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FOOD PREFERENCE OF *CHRYSOLINA FASTUOSA* ADULTS (COLEOPTERA: CHRYSOMELIDAE)

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Chrysolina fastuosa (Scopoli, 1763) is a widely distributed chrysomelid beetle in Europe. According to the literature *C. fastuosa* has been found in association with Lamiaceae plants such as *Ballota nigra* L., *Galeopsis pubescens* Besser, *Lamium album* L. and *Urtica dioica* L. (Urticaceae). Host plants have been referred often merely on plant genus level and many authors listed host plants for *C. fastuosa* which taxonomically differed significantly from one another. In spite of many references which mention consumption and/or association of *Ch. fastuosa* on stinging nettle, the author has almost never observed the beetle on *Urtica* species. This paper presents results of two laboratory experiments showing feeding preference of *C. fastuosa* adults concerning some Lamiaceae (*B. nigra*, *Lamium purpureum* L. and *Lamium amplexicaule* L.) but not on *U. dioica*. *B. nigra* seems to be one of the most preferable host plant species under natural and experimental conditions.

Key words: *Chrysolina fastuosa*, feeding, preference, Lamiaceae, *Urtica dioica*.

INTRODUCTION

Chrysolina fastuosa (Scopoli, 1763) is a widely distributed chrysomelid beetle in Europe (Kippenberg 1994). Recent sources have reported its occurrence in Belgium (Varlez 1988), Hungary (Vig 1997, 2001), Slovakia (Vig 1997), Czech Republic (Rehounek 2002), Romania (Maican & Serafim 2004, Ungureanu *et al.* 2008), Latvia (Bukeis & Telnov 2010) and Great-Britain (Cox 2007). The Global Biodiversity Information Facility reports it also at some parts of France, Denmark, Sweden and Finland (GBIF 2014). *C. fastuosa* has been introduced in the USA where its status is "harmful non-indigenous species" (U.S. Congress 1993). Consequently, studying feeding habit of this species may be challenging.

C. fastuosa feeds on hemp-nettle (*Galeopsis pubescens* Besser), black horehound (*Ballota nigra* L.), white dead-nettle (*Lamium album* L.), stinging nettle (*Urtica dioica* L.) and on other Lamiaceae plants (Vig 1997, 2001). Table 1 shows some further information on the food plants consumed or associated with this species. However, in these previous findings only general remarks listing their host plant species or plants associated with them can be found (Fuss *et al.* 2005).

The difficulty and unreliability of these records derive mainly from two reasons (1) authors often mention only plant genera and not species name when describing food plants and (2) host plant species list of a given chrysomelid species differ significantly even if studies were performed in areas lying together (see Table 1).

C. fastuosa can be a pest (if it consumes *Urtica* spp.) or a biological control agent (if it consumes some minor weeds of the Lamiaceae family, like *B. nigra*) (Bozsik 2006). The latter one is also a medicinal plant which has been used in the European traditional herbalism (Hoffmann 1990). Regarding the pest status of *C. fastuosa* on *Urtica* spp., if proven, it cannot be overseen because of the multiple utility of stinging nettle species (food, feed, nitrate accumulator (Müller-Sämann *et al.* 2001), fibre (Dreyer *et al.* 1996), medicinal plant (Chrubasik *et al.* 2007), spray against aphids in organic production (Köllner & Sauthoff 1983, Bozsik 1996, Gaspari *et al.* 2007). Its Hungarian name (*csalán levélbogár*) means stinging-nettle leaf beetle suggesting for Hungarians that the beetle must feed on stinging nettles (*Urtica dioica* or *U. urens* L.). Other common names like dead-nettle leaf beetle refer rather to the family Lamiaceae as host plants.

