocujących na pędach jednorocznych w sierpniu – wrześniu. Uszkodzone pędy są osłabione i zasychają przed owocowaniem. Doświadczenia prowadzono w latach 2006-2007 w Polsce centralnej na niechronionej plantacji maliny. Dynamikę lotu muchówek monitorowano raz w tygodniu, odławiając samce w standardowe pułapki typu delta z feromonem pryszczarka zawieszone 0,5 m nad ziemią. Dynamikę składania jaj i wylęgania się larw określano raz w tygodniu. W tym celu na plantacji zaznaczano pędy, wykonywano na nich sztuczne zranienia, w które samice składały jaja. Część pędów wycinano po jednym tygodniu, a część po dwu tygodniach. W laboratorium liczono jaja i larwy w zranieniach. Obserwacje prowadzono przez cały sezon wegetacji.

W warunkach Polski pryszczarek rozwija zwykle 3 pokolenia w roku. Lot muchówek trwa od końca kwietnia lub początku maja aż do początku października. Na odmianie ‘Malling Promise’ owocującej na pędach dwuletnich intensywny lot muchówek pierwszego pokolenia notowano w pierwszej lub drugiej połowie maja, zależnie od roku. Intensywny lot drugiej generacji wystąpił w ostatniej dekadzie czerwca i na początku lipca, przed lub podczas zbioru owoców. Największą liczbę samców trzeciego pokolenia notowano w pułapkach w sierpniu, po zbiorze owoców z odmiany ‘Malling Promise’. Na podstawie obserwacji przebiegu lotu muchówek łatwo jest wyznaczyć termin zwalczania pryszczarka. Na odmianach owocujących na pędach dwuletnich jest to okres przed kwitnieniem i na początku kwitnienia oraz po zbiorze owoców.

Słowa kluczowe: pryszczarek namalinek łodygowy, *Resseliella theobaldi*, malina, ‘Malling Promise’