

COMPARISON OF *MYZUS PERSICAE* (SULZ.)
AND *MACROSIPHUM EUPHORBIAE* (THOM.)
DEVELOPMENT ON BOXTHORN
(*LYCIUM HALIMIFOLIUM* MILL.)

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Abstract: The observations on *Myzus persicae* and *Macrosiphum euphorbiae* development were carried out on boxthorn (*Lycium halimifolium*) growing in various places of the city of Wrocław in 1999–2001. They concerned the following issues: aphid population dynamics and aphid age and morph diversity in population structure. Aphids infested only certain boxthorn bushes and other bushes were free of these insects. *M. persicae* infested more bushes than *M. euphorbiae* did. The first species appeared 7–10 days earlier on boxthorn than the second one. Time of the maximum population density of both aphid species was similar. Age structure of *M. persicae* and *M. euphorbiae* populations was similar. The youngest larvae (L_1 – L_2) predominated and the least numerous were alatae females. Coccinellids were the most numerous aphid predators on boxthorn.

Key words: *Myzus persicae*, *Macrosiphum euphorbiae*, *Lycium halimifolium*, development, population age structure

INTRODUCTION

The peach potato aphid, *Myzus persicae* (Sulz.) is the most important aphid virus vector. It is able to transmit over 100 persistent and non-persistent plant viruses (Kennedy et al. 1962). The races of this aphid differ in their life cycles: some are holocyclic – sexual forms develop under short photoperiods and produce eggs on their primary hosts; some are anholocyclic – reproduce parthenogenetically on secondary plant hosts all the year round. Others are intermediate – produce sexual and asexual forms (Blackman 1972). In Poland, *M. persicae* lay their overwintering eggs almost exclusively on mature trees of peach (*Prunus persica* Batsch.) and boxthorn bushes (*Lycium halimifolium* Mill.) (Szełęgiewicz 1960).

The potato aphid, *Macrosiphum euphorbiae* (Thom.) feeds on over 200 plant species. In Europe, *M. euphorbiae* reproduces mainly parthenogenetically and overwinters in an active stage in greenhouses, stored plants and on pot flowers. This species is a direct pest, which causes damage by sucking out plant juices and is also a vector of over 40 non-persistent viruses and 5 persistent ones (Blackman and Eastop 1984). In Poland, this species is particularly dangerous for potatoes because it transmits potato leaf virus (PLRV), virus Y (PVY), virus A (PVA) and virus M (PVM).

Boxthorn is a plant from *Solanaceae* family. It grows up to 2.5 m in hedges on slopes of riverbanks and at road borders. The bush blooms from June to September (Podbielkowski 1989).

It is known that *M. persicae* overwinters and develops on *L. halimifolium* (Szelegiewicz 1960; Muller 1963). Our previous observations showed that *M. euphorbiae* also developed on this bush (Hurej and Kukuła 2001). Therefore, the main object of our study was to compare the development of these two aphid species on boxthorn.

MATERIAL AND METHODS

The observations were carried out on boxthorn growing in various places of the city of Wrocław in 1999–2001. In 1999 and 2001 observations were carried out on 5 bushes and in 2000 on 2 bushes. They concerned the following issues:

1. Aphid population dynamics

Observations were carried out during the whole growing season of *L. halimifolium*. On each bush – on 50 shoots, each 40 cm long, aphids and their natural enemies were counted once a week in 1999 and 2000 and twice a week in 2001. Shoots were chosen at random from each side of the bush.

2. Aphid age and morph diversity in population structure

To determine the time of winged morph appearance, 150–300 aphids were collected from individual bushes once a week and preserved in 75% ethyl alcohol. In laboratory they were divided into 5 age groups, i.e. nymphs L_1 – L_2 and L_3 – L_4 , winged nymphs, apterous females and alatae females.

RESULTS AND DISCUSSION

1. Aphid number and population dynamics on boxthorn

During 3 years of our studies, aphid species, *M. persicae* and *M. euphorbiae* were found on *L. halimifolium* in the city of Wrocław (Tab. 1). In some cases mixed colonies were observed but also only peach potato aphid colonies were found. *M. persicae* was the most abundant in 2001 while *M. euphorbiae* in 1999. In 2000 number of aphids of both species was similar. Aphids occurred in greater numbers only on certain bushes and other bushes were free of these insects.