References shown above suggest *Urtica* spp. as host plants of *C. fastuosa*, however, regarding the scarce occurrence of *C. fastuosa* with the *Urtica* spp. (Ungureanu 2008, Bukeis & Telnov 2010) and personnel observations of the

Table 1. Plants consumed or associated with *Chrysomela fastuosa.*

Plant species	References
Galeopsis ladanum L.	Fabre (1855)
Galeopsis sp., *Lamium* sp.	Mohr (1966), Kippenberg (1994)
Galeopsis tetrahit L., *Lamium album*	Tischler (1979)
Galeopsis ladanum, *G. tetrahit* L., *Lamium* sp. other Lamiaceae, *Urtica dioica*	Burakowski *et al.* (1990)
Lamiaceae and *Urtica* sp.	Kaszab (1969), Bieńkowski (2010)
Galeopsis sp., *Urtica* sp., *Lamium* sp.	Vig (1997), Rozner (1997, 2003), Maican & Serafim (2004), Cox (2007), Bukeis & Telnov (2010)
Galeopsis sp., *Lamium* sp., *Leonurus* sp., *Prunella* sp.	Garin *et al.* (1999)
Urtica sp. and *Lamium* sp.	Pozsgai (2003)
Urtica sp.	Bieńkowski (2004), Ungureanu *et al.* (2008)
Galeopsis speciosa L.	Fuss *et al.* (2005)
Ballota nigra	Bozsik (2006)
Galeopsis tetrahit	Rassart *et al.* (2007)

author – only two individuals have been found on *U. dioica* in the immediate neighbourhood of *B. nigra* for an observation period of about 10 years – contradicts this. As a consequence of these data and observations, the aim of this study was to find out the edibility of *U. dioica* for *C. fastuosa* adults as the most important, grown nettle species (Dreyer *et al.* 1996) compared with the ingestion of *B. nigra* and three other Lamiaceae species. In this study feeding experiments were carried out to characterise the food choice of this chrysomelid species.

MATERIAL AND METHODS

Adult *C. fastuosa* individuals were collected using a sweep-net (45 cm in diameter) in early May 2009 on the northern side of an abandoned orchard in Gödöllő, Hungary (47°35′42′′ N, 19°22′54′′ E, altitude 207 m). The beetles fed on black horehound adjacent to a stinging nettle stand. Adults were used for testing after a two days starving period. Both trials were carried out in the laboratory at 23±3°C, under 16L–8D h photoperiod.

Experiment 1

Leaves of similar size of *U. dioica* and *B. nigra* were collected from the same area and placed in Petri dishes with nine cm in diameter lined with pieces of equally wet filter paper. Five randomly chosen *C. fastuosa* adults were added into one dish. In the first treatment only stinging nettle, in the second, black horehound leaves were offered to the beetles. Four replications were applied. The leaf surface area consumed was measured and area calculated after 8 days by the method of Jarou (2009) when the digitalized leaf surface areas were determined with Adobe Photoshop CS3. To test the significance of differences of the means of two groups, two-tailed t-test was performed at the VassarStats website (VassarStats 2014).

Experiment 2

The second experiment was similar to the first one in a manner that in one treatment only one plant species was offered. Leaves of similar size of *U. dioica* and *B. nigra* and some leaves (whose full size was similar of those of *U. dioica*) of *Lamium purpureum* L. and *L. amplexicaule* L. were collected and used for testing. The leaf surface area consumed was measured and area calculated after 8 days as described before. One way ANOVA and Tukey test were performed at the VassarStats website (VassarStats 2014).

RESULTS

Results of the experiment 1 are presented in Table 2. During the eight days of the experiment none of the *C. fastuosa* adults fed on the *U. dioica* leaves; but the leaf surface area of black horehound decreased remarkably. The two tailed t-test showed significant difference between the treatments ($t = 8.66$, $df = 6, 8$, $P < 0.001$).

Table 2. Average leaf area (±SD) of two plants consumed by five *Chrysolina fastuosa* adults. Means followed by the same letter within a column are not significantly different at P = 0.05 by two tailed t-test.

