APHIDS AND OTHER HEMIPTEROUS INSECTS	VOL. 14 147-153

The influence of selected host plants on the development of *Rhopalosiphum padi* (Linnaeus, 1758) /Hemiptera, Aphidoidea/ population

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Introduction

Rhopalosiphum padi (Linneaus, 1758) is a host alternating species, which migrates cyclically between bird cherry (*Pranus padus* L.) (primary host) and herbaceous plants of the grasses family, Poaceae (secondary hosts). The research on the environmental interactions taking place between the *R. padi* and its host plants was concentrated for a long time mainly on cereals, due to the harm caused by these phytophags (Leszczyński *et al.* 1990; Quiroz *et al.* 1997; Ruszkowska, 1997). They were concerned with the primary host and the process of spring migrations to a lesser extent, while the aspect of differentiation of *R. padi* secondary hosts was almost completely omitted.

The aim of this paper was to study the development of *R. padi* population on primary host and selected secondary hosts: orchard grass (*Dactylis glomerata* L.), the wild-growing plant and winter triticale (crop plant).

Material and methods

R. padi populations development was observed in the Alexandria Park in the town of Siedlce in 2003-2005. The number of *R. padi* aphids on primary host was assessed on 50 young shoots of bird cherry selected at random (each about 30 cm long), from the moment of fundatrices appearance until the disappea-

rance of their population on the shrub. The population dynamics on orchard grass and winter triticale cv. Marko was researched from the moment of the first migrant settling until the disappearance of insect population. The number of aphids on the secondary hosts was assessed in a week-long intervals, on 50 plants selected at random, in three repetitions.

Results

First specimens of *R. padi* hatched from the overwintering eggs on the primary host in the second half of April. Along with the development of the fundatrices generation on young shoots of *P. padus*, a sudden increase in the number of population was observed leading up to the maximum number in the first (2004 and 2005) or second (2003) decade of May (Fig. 1). During the period of maximum aphid density on *P. padus*, the winged migrants started to appear in the population which resulted in the decrease of *R. padi* number dynamics on this host and their settling of the secondary hosts. The first winged specimens of *R. padi* appeared on orchard grass (*Dactylis glomerata* L.) and winter triticale in the first or second decade of May, during an intensive growth of these plants in the stages of stem elongation and earing. In May and June an increase in *R. padi* population on secondary hosts was observed until their peak number at the end of June, the beginning of July, which on triticale always took place around one week earlier than on orchard grass (Fig. 1). When comparing the level of *R. padi* population in 2003-2005, one has to state that the highest number of aphids on *Prunus padus* was observed in 2004, however, on secondary hosts in that year the smallest number of *R. padi* was recorded. The highest number of *R. padi* on secondary hosts was observed in 2003. Moreover, in three years of research, more aphids were recorded on a wild-grown host than on a crop plant, though in all the years of research the level of *R. padi* population on secondary hosts was low.

When analyzing the presence of winged *R. padi* specimens on the studied host plants it was found out that their greatest number on cherry bird always took place in the second half of May (Tab. 1). One has to point out to the fact that during the survey of *P. padus* shoots, one recorded only a part of winged specimens which were formed in the population. On orchard grass and winter triticale most winged morphs migrating from *P. padus* were recorded in the third decade of May and in the first days of June. During the summer generation (exules) development few winged specimens also appeared on the studied secondary hosts. During all the years the migrating specimens of *R. padi* settled orchard grass to a greater extent than winter triticale. Moreover, the years of a higher number of migrants settling the secondary hosts were characterized by a higher level of *R. padi* population in these plants (Fig. 1, Tab. 1).

