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Contribution to the knowledge on bionomics of *Byctiscus betulae* L. (Coleoptera, Curculionidae) on grapevine

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ABSTRACT

At a time of its massive occurrence on grapevine a less known part of the vine leaf roller (*Byctiscus betulae* L.) bionomics was studied in the period from the last decade of April until the first decade of May 2000 in the region of Slovenian Istria. It was established that in 90% of the cigar-like structures, which are formed of rolled leaves, their length was between 6.5 to 10.0 cm. In almost 50% of cases the females lay 3–4 eggs per 'cigar'. A statistically significant and very weak positive correlation was noted between the length of the 'cigar' and the number of eggs laid into the 'cigar'. A similar statistical relationship was observed between the number of bitten leaves during the supplemental feeding of weevils and the number of 'cigars'. This shows that the number of laid eggs is influenced by a number of factors and that the females do not lay eggs only on the plants on which they feed, but also on other plants. Though the weevil can harm on average more than 10 leaves in the early stage of vine development, it is listed among interesting rather than among damaging insects. The most abundant in the population were the weevils of metallic green color.

Key words: vine leaf roller, *Byctiscus betulae*, grapevine, bionomics, correlation

IZVLEČEK

PRISPEVEK K POZNAVANJU BIONOMIJE TRTARJA (*Byctiscus betulae* L., Coleoptera, Curculionidae) NA VINSKI TRTI

Ob masovni populaciji trtarja (*Byctiscus betulae* L.) na vinski trti v Slovenski Istri v obdobju od zadnje dekade aprila do prve dekade maja 2000 smo preučevali do tedaj manj znan del žuželkine bionomije. Ugotovili smo, da znaša dolžina skoraj 90% cigar od 6,5 do 10,0 cm in da samice v cigaro najpogosteje (v skoraj 50% primerov) vložijo 3-4 jajčeca. Med dolžino cigar in številom vanje vloženih jajčec smo ugotovili statistično značilno in zelo šibko pozitivno korelacijo. Podobno statistično razmerje smo ugotovili tudi med številom listov, ki jih hroščki objedo med dopolnilnim hranjenjem, in številom cigar. To pomeni, da na število odloženih

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jajčec v cigaro vplivajo številni dejavniki in da samice trtarja ne odlagajo jajčec le na rastlinah, kjer se hranijo, ampak tudi na drugih rastlinah. Čeprav lahko žuželka v zgodnji fazi razvoja vinske trte v povprečju poškoduje več kot 10 listov, jo bolj kot med škodljive, uvrščamo med zanimive žuželke. V populaciji trtarja so se v največjem številu pojavljali hroščki kovinsko zelene barve.

Ključne besede: trtar, *Byctiscus betulae*, vinska trta, bionomija, korelacija

1 INTRODUCTION

Among the pests of grapevine (*Vitis vinifera* L.) in Europe a less significant role has been assigned to the vine leaf roller (*Byctiscus betulae* L.) (Geoffrion, 1979; Flick, 1988). Use of chemicals in the pest management of grapevine has been decreasing in the past years due to increased integrated production of grapes. However, there are some economically important pests which are occasionally controlled by insecticides (i. e. grape berry moth (*Eupoecilia ambiguella* Hübner) and grapevine moth (*Lobesia botrana* Denis & Schiffermüller) (Oliva *et al*., 1999). In the past years more attention has been paid to phylloxera (*Dactulosphaira vitifoliae* Fitch) (Granett *et al.*, 1998; Valič and Milevoj, 1999) too.

Contrary to the previously mentioned species the vine leaf roller (*Byctiscus betulae* L.) is interesting because of unusual damages on the leaves. The females roll the leaves in cigar-like structures and they lay eggs into them. The insect has one generation per year and grapevine is not its only host, although the most abundant populations of weevils are usually found on grapevine, where the damage is also the most extensive (Peršurić, 1995). Weevils also bite the swollen buds and leaves, but these damages are less evident.