Plants offered	Leaf area consumed for 8 days (cm^2)
Black horehound	28.90 (6.68)[a]
Stinging nettle	0.00 (0.00)[b]

Table 3. Average leaf area (±SD) of some plants consumed by five *Chrysolina fastuosa* adults. Means followed by the same letter within a column are not significantly different at P = 0.05 by one way ANOVA and Tukey test. HSD = Honestly Significant Difference.

Plants offered	Leaf surface consumed for 8 days (cm^2)
Black horehound	19.49 (7.42)[a]
Stinging nettle	0.00 (0.00)[b]
Red deadnettle	8.27 (5.33)[b]
Henbit deadnettle	3.76 (3.83)[b]
HSD[0.05]	10.41

In the experiment 2 none of the *C. fastuosa* adults fed on the *U. dioica* leaves but consumed the offered leaves of Lamiaceae. The ingestion of *B. nigra* was the highest; it differed significantly from the other treatments. As to the consumption of *L. purpureum* and *L. amplexicaule*, these values did not differ significantly from each other either from that of *U. dioica* (Table 3) ($F = 11.37$, $df = 3, 16$, $P < 0.001$).

DISCUSSION

C. fastuosa adults fed only on the leaves of Lamiaceae plants in our experiments. According to the results of both experiments, *C. fastuosa* adults did not feed on *U. dioica* under laboratory conditions. These results are concordant with the data of Fuss *et al.* (2005), who proved with feeding choice experiment that *U. dioica, Stachys sylvatica* L., *Scutellaria galericulata* L. and *Lycopus europaeus* L. were not suitable for *C. fastuosa,* but it fed on *Galeopsis speciosa* Mill. Tischler (1979) corroborated with observations that *Lamium album* was a tolerable food plant for *C. fastuosa* adults in early spring when *Galeopsis tetrahit* did not appear. He ascertained that *U. dioica*, *L. purpureum*, and *Lamium galeobdolon* (L.) Ehrend et Polatschek were unsuitable host plants for any developmental stage of *C. fastuosa*. However, present experiments prove that *L. purpureum* can be a sufficient food source for *C. fastuosa* adults in the lack of a more preferable host plant.

Under natural conditions only *G. tetrahit* proved to be as a true host plant either for larvae or for adults of *C. fastuosa* (Tischler 1979). *C. fastuosa* larvae

could feed on *L. album* but do not finish their development under laboratory conditions, thus Tischler (1979) considered it as a seasonal food plant. Neither Tischler (1979) nor Fuss *et al.* (2005) examined or observed the relationship between *B. nigra* and *C. fastuosa*. Fuss *et al.* (2005) came to their conclusions according to the immeasurable feeding scars on the offered plants, which mean that the feeding preference of *C. fastuosa* seemed difficult to determine. *B. nigra* proved to be a suitable host plant for *C. fastuosa* adults either under natural (Bozsik 2006) or experimental conditions (these studies). Its suitability for *C. fastuosa* larvae has not been examined yet, however, regarding the continuous (from April to October) presence and feeding of *C. fastuosa* on *B. nigra* (Bozsik personal observation), it may be a true host plant like *G. tetrahit* or *G. speciosa*.

According to the author's observations and results of the present experiments *C. fastuosa* presumably did not feed on *U. dioica* in nature. As a consequence, I suggest a more correct Hungarian name for this beetle as hemp-nettle leaf beetle (*kenderkefű-levélbogár*) or horehound leaf beetle (*peszterce-levélbogár*) instead of the current *csalán-levélbogár*. Data concerning its consumption of *Urtica* species can be explained by the very similarity of the leaves of both, *U. dioica* and *B. nigra*. That is why these two species can be confused easily in the field. The information that *C. fastuosa* is a stinging nettle consumer has been integrated widely into the literature (Table 1), but this belief is probably improper. However, it is crucial to mention that the feeding of *C. fastuosa* has not been studied thoroughly and further investigations are needed.

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