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Short communication

LABORATORY ASSESSMENT OF THE SUITABILITY OF PREDATORY BUGS *ORIUS LAEVIGATUS* AND *ORIUS MAJUSCULUS* AS NATURAL ENEMIES OF SEED POTATO PESTS IN GREENHOUSES

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Laboratory experiments were performed to test *Orius majusculus* and *Orius laevigatus* suitability for potato protection. The adult bugs released on potato plants infested with *Myzus persicae* can normally survive, mature, and reproduce. In the absence of prey, the bugs can survive for about a week. And though addition of flower pollen increased survival, insect fecundity remained low. Only feeding by *Sitotroga cerealella* eggs added to potato plants provided for sustainable fecundity of *Orius* females laying up to 200 eggs during the lifetime. Thus, *O. majusculus* can be applied for biological control of aphids on seed potatoes in greenhouses and the grain moth eggs can be used as an additional food for the bugs.

Keywords: Anthocoridae, biological control, survival, fecundity, *Sitotroga*

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Introduction

Potatoes are among the most important crop plants. The growing of virus-free seed potatoes from meristem culture in greenhouses is vitally important for the potato production in many countries (Chiipanthenga, Maliro, Demo & Njoloma, 2012). The production of seed potatoes requires various crop protection measures: using of geographically isolated seed production fields, removal of infected plants, crop borders, pesticides, and mineral oils (Boiteau & Singh, 1999; Boiteau, Singh & Lavoie, 2009). However, long-term use of pesticides can result in development of resistant pest populations (Giordanengo, Vincent & Alyokhin, 2012) and has a negative impact on greenhouse workers' health. Therefore, biological control of seed potato pests is particularly important nowadays.

The main component of the growing of virus-free seed potatoes is the control of virus vectors, particularly aphids, and the green peach aphid, *Myzus persicae* Sulz. is among the most important virus vectors= (Loebenstein, Berger, Brunt & Lawson, 2001). In potato fields this aphid species co-occurs with a predatory bug *Orius tristicolor* White and population densities of the two insects are often positively correlated. Feeding of *O. tristicolor* on *M. persicae* has been observed also in laboratory (Hollingsworth & Bishop, 1982). Our previous research showed that beneficial bugs, in particular O. majusculus Reuter, cannot transmit potato Y virus (Pazyuk, Fominykh, 2019), confirming their sutability for the control of sucking pests on potatoes. The aim of this study was to evaluate the ability of two species of the same genus, *O. majusculus* and *Orius laevigatus* Fieber, to prey on the green peach aphid and to survive feeding on various other foods (flower pollen, the grain moth eggs) or without any additional food on seed potatoes in greenhouses.

Materials and Methods

The study was conducted with laboratory strains of *O. laevigatus* and *O. majusculus* originated from about 500 individuals purchased from Biobest in 1996 and in 2016, correspondingly. Both strains were reared in 0.5 l plastic containers on common bean (*Phaseolus vulgaris* L.) stems and fed on eggs of the grain moth (*Sitotroga cerealella* Oliv.). To obtain adults for the experiment, larvae of the 4–5 instars were individually placed in Petri dishes, fed on the same diet and daily checked for adult emergence. Emerging adults were paired and randomly selected for one of the 5 treatments differed only in diet: (1) bean leaves and grain moth eggs (this diet was used for mass rearing of both species and thus can be considered as positive control), (2) potato leaves, (3) potato leaves and flower pollen (mix of *Taraxacum* sp., *Salix* sp., and *Tussilago* sp. collected less than 1 year before the experiment), (4) potato leaves and grain moth eggs, (5) potato leaves and green peach aphids *M. persicae*, which is a potential target of biological control in greenhouses. Every second day, fresh leaves and new food (always in excess) were provided and laid eggs were counted. Thus, for each female its pre-oviposition period, lifetime, and total fecundity were recorded. The experiment was performed in 5 replicates with a total of at least 15 females per each diet. For each parameter, replicate means were calculated and used as units for statistical analyses (ANOVA and the Tukey's HSD test).

Results and Discussion

Potatoes were a good host plant for both studied *Orius* species: with the same food (the grain moth eggs) all biological parameters were the same or even higher than those on beans which are commonly used for mass rearing of these predatory bugs (Fig.). Without any additional food, however, feeding on potatoes resulted in a sharp decrease in the lifetime and fecundity (*O. laevigatus* females did not lay eggs). An addition of pollen caused a marked increase in lifetime, but preoviposition period was longer and fecundity much lower than those of bugs fed on the grain moth eggs, although these differences were statistically significant only for *O. majusculus.* When fed on the optimal diet (potatoes and the grain moth eggs) *O. majusculus* showed the significantly faster maturation, longer lifetime, and higher fecundity than *O. laevigatus.*

It is known that *Orius* species can develop and reproduce when fed on pollen but their fecundity on this diet is much lower than that in case of feeding on animal prey (Cocuzza et al., 1997). Our data support this conclusion. Earlier pollen was used as an additional food for *O. laevigatus* released against *Frankliniella occidentalis* Pergande. In that case, not only predator, but also target prey, the western flower thrips, can feed on pollen (Skirvin, Kravar-Garde, Reynolds, Jones & De Courcy, 2006). Aphids, however, can not feed on pollen and thus in our case this problem is not relevant. It is known that *O. laevigatus* и *O. majusculus* can feed on various aphids (Hosseini et al., 2010, Hejzlar & Kabicek, 2000). Our study showed that *M. persicae* is also suitable for survival and reproduction of these predators.