The vine leaf roller (*Byctiscus betulae* L.) in Slovenia has not been precisely studied as yet. The aim of this research was to determine a less known part of the insect bionomics, namely, if the number of eggs laid into the cigar is in correlation with the length of the cigar and whether a female lays eggs on the same plant on which it supplementary feeds.

2 MATERIALS AND METHODS

In the last decade of April 2000 a mass occurrence of the vine leaf roller (*Byctiscus betulae* L.) on grapevine (*Vitis vinifera* L.), cv. 'Refošk' was established in Primorska region (location Spodnje Škofije pri Kopru) (Vinakoper d.o.o. Koper, Work unit Purissima, 41 m above sea level, UTM VL04). On the leaves of host plants typical damages occurred, which were cigar-like structures and leaves bitten by weevils.

Grapevines were planted in 56 rows, 50 plants per each row. The distance between the rows and between the plants within each row was 2 m. The evaluation was performed on 6 May, when the grapevine was in the developmental stage “inflorescence emerge” (BBCH 53-55). 5 plants were randomly chosen in each from the 12 rows (1, 6, 11, 16, 21, 26, 31, 36, 41, 46, 51 and row 56). The number of leaves transformed in cigar-like structures, the number of wilting leaves (due to biting the leaf stem by the females) and the number of bitten leaves (damages caused by supplemental feeding of the weevils) were established.

From the investigated grapes 60 cigars were randomly collected, one per each sample plant. In the Entomological Laboratory of Institute of Phytomedicine (Biotechnical Faculty, Ljubljana,

Slovenia) the length of the cigars was measured and the number of the eggs laid within cigars was counted. Cigars were sorted into four classes by their length (I. class: < 6.0 cm, II. class: 6.5–8.0 cm, III. class: 8.5–10.0 cm, IV. class: 10.5–12.0 cm) and by the number of eggs laid (I. class: < 2 eggs, II. class: 3–4 eggs, III. class: 5–6 eggs, IV. class: 7–8 eggs).

Data was processed by the program Statgraphics Plus for Windows 4.0 and the following parameters were determined: the mean number of cigars, the mean number of wilting leaves and the mean number of bitten leaves per plant. A statistical relationship between the length of cigars and the number of eggs laid within them as well as relationship between the number of bitten leaves and the number of cigars were observed by linear regression.

3 RESULTS AND DISCUSSION

Based on the results of the study it was concluded that the majority of cigars (88.3%) were from 6.5 to 10.0 cm long, the percentage of cigars in the III. class being slightly higher (48.3%) than the percentage of cigars in the II. class (40.0%). Only one tenth of the total number of transformed (damaged) leaves represent cigars shorter than 6.5 cm and longer than 10.5 cm (Fig. 1). The length of the cigars is most likely in correlation with the size of a host leaf (longer cigars are rolled out of greater leaves), which lead to conclusion that females bite leaf stems of middle-sized leaves and they usually do not use small (younger) and large (older) leaves to establish a proper environment for the offspring. Most weevils in the observed population were of metallic green color, the number of those of metallic blue color was smaller, whereas only a few metallic red weevils were found.

In most cigars (46.7%) 3–4 eggs of the vine leaf roller were found. In 31.7% of cigars 1–2 eggs were found while in 18.3% of cigars of the whole sample 5–6 eggs were found. The highest number of eggs was 7-8 and was found only in 3.3 % of the cigars (Fig. 2).