Population dynamics of aphids is presented basing on results obtained from the most heavily infested bush in the year.

In 1999, the first wingless aphids found on the most heavily infested *L. halimifolium* were identified as *M. persicae*. They were recorded on shoots at the end of the second decade of May (Fig.1). Aphids had probably hatched from over-win-

Table 1. Total number of aphids found on boxthorn during the whole growing season

Bushes	<i>Myzus persicae</i>			<i>Macrosiphum euphorbiae</i>			Predators
	No. of aphids	Max % of infested shoots	Data of first appearance	No. of aphids	Max % of infested shoots	Data of first appearance	Total number
1999							
1	145	32	10.05	0	0	0	8
2	20	8	19.05	0	0	0	6
3	47	28	31.05	0	0	0	9
4	0	0	0	0	0	0	2
5	1039	36	18.05	2108	100	1.06	32
2000							
1	0	0	0	0	0	0	0
2	801	16	5.05	282	36	5.05	29
2001							
1	3502	60	11.05	306	46	18.05	40
2	1939	60	5.05	170	30	18.05	49
3	206	32	18.05	0	0	0	27
4	15	16	6.06	5	4	6.06	6
5	22850	98	5.05	1659	42	11.05	183

tered eggs in the end of March or the beginning of April. According to Wilkaniec and Karczewska (1993) the larval period of stem mothers lasts from 36 to 40 days. Later in May an increase in aphid population was observed. At the beginning of June 123 aphids per 50 shoots were recorded. The maximum of *M. persicae* population occurred at the end of June and at the beginning of July, 132 and 145 aphids, respectively. At that time aphids infested from 34 to 36% of shoots. The last insect of this species was found on boxthorn bush in summer on July 20.

The first autumn migrants of *M. persicae* and their progeny were recorded only on one boxthorn at the beginning of the last decade of September that year (Fig. 1). At the end of September and at the beginning of October the maximum number of aphids was found (111 and 100/50 shoots). At the autumn maximum aphids infested 32% shoots. In mid-October the alatae males appeared on boxthorn. *M. persicae* occurred on their winter host until the end of the first decade of November. The defoliation of bushes caused by mildew and first frost later in November caused a complete decrease in aphid population.

In 1999, first *M. euphorbiae* were observed on *L. halimifolium* later than *M. persicae* i.e. in the beginning of June (Fig. 1). Their number increased rapidly, and in mid-June 377 aphids were found which infested 34% of shoots. The second maximum occurred on July 5, about 650 specimens on 50 shoots. At that time, all examined shoots were infested by aphids of this species. The feeding of numerous aphids caused serious deformation of boxthorn leaves. After the maximum reproduction period, *M. euphorbiae* population decreased rapidly. The last aphids were observed on boxthorn in mid-July of 1999. No *M. euphorbiae* was recorded on boxthorn in autumn.

