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THE POTENTIAL OF AGLAIS URTICAE L. FOR BIOLOGICAL CONTROL OF PARIETARIA PENSYLVANICA MUNHELEM. EX WILLD.

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ABSTRACT

Chemical control of weeds in some environments and due to the condition and degree of weed-growth does not bring expected results. For that reason alternative methods have been searched for. Biological control of weeds has been traditionally perceived as reducing the agrophage population to such a level where they do not constitute a threat. In the present research, an attempt has been made to introduce Aglais urticae L. to control the population of Parietaria pensylvanica M. ex. Willd.

Key words: biological control of weeds, Parietaria pensylvanica M. ex Willd., Aglais urticae L.

INTRODUCTION

Plants spread to new habitats very quickly due to the lack of natural enemies in these ecosystems in the initial stage. Undoubtedly for the last few years Parietaria pensylvanica M. ex Willd has been becoming one of such plants. The plant belongs to Urticaceae. In Bydgoszcz it was identified for the first time in 1995. It is an annual plant with its flowering period from May to October. It grows in the woods in the shade on the riverbanks as well as in gardens, parks [5]. The plant spreads quickly covering new areas; in Bydgoszcz the number of its habitats grows every year. Naturally, when exposed to danger by unwanted organism, an attempt is made to destroy it. In weed control, a chemical method prevails. However it has a lot of disadvantages which limit its application: as a result of selection, resistant biotypes emerge which are difficult to control further on and herbicides pollute the environment [2].

Chemical methods applied in the control of some weeds do not bring expected results. Following chemical application, the plant starts its vegetation the following year. Similarly highly toxic chemicals cannot be applied in the municipal green areas or scenery parks.

One of the methods, a complimentary method, is a biological control. Generally the biological control of weeds is defined as application of some organisms, e.g. insects or fungi to reduce the plant population to the extent that the plant does not constitute a threat any more. Biological control is successful once the level of weed-growth has been reduced below a specified level [3] which is acceptable [8]. With this method, a selection of appropriate representative does not guarantee a success yet [1]. Agents selected to reduce weed-growth should have the following characteristics: the adequate pace of development and concentration level, insect ontogeny and plant development synchronisation, adequate fertility [6, 7].

Developing biological control methods, a considerable attention is given to weed biology and ecology [4]. Research is conducted taking into consideration interactions between phytophagus and the plant [9]. When applying biological control a complete plant destruction is not necessary. Frequently reduction of its population eliminates its economic significance [2]. Such unwanted plant reduction method will not replace chemicals, however it can constitute a significant factor in weed-growth elimination as well as play an important role in integrated plant protection [10].

Taking all the above into consideration, an attempt has been made to define the possibilities of re-duc-tion of the population of Parietaria pensylvanica M. ex Willd. with the application of Aglais urticae as the biological agent.

MATERIALS AND METHODS

The research was conducted in 1996 and 1997. Biological control targeted at Parietaria with the application of a phytophagous agent - Aglais urticae. The insect in its natural habitat is found on Urtica dioica, the plant belonging to the same family as Parietaria. Aglais urticae is characterised by its wide range-land, namely from Europe to Asia. It can be found in between-the-wood meadows, pastures in the mountains and on the edge of the woods. Aglais flies from June to September whereas larvae are present on the Urtica dioica L. - from May to August.

In 1996 the research conducted constituted of the observation of the Aglais urticae introduced onto Parietaria in the laboratory environment. Breeding insulators were applied here. Three series of research were conducted with two insulators each. The first two were provided with Urtica dioica leaves in a water-filled container. The other two were provided with Urtica dioica as well as Parietaria leaves, similarly like the others in a water-filled container. Parietaria leaves were placed into the remaining two. In each of the three series Aglais urticae larvae were applied (10 individuals each) stage L1 and L3 into separate insulators. Every day fresh leaves were provided.