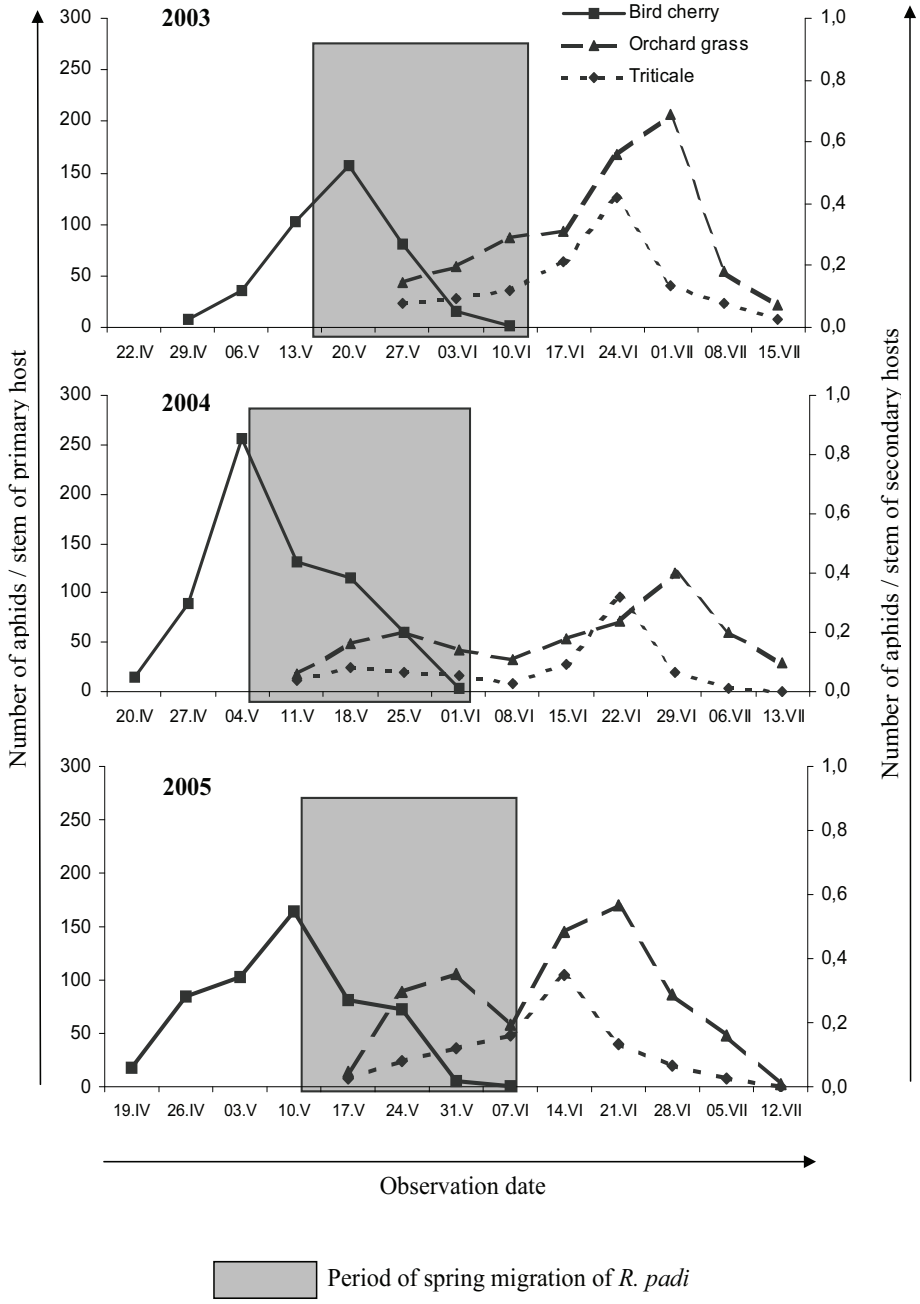

Figure 1. *Rhopalosiphon padi* population dynamics on primary – and secondary host plants, in 2003-2005

Table 1. Mean number of *Rhopalosiphum padi* winged migrants on researched host plants, during spring migration in 2003-2005 (bird cherry-on shoot; secondary hosts-on 50 stems)

Host plant /year	**Date of observation**												
2003	**22. IV**	**29. IV**	**06.V**	**13.V**	**20.V**	**27.V**	**03.VI**	**10.VI**	**17.VI**	**24.VI**	**01.VII**	**08.VII**	**15.VII**
Bird cherry		0.0	0.0	0.3	30.7	36.1	11.4	1.2					
Orchard grass						5.3	4.7	5.7	2.7	1.0	0.0	0.3	0.0
Triticale						2.7	3.3	3.3	0.0	0.0	0.3	0.0	0.0
2004	**20.IV**	**27.IV**	**04.V**	**11.V**	**18.V**	**25.V**	**01.VI**	**08.VI**	**15.VI**	**22.VI**	**29.VI**	**06.VII**	**13.VII**
Bird cherry	0.0	0.0	9.6	39.1	45.8	17.9	3.3						
Orchard grass				2.0	2.3	3.0	3.0	1.7	1.0	0.0	0.3	0.0	0.7
Triticale				1.3	2.0	2.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0
2005	**19.IV**	**26.IV**	**03.V**	**10.V**	**17.V**	**24.V**	**31.V**	**07.VI**	**14.VI**	**21.VI**	**28.VI**	**05.VII**	**12.VII**
Bird cherry	0.0	0.0	0.0	1.3	24.5	31.7	5.3	0.4					
Orchard grass					1.3	6.0	5.7	2.0	1.0	0.3	0.0	0.3	0.0
Triticale					0.7	2.7	3.3	2.0	0.0	0.0	0.0	0.3	0.0

About 75% of *R. padi* population was present on bird cherry leaves, about 20% of specimens tended to favor young green parts of shoots, and only 5% were present on flowers (Fig. 2). In the case of orchard grass and winter triticale, this aphid favored bottom leaves and stalks on which in total there were 64.6% and 67.9% of the population, respectively. More than 10% of the specimens was observed on flag leaves, whereas 20% of the population favored generative plant organs.