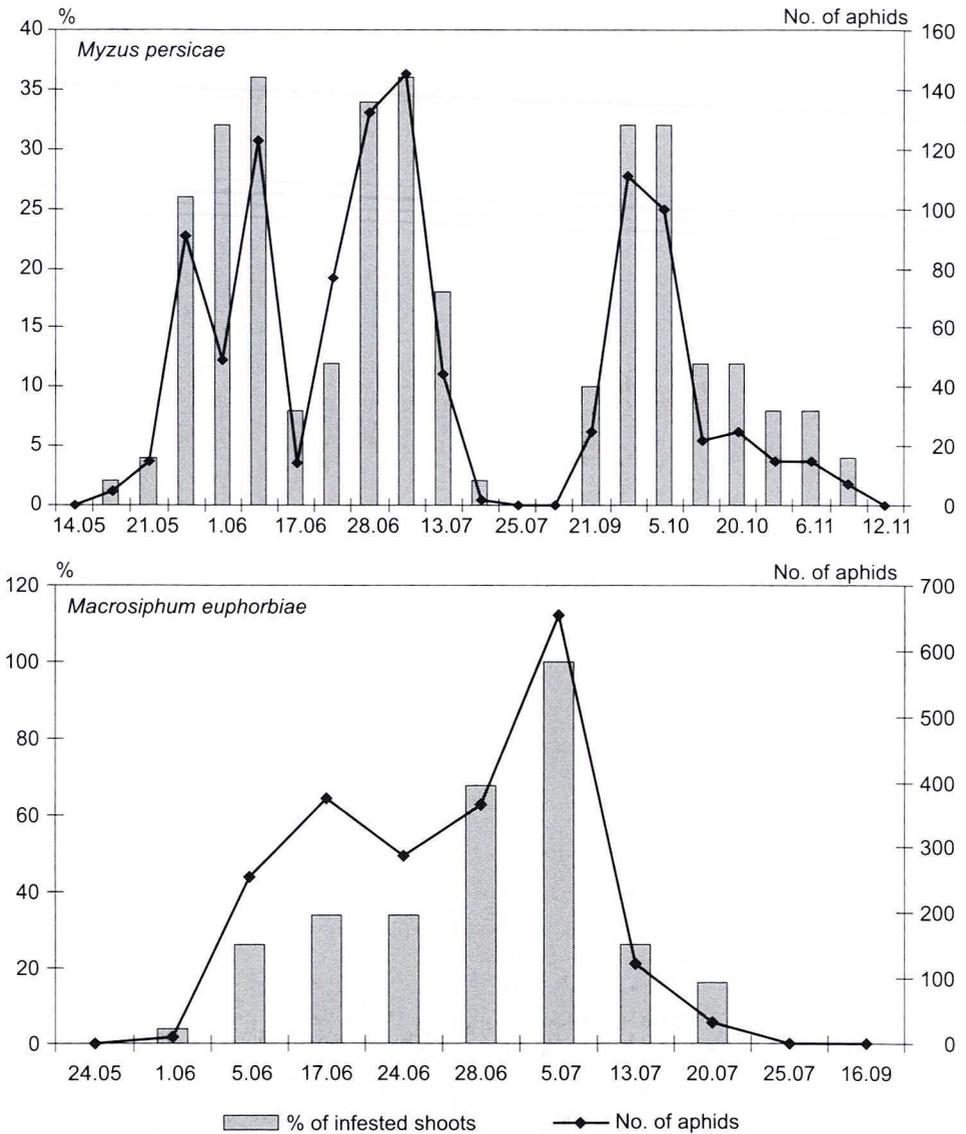


Fig. 1. Population dynamics of *M. persicae* and *M. euphorbiae* on boxthorn bush in 1999

In 2000, first *M. persicae* were found on *L. halimifolium* at the beginning of May (Fig. 2). Later in the month, their number increased slowly. In May, aphids infested from 8 to 16% of shoots. The maximum of *M. persicae* population was recorded in the first days of June (200 aphids). At that time they infested 16% of shoots. Later in June and in July, the slow decrease both in aphid population and in the percentage of infested shoots was observed. The last insects were found on boxthorn in mid-July.