In 1997 detailed laboratory tests were conducted to specify the weight of the food consumed. Parietaria leaves together with 5 Aglais urticae larvae stage 3 were placed into Petri dishes each time. The remaining 4 Petri dishes were provided with Urtica dioica leaves and 5 Aglais urticae larvae stage 3 each time. A 48-hour test was conducted to determine weight of the food consumed as well the increase in the larva weight per each time unit. Leaves with no insects feeding on constituted a control factor in order to take into consideration a natural process of leaves drying. Also field tests were conducted by introducing Aglais urticae larvae onto the plant.

RESULTS

From the observation conducted in 1996 one can recognise a different extent of feeding on leaves in the three insulators provided. In the first one, with Urtica dioica larvae placed in the water-filled container were feeding on intensively. The same applied to the tests with larvae stage L1 and L3. Both initial larval stages L1 and L3 completed their development, obviously within a different period. Slightly different results were obtained from insulators with Parietaria leaves and Urtica dioica leaves. L1 larvae were observed to prefer Urtica dioica leaves. They did not feed on Parietaria. In the insulator with L3 stage larvae a definite defoliation was observed in Parietaria and Urtica dioica. Both larva stages completed their development.

Most interesting results for biological regulation of weed-growth were observed in the third research series, with Parietaria leaves only. The larvae in insulator with L1 larvae did not complete their development and died. The larvae in the insulator with L3 larvae completed their development and the imago obtained was similar to the one in the repeated tests with Urtica dioica. In 1996 in breeding insulators it was observed that newly emerged adults butterflies laid their eggs on the Urtica dioica and Parietaria. However no larvae were obtained on the Parietaria leaves whereas the development was uninterrupted on the Urtica dioica. The research conducted in 1997, laboratory test, specifies the weight of the food consumed as well as the increase in larva weight (Table 1 and 2).

Table 1. *Urtica dioica* L. - a 48-hour *Aglais urticae* larva L3 feeding -on test

June, 24	June, 25
mean leaf defoliation after 48h (g)	increase in mean larva weight after 48h (g)
0.908	0.111

The test, which also considered the natural leaf evaporation, gave the result of 0.136g

Table 2 . *Parietaria* - a 48-hour *Aglais urticae* larva L3 feeding-on test

June, 24	June, 25
mean leaf defoliation after 48h (g)	increase in mean larva weight after 48h (g)
0.865	0.105

The test, which also considered the natural leaf evaporation, gave the result of 0.167g

As seen in tables 1 and 2, L3 larval stage feeding does not differ significantly provided that Urtica dioica L. and Parietaria constituted the food. Larva weight increase per one time unit and a considerable leaf weight reduction were observed. Field tests showed also that Parietaria is not fed on by any insects in the field. Experiments to bring Aglais urticae larvae upon the plant in the laboratory gave a negative result. After two days since the larvae had been placed, the insects were not observed on the plant. Probably it was due to the fact that Parietaria requires different environment, damp places in the shade, whereas Aglais urticae L. requires sunny and warm spots.

DISCUSSION

Classical biological control of weeds is defined as the application of organisms, plant-eaters for the reduction of unwanted plant populations [1,2,4,8,9]. Here about 100 species are known to be most successful, including foliage masticating, leaf mining, steam boring and sap sucking insects [6]. Butterfly caterpillars e.g. Aglais urticae L. shows 14% introduction efficiency threshold, which is satisfactory [2], when compared with leaf beetles of Curculionidae and Chrysomelidae families with about 25 % success. In biological control it is not necessary to eliminate weeds; very often reducing their populations decreases their economic significance substantially [2]. Such a weed reduction method will not replace chemical control, however it may be significant in weed reduction as well as integrated plant protection. Larvae of Aglias urticae in our experiment damaged the leaves of Parietaria caused their considerable defoliation. Most probably a short period of time when the plant managed to adapt in Poland was not enough to enhance acclimatisation of any of the species of the pest. However, the above findings encourage further scrutiny to identify links between the host and the phytophagous plant.

CONCLUSIONS

From the results obtained in the laboratory one can conclude that Aglais urticae L larvae in their L3 stage feed intensively on Parietaria pensylvanica M. ex Willd. Despite the positive results obtained in the laboratory, Parietaria pensylvanica M. ex Willd does not have natural enemies who would limit its population in the field.

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