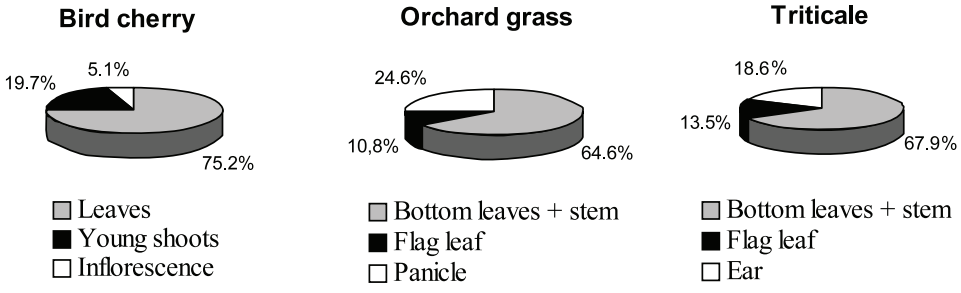

Figure 2. *R. padi* feeding preferences in relation to analyzed organs of host plants (mean number from 2003-2005)

Discussion

The observation, which was carried out, showed that dynamic growth of *R. padi* population took place on bird cherry, during leaf development and young shoot growth. When leaves developed fully, the winged morphs of *R. padi* moved to secondary host plants which at this time were in the phase of intensive growth. *R. padi* specimens showed a stable preference in relation to the analysed organs of host plants. Both on the primary and the secondary hosts over 70% of the population was present on leaves. The results of these observations confirm earlier data provided by Leszczyński *et al.* (1999), Ciepiela & Sytykiewicz (2001), who showed that the majority of *R. padi* population fed on the leaves of the researched plants and as the number of colonies increased, part of the specimens in the case of bird cherry moved up on to the top parts of the shoots, and in the case of cereals it moved up on to the ear.

Aphids, which are insects with a sucking-piercing mouth apparatus, favor the youngest, quickly growing plant parts which have a high content of nutrients because of the intensive course of metabolic processes (Cichocka, 1980; Sandstroem, 2000). In later plant developmental phases, usually aphid mortality increased, their fecundity and population growth rate decreased as well, followed by the abandonment of the host plant (Zhou & Carter, 1992). The results of the observations imply that dense population concentration may have had a significant meaning in the process of *R. padi* spring migrants. The first winged specimens on cherry bird appeared at the time when the insects reached the maximum number in their population. Certainly, however, this was not the only stimulus that had an impact on the formation of migrants because these morphs also appeared on cherry bird shoots which characteristically had a small number of *R. padi* specimens. Dixon & Glen (1971) and Müller *et al.* (2001) showed that a worsening nutrient quality of host plants is another important factor which decides on the appearance of winged morphs in a population.

The appearance of a phytophags population on the studied secondary hosts resulted from the spring migration of *R. padi*. The number of migrants settling orchard grass and winter triticale to a large extent conditioned the subsequent number of *R. padi* population. Similar dependencies were recorded by Wójtowska (1990) in the case of pea aphid, *Acyrthosiphon pisum* (Harris, 1776) during its presence on legume family (Leguminosae) plants. Orchard grass characteristically was settled by the *R. padi* population on a slightly higher level than triticale but in both cases the number of aphids was very small, not exceeding one specimen per plant. Leather & Lehti (1982), when studying the level of *R. padi* population on cereals in Finland, showed that the number of this phytophag on oat and barley was up to 800 individuals per 100 plants, and in the case of rye was much lower. A relatively

high level of *R. padi* population was also recorded on corn (Peńkosz *et al.*, 2005). This data suggests that neither orchard grass nor winter triticale are the best secondary host plants for this insect which is confirmed also by the presence of the winged specimens in big numbers in summer populations (exules). Thanks to these morphs, formed during the summer generation development it is possible for the insects to further change secondary hosts (dispersal flights) to young grass sucker regrowth or the previously mentioned corn. These plants are characterized by a longer growth season than in the case of rye, triticale, wheat or wild grass. They enable the development of *R. padi* population probably in better conditions until the autumn as well as the formation of migrants returning to the primary host.

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Wpływ wybranych żywicieli na rozwój populacji mszycy czeremchowo-zbożowej (*Rhopalosiphum padi* (Linnaeus, 1758)) /Hemiptera, Aphidoidea/

Streszczenie

Przeprowadzone badania wykazały, że rozwój populacji mszycy czeremchowo-zbożowej w dużym stopniu zależał od fenologii analizowanych roślin żywicielskich. Najbardziej dynamiczny wzrost populacji na pierwotnym żywicielu obserwowano na przełomie kwietnia i maja, podczas rozwoju młodych pędów czeremchy zwyczajnej. W drugiej połowie maja na żywicielu pierwotnym pojawiały się osobniki uskrzydlone, migrujące na wtórne rośliny żywicielskie, które w tym okresie były w fazie intensywnego wzrostu. Spośród badanych żywicieli wtórnych, kupkówka pospolita była w większym stopniu zasiedlana przez uskrzydlone migrantki mszycy czeremchowo-zbożowej, a także na tym żywicielu obserwowano nieznacznie wyższy poziom populacji owada w porównaniu z pszenżytem ozimym.