To summarize, our data suggest that (1) *O. majusculus* can be considered as a potential agent for biological control of aphids on potatoes; (2) adults of this zoophytophagous bug released on potato plants infested with aphids can normally survive, mature, and reproduce; (3) in case of the absence of prey, the bugs can survive for some time (about a week) feeding on potatoes; (4) the adding of flower pollen markedly increases the survival but female fecundity remains very low; (5) *O. majusculus* females feeding on the grain moth eggs spread over potato plants show even higher fecundity than those feeding on the same eggs spread over common beans which are used for mass rearing of this bug.

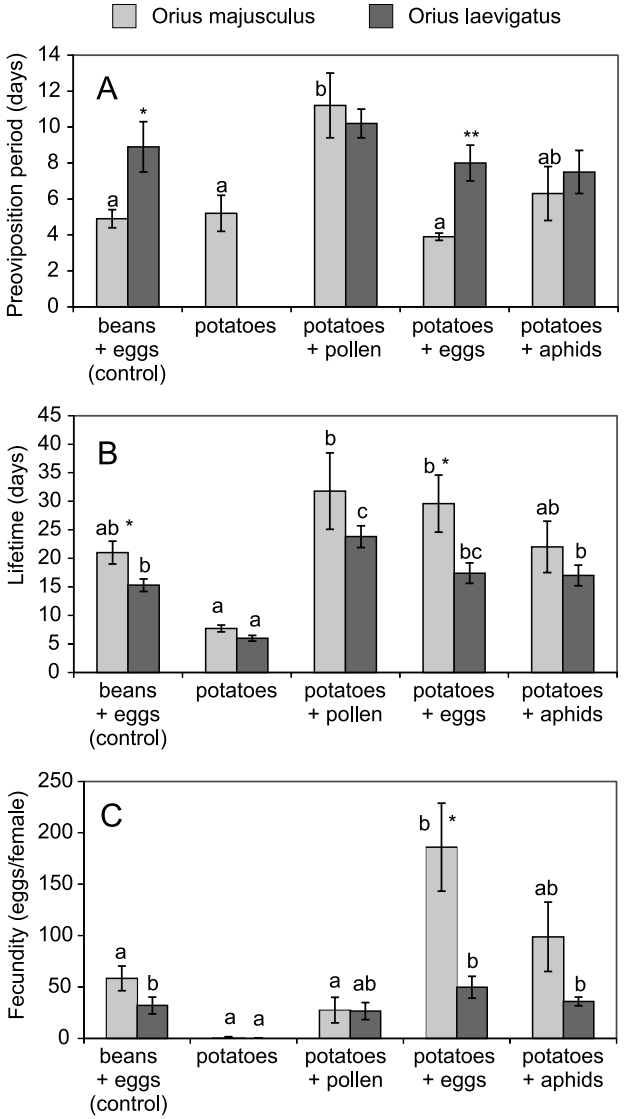

Figure. Influence of diet on preoviposition period (A), lifetime (B), and fecundity (C) of *Orius laevigatus* and *O. majusculus* females. Bars of the same pattern with different letters indicate significant ($p < 0.05$) difference between values for the same species on different diets (absence of letters means absence of significant differences). Asterisks above the bars mean significant difference between the values for the different species on the same diet (* – $p < 0.05$, ** – $p < 0.01$)

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Краткое сообщение

ЛАБОРАТОРНАЯ ОЦЕНКА ПРИГОДНОСТИ ХИЩНЫХ КЛОПОВ *ORIUS LAEVIGATUS* И *ORIUS MAJUSCULUS* В КАЧЕСТВЕ ЭНТОМОФАГОВ ДЛЯ ИСПОЛЬЗОВАНИЯ НА СЕМЕННОМ КАРТОФЕЛЕ В ТЕПЛИЦАХ

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Лабораторные эксперименты показали, что имаго *Orius majusculus* и *Orius laevigatus* выпущенные на растения картофеля, заселенные тлей *Myzus persicae,* способны к выживанию, взрослению и репродукции. В отсутствие жертв клопы могли выживать в течение недели, однако, хотя при добавлении цветочной пыльцы улучшалась выживаемость хищников, плодовитость имаго оставалась на низком уровне. Лишь при питании на яйцах зерновой моли *Sitotroga cerealella*, дополнительно наносимых на растения картофеля, самки ориусов были способны реализовать свой репродуктивный потенциал, откладывая до 200 яиц в течение жизни. Таким образом, хищный клоп *O. majusculus* может быть использован для биологической защиты на семенном картофеле в теплицах. Яйца зерновой моли могут использоваться в качестве дополнительной подкормки для хищных клопов.

Ключевые слова: Anthocoridae, биологическая защита растений, плодовитость, выживаемость, *Sitotroga*

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