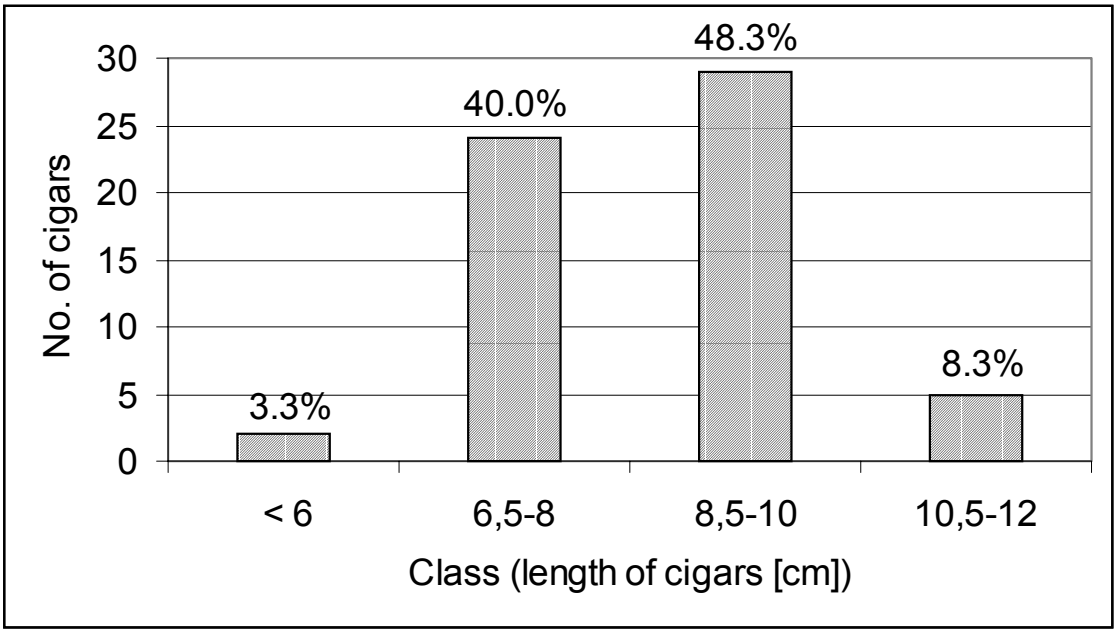


Fig. 1: The number of cigars in the particular class according to their length. Values on the top of each column represent percentage of cigars in the particular class

in relation to the total number of cigars (n=60).

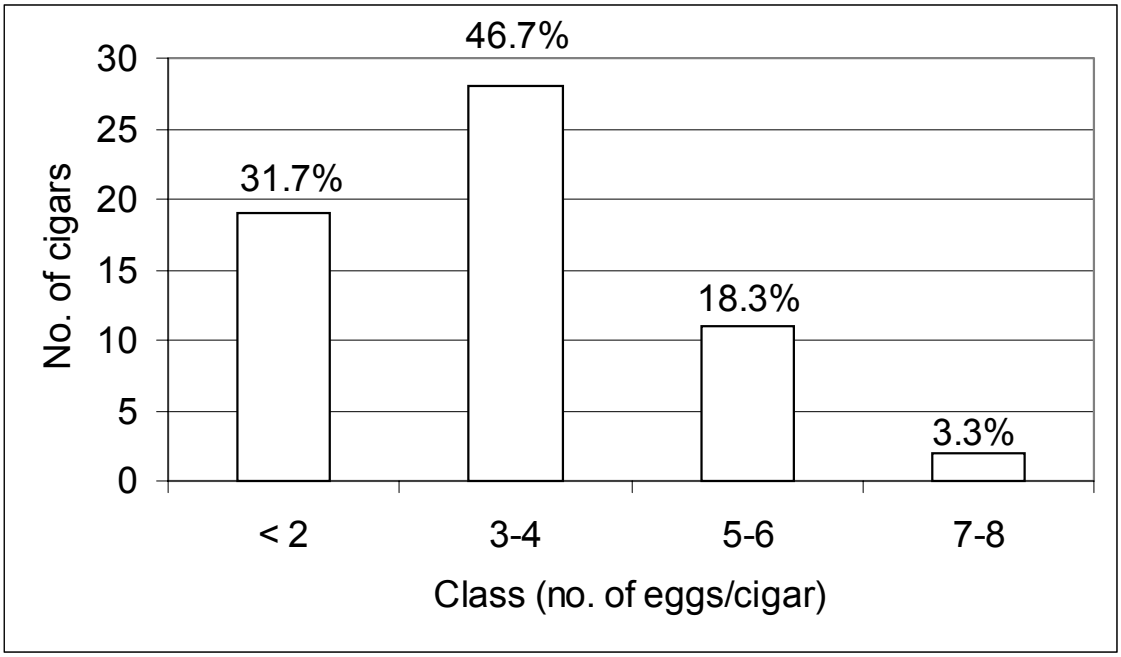


Fig. 2: The number of cigars in the particular class according to the number of eggs per cigar. Values on the top of each column represent percentage of cigars in the particular class in relation to the total number of cigars (n=60).