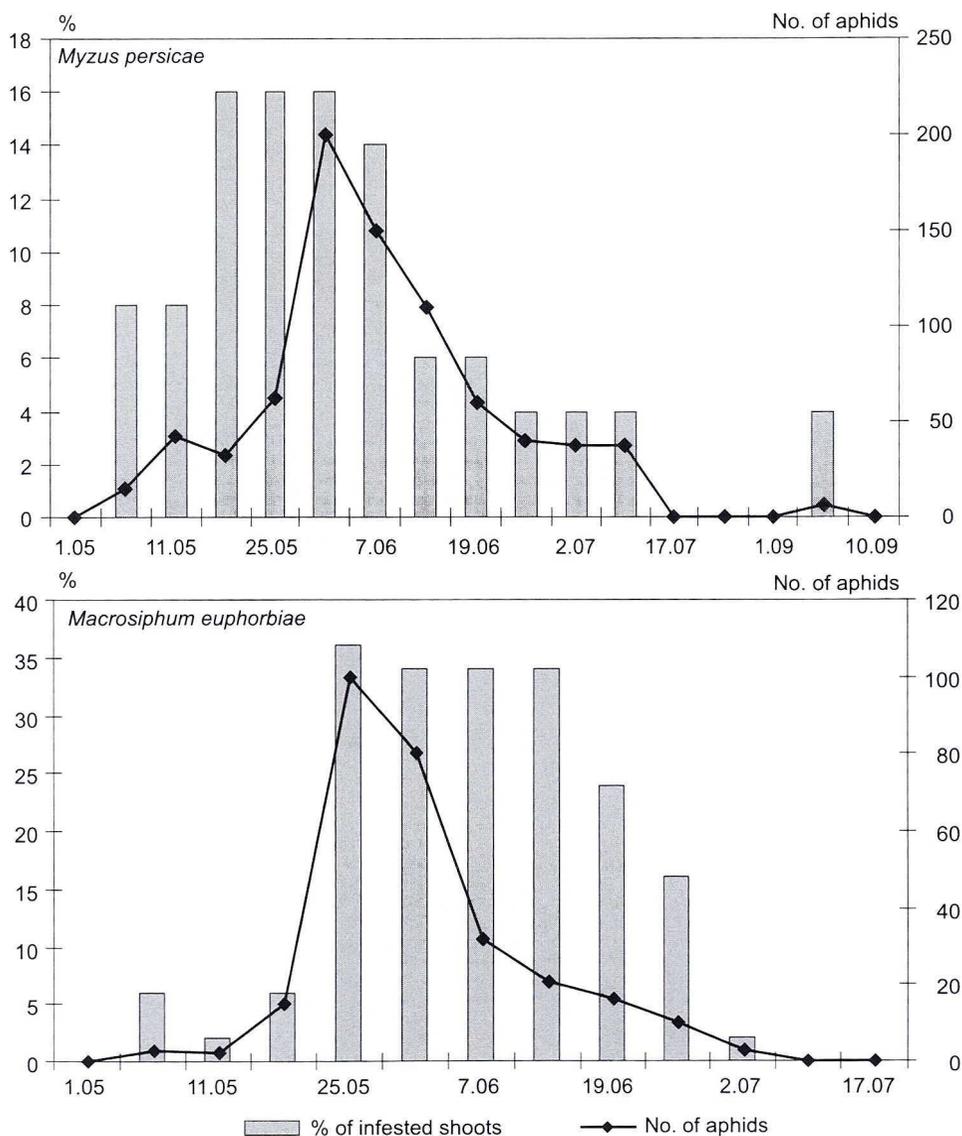


Fig. 2. Population dynamics of *M. persicae* and *M. euphorbiae* on boxthorn bush in 2000

Single autumn migrants of peach potato aphid were recorded on boxthorn only once in 2000, i.e. at the beginning of September (Fig. 2).

In 2000, the number of *M. euphorbiae* was much smaller than in 1999. Initially, only few specimens started to infest the boxthorn at the beginning of May (Fig. 2). A small number of aphids was observed until the end of the second decade of May. An increase in potato aphid numbers took place in the last decade of May. At that time the maximum number, i.e. 100 individuals on 50 shoots was recorded. At the maximum, aphids infested 36% of shoots. *M. euphorbiae* occurred in rela-

