Corresponding author:
e-mail: robert@utp.edu.pl

© Copyright by RIVC

OCCURRENCE OF *Crioceris* SPP. OF TEN EUROPEAN ASPARAGUS CULTIVARS DEPENDING ON DRIP IRRIGATION

Robert LAMPARSKI, Roman ROLBIECKI, Dariusz PIESIK, Dariusz PAŃKA
University of Technology and Life Sciences
Kordeckiego 20, 82-225 Bydgoszcz, Poland

Received: April 7, 2009; Accepted: November 2, 2010

Summary

The influence of drip irrigation of 10 European asparagus cultivars on the occurrence of *Crioceris duodecimpunctata* (L.) and *Crioceris asparagi* (L.) was studied. We tested 5 German cultivars (‘Ravel’, ‘Rambo’, ‘Rally’, ‘Ramada’, ‘Rapsody’), 2 Spanish cv. (‘Cipres’ and ‘Plaverd’), 2 Dutch cv. (‘Backlim’ and ‘Grolim’) and French cv. ‘Orane’ in the field conditions. The field experiment was carried out in two consecutive years (2005-2006) at Kruszyn Krajeński near Bydgoszcz on a sandy soil. Adults and larvae of *C. duodecimpunctata* (twelve-spotted asparagus beetles – T-SAB) and *C. asparagi* (common asparagus beetles – CAB) reached over 91% of all insects settled on asparagus summer stalks. The German cultivars ‘Rambo’ and ‘Rally’ were considerably settled by adults and larvae of T-SAB. The highest number of individuals (adults and larvae) of CAB on the Dutch cv. ‘Backlim’ were observed. However, German cv. ‘Rapsody’ were significantly less numerous (both CAB and T-SAB). Moreover Dutch cv. ‘Backlim’ was more occupied by adults and larvae of CAB in drip irrigation plots than all five tested German cultivars. Also adults and larvae of T-SAB as well as CAB often prefer drip irrigated asparagus summer stalks.

Key words: drip irrigation, *Asparagus officinalis*, *Crioceris duodecimpunctata*, *Crioceris asparagi*

INTRODUCTION

Asparagus is the perennial crop cultivated mainly for the spears which characterised high nutritional value. Up to now, increased interest of consumers in green spears is observed. It is mainly due to higher nutritional value in comparison to white spears and moreover the green spears are less fibrous and sour.

The asparagus plantations are mostly located on the very light soils. Asparagus is considered as a drought tolerant plant, however it responds to irrigation with increases in yield of spear, spear number and size (Ruth & Gardner 1991). The drip irrigation effected also on the development of assimilation stalks of asparagus. The usage of this system increase the height and diameter of the stalks and
also number of the assimilation stalks from the plant (Rolbiecki & Rolbiecki 2008).

During the growing season the asparagus stalks are very often seatled by the different insects. In conditions of middleeuropean climate Lamparski et al. (2010) and Szwejda (1999, 2002) - in Poland and Stary (1990) in Czech Republic showed following insects as very important C. duodecimpunctata and C. asparagi (Col., Chrysomelidae), Platyparea poeciloptera, Delia platatura, Brachycorynella asparagi, Aphis fabae and also Carpocoris fuscinus (Pentatomidae).

Many various factors can impact the number of pest asparagus insects. Lamparski et al. (2010) found that drip irrigation influenced on the development and number of asparagus pests. Microirrigation system of three European asparagus cultivars (‘Gijnlim’, ‘Ramos’ and ‘Vulkan’) cultivated on the very light soil influenced the occurrence of adults and larvae of T-SAB (twelve-spotted asparagus beetles) and CAB (common asparagus beetles). Both adult and larvae of CAB were significantly less numerous on ‘Ramos’ cultivar. In case of adults, microirrigation system did not affect the occurrence of insect species. Both beetles and larvae of the T-SAB were the most numerous on ‘Ramos’ cultivar. However, no significant effect of microirrigation system on the number of insect in population was stated.

Drip irrigation can considerably influence the increase of phytophagous insects on many cultivated plants. It is well known that drip irrigated plants may be in better condition and more attractive meal for the insects (Lamparski et al. 2008, 2009).

The main scope of the paper was estimation the influence of drip irrigation and different asparagus cultivars on the insects occurrence in the field conditions.

MATERIAL AND METHODS

The field experiment was carried out in two consecutive years (2005-2006) at Kruszyn Krajenski near Bydgoszcz on a sandy soil (Haplu-dolls). The asparagus plantation was in the first two years of harvest. The water reserve to 1 m soil depth at field capacity was 87 mm and the available water quantity 67 mm. The field experiment was conducted in a randomized block design of a two-factorial system with four replications. The first factor was irrigation used in two variants (O - non-irrigated plots (control), D - drip-irrigated plots); the second factor was 10 European asparagus cultivars. The crowns were planted 10th of April 2003.