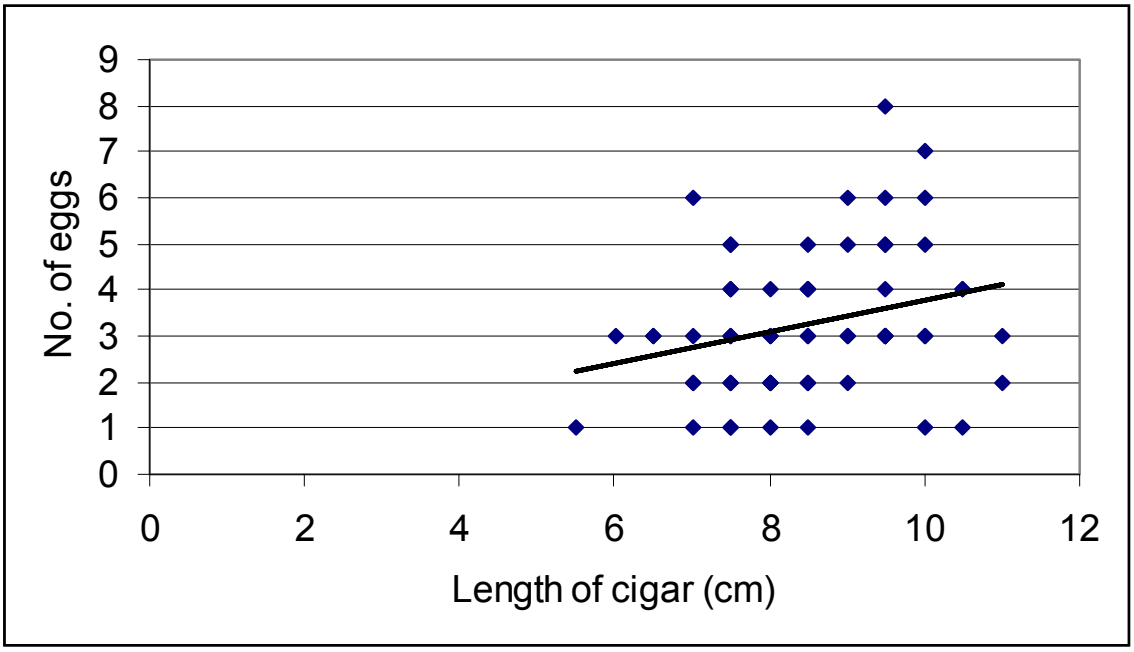


Fig. 3: The correlation between the length of cigars (cm) and the number of eggs laid by the females of *Byctiscus betulae* L. No. of eggs (y) showed a significant and positive, but weak correlation with the length of cigars (x) ($y = 0.38 + 0.34x$; $r^2 = 0.07$).

Between the length of cigars (x) and the number of eggs of the vine leaf roller (y) in a cigar, a statistically significant (p=0.0379), positive but very weak correlation

(r^2=0.07) was observed. The most convenient model was the linear model y = 0.38 + 0.34x, but only 7% of variability in egg number of the leaf roller in a cigar was explained as a consequence of the cigar length (Fig. 3). We thus concluded that the size of the leaves from which cigars are rolled, in spite of a statistically significant correlation between both parameters, is one of the less important factors influencing the number of eggs laid within a cigar.