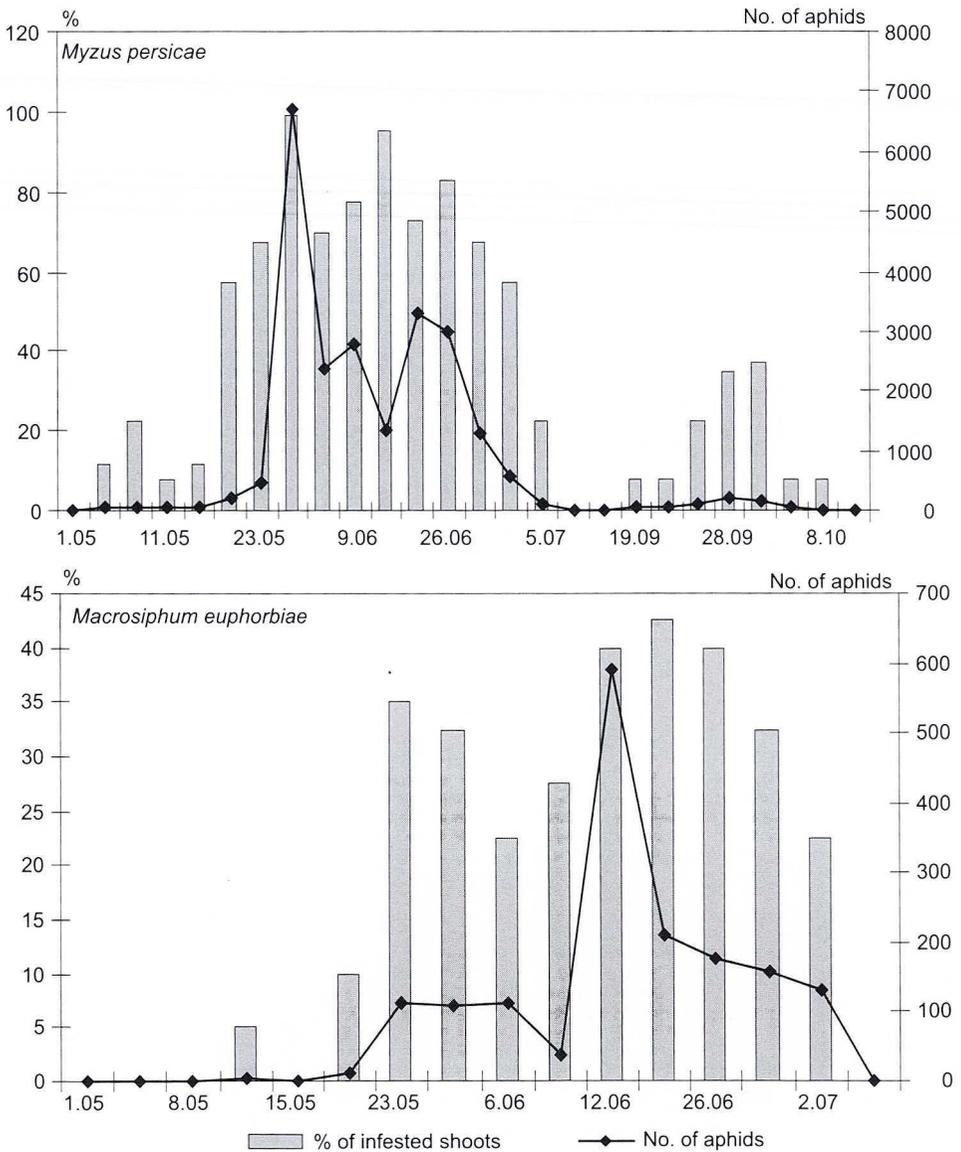


Fig. 3. Population dynamics of *M. persicae* and *M. euphorbiae* on boxthorn bush in 2001

tively great numbers until the first days of June. In the subsequent observations carried out in June and in the beginning of July, a slow decrease in aphid population was observed. The last insects of this species were found on boxthorn in the first days of July.

In 2001, as in previous year, first *M. persicae* individuals were recorded on boxthorn in early May (Fig. 3). In the consecutive observations carried out in the first half of May, aphid numbers increased slowly. Later that month, a rapid increase in aphid multiplication and in the percentage of infested shoots was observed. At the

end of May *M. persicae* occurred in the greatest number i. e. about 6700 insects which infested almost all of the examined shoots of boxthorn. In June, the peach potato aphid still occurred in the great numbers (1300–3300/50 shoots). In this period they occupied from 68 to 96% of shoots. In the first few days of July, a complete aphid population decrease was recorded.