The standard growing technique according Knaflewski (2005) was applied. The plot area for harvest was 15.12 m² (24 plants x 35 cm x 180 cm). During harvest the ridges were black-white plastic covered. The asparagus was harvested for white spears. The surface drip irrigation was done with the use of drip line T-Tape. The irrigation was started when the soil water tension was –0.05 MPa. The observations were made after the harvest, when the summer stalks were grown. The number of adults and larvae of T-SAB and CAB was observed on all plot area, three times during the vegetation period in July and August (from the first decade of July every three weeks). Insects were
counted and determined of species with the use of the keys of War-
chołowski (1971). Data were statistically calculated by analysis of vari-
ance. A Tukey’s test at $P=0.05$ was used to identify mean values with
significant differences.

The meteorological conditions
during the two vegetation periods were
characterized by lower precipitations and higher temperatures in June and
July and September in comparison to long-term mean (Fig. 1). In August
2006 the rainfall was higher and temperature lower than long-term means.

**RESULTS**

Two species: T-SAB and CAB occurred on asparagus while field
observations. The first one was the more numerous. Insects larvae
reached almost third part of all ob-
erved *Criocerus* spp. on tested plants.
The majority of studied cultivars was
seattled by 1 to 3 individuals of T-
SAB per plot on average.

In 2005 adults T-SAB were more
numerous on the ‘Rambo’, ‘Cipres’,
‘Plaverd’ and ‘Orane’ cv. on the irri-
gated plots, in comparison to non-
irrigated plots. From all irrigated Eu-
ropean cultivars of asparagus during
the 2005 season, the ‘Ramada’ was
least settled by the adults of T-SAB
(0.92 individuals per plot). The big-
gest numerous of insects were ob-
tained on cultivars ‘Orane’ (10 indi-
viduals per plot) and ‘Rambo’ (8 indi-
viduals per plot). On the control plots
the most willingly settled cultivars
were ‘Cipres’ and ‘Rambo’ - 4 indi-
viduals per plot, in comparison to the
rest of all non-irrigated asparagus
cultivars in the field experiment (Ta-
ble 1). In 2006 from among of all
cultivars tested on the irrigated and
non-irrigated plots, the ‘Rambo’ cv.
was the most willingly settled by the
adults of T-SAB (6 and 9 individuals
per plot, respectively) (Table 1).

In case of larvae T-SAB during
the 2005 and 2006 the most numerous
of individuals for ‘Rambo’, ‘Rally’
and ‘Cipres’ were observed. The irri-
gated plants were willingly attacked
by larvae, than plants from non-
irrigated plots (Table 1).
Table 1. Effect of drip irrigation on occurrence of adults and larvae (*Crioceris duodecimpunctata* L.) on European asparagus cultivars (individuals per plot)

| Year | I - Irrigation | Ravel | Rambo | Rally | Ranada | Rapsody | Cipres | Plaverd | Backlim | Grolim | Orane | LSD\(_{0.05}\) |
|------|----------------|-------|-------|-------|--------|---------|--------|---------|---------|--------|--------|--------|----------|
| 2005 | Drip irrig.    | 2.25 c| 8.00 Bf| 2.09 bc| 0.92 a | 1.08 ab | 6.42 Be| 4.25 Bd | 1.00 ab | 1.00 ab | 10.00 Bg| I=1.09 |
|      | Control        | 1.25 a| 4.00 Ab| 1.50 a | 0.67 a | 0.50 a  | 4.08 Ab| 2.33 Aab| 1.42 a  | 0.58 a  | 1.25 Aa | II=1.86 |
| 2006 | Drip irrig.    | 1.58 a| 6.17 Ab| 0.84 a | 1.25 a | 0.58 a  | 2.50 a | 1.17 a  | 0.67 a  | 1.33 a  | 1.17 a  | I=1.79 |
|      | Control        | 0.92 a| 9.17 Bb| 1.33 a | 0.75 a | 1.50 a  | 0.83 a | 2.75 a  | 1.33 a  | 0.59 a  | 0.50 a  | II=3.01 |

*Crioceris duodecimpunctata* L. - larvae

| Year | I - Irrigation | Ravel | Rambo | Rally | Ranada | Rapsody | Cipres | Plaverd | Backlim | Grolim | Orane | LSD\(_{0.05}\) |
|------|----------------|-------|-------|-------|--------|---------|--------|---------|---------|--------|--------|--------|----------|
| 2005 | Drip irrig.    | 0.99 Bab| 2.75 Bc| 3.78 Bd| 0.40 Aa | 0.68 ab | 0.61 ab| 2.68 Bc | 2.52 Bc | 0.55 ab | 1.15 Bb | I=0.34 |
|      | Control        | 0.40 Aa| 2.04 Ab| 2.89 Ac| 1.79 Bb| 0.51 a  | 0.58 a | 1.55 Ab | 0.45 Aa | 0.30 a  | 0.34 Aa | II=0.67 |
| 2006 | Drip irrig.    | 0.14 a| 0.79 Bcd| 1.04 Bd| 0.47 abc| 0.20 ab | 2.15 Be | 0.79 cd | 0.54 abed| 0.47 abc| 0.74 bcd| I=0.36 |
|      | Control        | 0.24 a| 0.21 Aa| 0.46 Aa| 0.18 a | 0.31 a  | 0.15 Aa| 0.54 a  | 0.20 a  | 0.40 a  | 0.70 a  | II=0.56 |