At the evaluation of the number of cigars, wilting leaves and bitten leaves on the chosen grapevines in the first decade of May (developmental stage of grapevine was »inflorescence emerge«) we found out that on average damaged leaves (almost 6/plant) were mostly transformed into cigars, whereas approximately half less of them were wilting (the cigar was only developing). A slightly higher number (3.52/plant) of leaves were bitten (damage due to the supplemental feeding of adult vine leaf rollers) (Fig. 4).

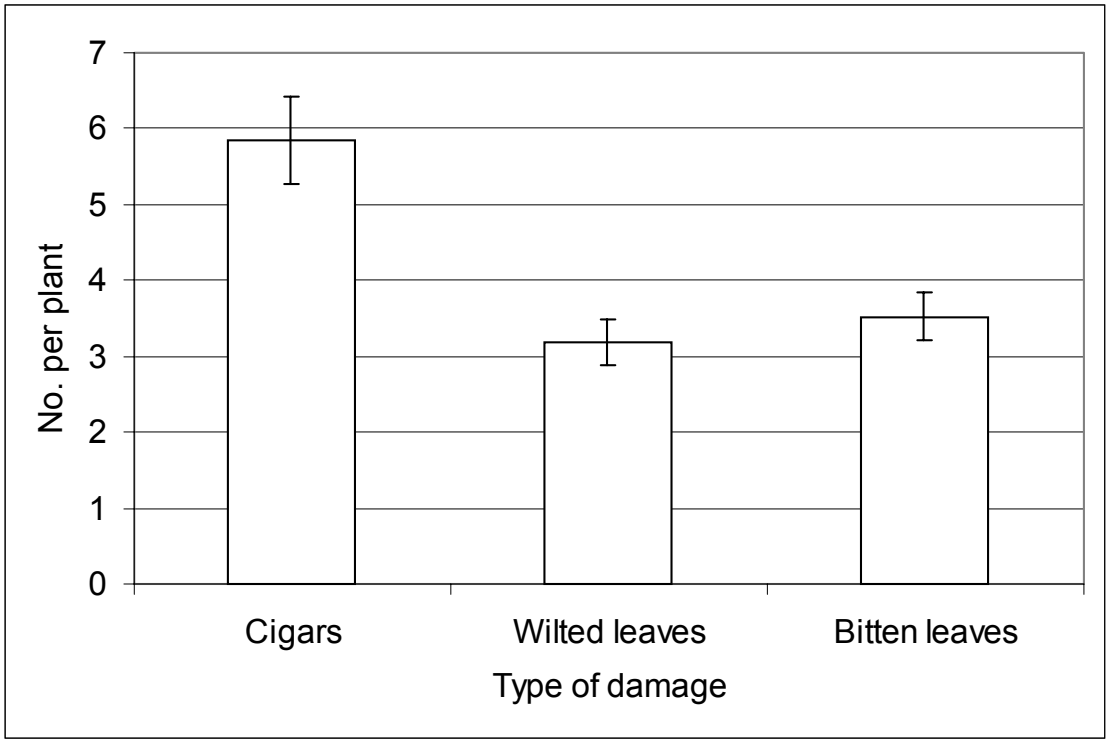
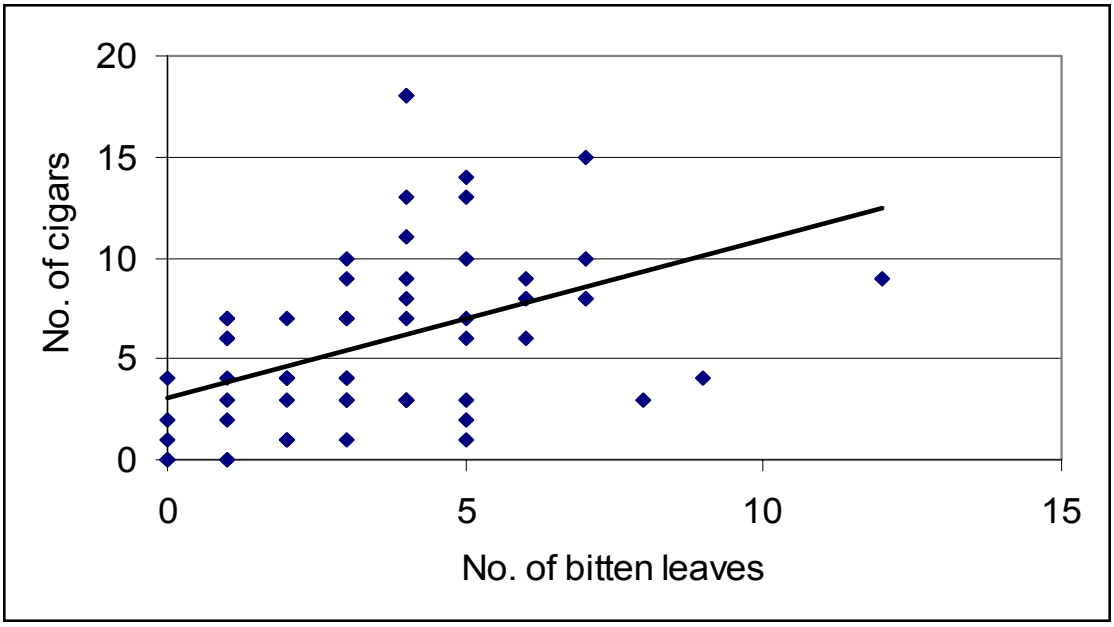