Appearance of the first autumn migrants of *M. persicae* in 2001 was noted at the end of second decade of September (Fig. 3). In autumn, as in previous years, aphids were less numerous than in spring and summer. They reached the autumn peak at the end of September (206 insects). At the maximum aphids infested 36% of shoots. Their development on boxthorn was recorded till the end of the first decade of October.

In 2001, *M. euphorbiae* appeared on boxthorn in mid May i.e. about 10 days later than *M. persicae* (Fig. 3). At the end of May and at the beginning of June, more than 100 aphids were found on 50 shoots. At that time they infested from 22 to 36% of shoots. In mid June, aphids reached their maximum population number, 590 aphids infested 40% of shoots. In the consecutive counts carried out later in June, both the number of aphids and the percentage of infested shoots decreased slowly. The last *M. euphorbiae* were found on boxthorn at the beginning of July.

2. Aphid age and morph diversity in population structure

Age structure of *M. persicae* and *M. euphorbiae* populations was very similar on *L. halimifolium* during the three-year-studies. As an example, in figure 4 the total age structure of both aphid species in spring-summer period of 2001 is shown. During this period, in *M. persicae* population the youngest larvae (L_1 – L_2) predominated making up 61% of all aphids. Older larvae (L_3 – L_4) and apterous females were identified in the same quantities (17%). Less numerous were winged nymphs (4%) and the least numerous alatae aphids: only 1% in the collected material.

In *M. euphorbiae* population, the youngest larvae (L_1 – L_2) also predominated (58%) (Fig. 4). Larvae L_3 – L_4 and apterous females were identified in similar percentage i.e. 17 and 16 of the total, respectively. Slightly more winged nymphs (6%) and alatae females (3%) were found in comparison to *M. persicae* population.

From the agricultural point of view the information on the time of appearance of the first winged *M. persicae* or *M. euphorbiae* on boxthorn is very important. Such

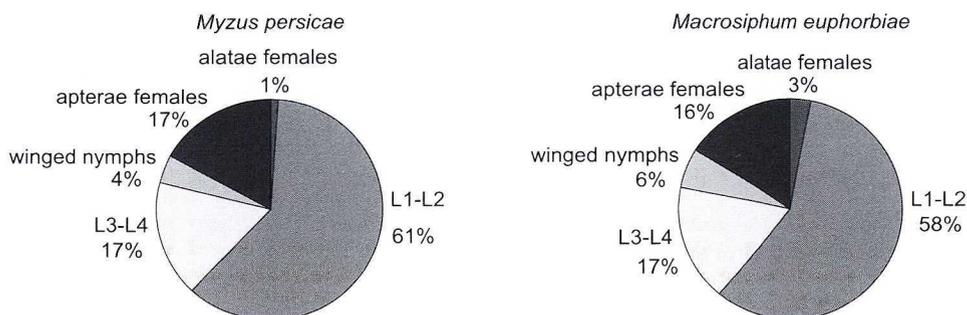


Fig. 4. Age structure of *M. persicae* and *M. euphorbiae* population on boxthorn, spring-summer period of 2001

aphids can fly from the bush to summer host plants which they damage directly or transmit plant viruses. In 1999, first winged aphids of *M. persicae* were observed on boxthorn at the beginning of the third decade of May while *M. euphorbiae* a week later i.e. at the beginning of June. In 2000, first winged individuals of both aphid species appeared at the same time and very early in the season (mid-May). In 2001, as in 1999, winged *M. persicae* were found earlier (mid-May) than *M. euphorbiae* (end of May).

3. Aphid predators

Aphid predators were the most numerous on those boxthorn bushes, which were heavily infested with aphids (Tab. 1). In 2001, aphids occurred in the greatest numbers, therefore, their predators were also the most numerous in this year. In mixed colonies, it was impossible to separate predators feeding on *M. persicae* or *M. euphorbiae*. Coccinellid beetles and larvae, syrphid larvae and lacewing larvae were the main predators found on boxthorn. Coccinellids were the most numerous predators making up from 71.5 to 87.5% of all aphid feeders. Two species of coccinellids were identified: *Adalia bipunctata* L. and *Coccinella septempunctata* L. The first species was much more numerous than the second one.