Fig. 4: The mean number of cigars, wilted and bitten leaves per plant on May 6 (Spodnje Škofije, Slovenia). The grapevine, cv. 'Refošk' was in a developmental stage "inflorescence emerge".

Between the number of bitten leaves (x) and the number of cigars (y) on plants a statistically significant correlation was found (p=0.0004), which was positive but also weak (r^2=0.20). By the linear model y = 3.10 + 0.78x, 20% of variability in the number of cigars per plant as a consequence of the number of the leaves eaten by the supplemental feeding of weevils was explained (Fig. 5). This shows that once the supplemental feeding has been finished the females do not lay eggs only on the plants on which they feed, but also on other (neighboring) plants and their choice of the plant to lay eggs on also depends on other factors (position of the plant and others).



Slika 5: The correlation between the no. of leaves eaten by adults of *Byctiscus betulae* L. during supplemental feeding and the no. of cigars. No. of cigars (y) showed a significant, weak and positive correlation with the no. of leaves eaten by the weevil (x) ($y = 3.10 + 0.78x$; $r^2 = 0.20$)

4 CONCLUSIONS

In the present research a less known part of the bionomics of the vine leaf roller (*Byctiscus betulae* L.) in the population from Slovenian Istria was observed. Based on the results it was concluded that females lay eggs on middle-size leaves (regarding the fact that a positive correlation exists between the length of a cigar and the size of the leaf). Almost 90% of cigars collected from cv. 'Refošk' were from 6.5 cm to 10.0 cm long and only a smaller percentage of cigars did not fit into this interval.

The females of the vine leaf roller lay up to 8 eggs into rolled leaves. However, in almost every second cigar 3 to 4 eggs were found, 2 eggs in every third cigar and 5 to 6 eggs in every fifth cigar. We determined that the length of the cigar is statistically significantly correlated with the number of the laid eggs, but the correlation is very weak. We therefore assume that a number of factors influence the number of the laid eggs in a cigar. A similar correlation was noted between the number of the leaves bitten during the supplemental feeding and the number of cigars. We explained this by the fact that the females do not lay eggs only on plants on which they feed, but also on other plants.

The grapevine (*Vitis vinifera* L.) is a vital plant species and therefore the damages caused by cigar-making and feeding of the weevils on the leaves most probably do not cause a substantial damage. However, in the developmental stage »inflorescence emerge« more than 10 leaves per plant can be damaged in one way or another, making the leaves photosynthetically inactive. The vine leaf roller is thus listed into

the group of "interesting insects" (due to the specific manner of care for the offspring - cigar-making), rather than among the pests.

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