In 1999 and 2001, the predators, mainly coccinellid beetles, appeared earlier (mid April) on boxthorn than aphids. Later in the season, their development was positively correlated with aphid development. Predators reached their maximum at the same time as aphids did, or a few days later. In autumn, only few predators were found in *M. persicae* colonies.

CONCLUSIONS

1. Both aphid species *M. persicae* and *M. euphorbiae* developed on boxthorn (*L. halimifolium*) in 1999–2001. Aphids infested only certain bushes. *M. persicae* colonized more boxthorn bushes than *M. euphorbiae* did.
2. *M. persicae* appeared 7–10 days earlier on boxthorn than *M. euphorbiae*. Time of the maximum population number of both aphid species was similar. *M. euphorbiae* did not develop on boxthorn in autumn.
3. Age structure of *M. persicae* and *M. euphorbiae* populations was very similar on boxthorn. The youngest larvae (L_1 – L_2) predominated and the least numerous were alatae females. Usually winged aphids of *M. persicae* appeared earlier than those of *M. euphorbiae*.
4. Coccinellids were the most numerous aphid predators on boxthorn. They appeared earlier than aphids on this bush. Predators reached their maximum number at the same time as aphids did or a few days later.

REFERENCES

- Blackman R.L. 1972. The inheritance of life cycle differences in *Myzus persicae* (Sulz.) (Hem. Aphididae). Bull. Entomol. Res., 62: 281–294.
- Blackman R.L., Eastop V.F. 1984. Aphids on the world's crops. John Wiley & Sons: 296–297.
- Hurej M., Kukuła A. 2001. Development of potato aphid (*Macrosiphum euphorbiae* Thom.) on boxthorn bushes. Aphids and Other Homopterous Insects 8: 71–77.

- Kennedy J.S., Day M.F., Eastop V.F. 1062. A conspectus of aphids as vectors of plant viruses. Commonwealth Institute of Entomology, London, 114 pp.
- Muller F.P. 1963. Wybór roślin-żywcicieli u niektórych szkodliwych gatunków mszyc. Biuletyn IOR 19: 19–33.
- Podbielkowski Z. 1989. Słownik roślin użytkowych. PWN, Warszawa, p. 43, 161.
- Szelegiewicz H. 1960. Uwagi o mszycy brzoskwiniowej – *Myzus persicae* (Sulz.). Pol. Pismo Entomol., 3–4, 30: 267–273.
- Wilkaniec B., Karczewska M. 1993. Studies on the bionomy and ecology of peach potato aphid, *Myzus persicae* (Sulz.) (Homoptera, Aphididae) on peach trees. Roczn. Nauk Roln. – Seria E – Ochrona Roślin 23 (1/2): 79–83.

POLISH SUMMARY

PORÓWNANIE ROZWOJU *MYZUS PERSICAE* (SULZ.) I *MACROSIPHUM EUPHORBIAE* (THOM.) NA KOLCOWOJU SZKARŁATNYM (*LYCIUM HALIMIFOLIUM* MILL.)

Badania dotyczące rozwoju *Myzus persicae* i *Macrosiphum euphorbiae* prowadzono na krzewach kolcowoju szkarłatnego (*Lycium halimifolium*) rosnącego na terenie miasta Wrocławia w latach 1999–2001. Dotyczyły one dynamiki rozwoju populacji obu gatunków mszyc oraz struktury wiekowej tych mszyc.

Mszycy zasiedlały tylko część badanych krzewów. *M. persicae* częściej zasiedlała kolcowój w porównaniu do *M. euphorbiae*. Mszyca brzoskwiniowa pojawiała się o 7–10 dni wcześniej na kolcowoju niż mszyca ziemniaczana smugowa. Oba badane gatunki okres maksymalnego rozmnożenia osiągały w podobnym terminie. Struktura wiekowa populacji *M. persicae* i *M. euphorbiae* była podobna. Dominowały najmłodsze larwy (L₁–L₂), natomiast najmniej liczne były uskrzydłone samice. Biedronki były główną grupą afidofagów występujących na kolcowoju.