Note: values with the same letter are not significantly different at P=0.05 according to Tukey’s test (A, B, ..., - irrigation (I); a, b, ..., - cultivars (II)).
Table 2. Effect of drip irrigation on occurrence of adults and larvae (*Crioceris asparagi* L.) on European asparagus cultivars (individuals per plot)

<table>
<thead>
<tr>
<th>Year</th>
<th>I - Irrigation</th>
<th>II - Cultivars</th>
<th>LSD$_{0.05}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><em>Crioceris asparagi</em> L. - adults</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ravel</td>
<td>Rambo</td>
</tr>
<tr>
<td>2005</td>
<td>Drip irrig.</td>
<td>0.83 a</td>
<td>1.00 a</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>0.67 a</td>
<td>1.08 a</td>
</tr>
<tr>
<td>2006</td>
<td>Drip irrig.</td>
<td>3.42 Bb</td>
<td>0.92 Aa</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>0.58 Aa</td>
<td>1.25 Ba</td>
</tr>
<tr>
<td></td>
<td><em>Crioceris asparagi</em> L. - larvae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>Drip irrig.</td>
<td>0.35 a</td>
<td>0.50 Aa</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>0.19 a</td>
<td>1.05 Bcd</td>
</tr>
<tr>
<td>2006</td>
<td>Drip irrig.</td>
<td>0.20 ab</td>
<td>0.13 a</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>0.18 a</td>
<td>0.12 a</td>
</tr>
</tbody>
</table>

Note: see Table 1
The adults of CAB in 2005 and 2006 were feeding considerably on ‘Ramada’, ‘Plaverd’, ‘Orane’ and ‘Ravel’ cultivars. However, the adult insects were more numerous on the irrigated plots (Table 2).

Dutch cultivar ‘Backlim’ was the most often settled by larvae of CAB. Larvae were feeding first of all on plants from the irrigated plots. Similar results were obtained in 2005 and 2006 for this cultivar, too (Table 2).

**DISCUSSION**

Insects of *Crioceris* spp. belong to the most important pests of asparagus summer stalks. Two insect species: T-SAB and CAB are very common in Europe.

Adults individuals mainly appear in April. Two generations are present in a vegetation season. Both larvae and adults feed on green parts of the plant, but also on the flowers. In a consequence of insects damaged plants begin to dry (Knaflowski 2005; Szwejda 2002). Szwejda (2002) noticed that adults of CAB in Poland appear by the end of May, but larvae in June. Females lay eggs on the leaves, flowers and also on a main and lateral shoots. Similarly adults T-SSB feed on the above-ground part of plants (summer stalks in case of asparagus) but larvae feed mainly inside the fruits of asparagus plants (Knaflowski 2005). The significant influence on the abundance of pests have a weather conditions. Szwejda (2002) noticed that CAB population of all developmental stages decreased after heavy rainfalls. These results were confirmed in the own investigations. In 2005 the larvae and adults of *Crioceris* spp. were the most numerous in comparison to 2006 which was characterised by higher precipitation during the vegetation season.

Szwejda (2002) observed in July and August only a few individuals per plant of CAB. The number of adults and larvae of CAB was observed on 10 plants grown at different places. The results obtained in own experiments also confirmed that data.

On the Dutch asparagus cultivar ‘Gijnlim’ more individuals (adults and larvae) of CAB than on two German cultivars (‘Ramos’ and ‘Vulkan’) were observed (Lamparski et al. 2010). It is in good agreement with previous own observations Dutch cv. ‘Backlim’ was higher occupied by adults and larva of CAB in drip irrigation plots in comparison to five tested German cultivars. It was previously well documented that ‘Backlim’ and ‘Rapsody’ possess large height of summer stalks (Rolbiecki & Rolbiecki 2008). On the first cultivar the highest number (adults and larvae) of CAB was observed. Surprisingly, the second cultivar was considerably less occupied by both CAB and T-SAB. Lamparski et al. (2010) noticed that ‘Ramos’ and ‘Vulkan’ were rather less settled by adults and larvae CAB, what was also observed for ‘Rambo’ and ‘Rapsody’.

The Dutch cultivar ‘Gijnlim’ was less attractive for adults and larvae of T-SAB than ‘Ramos’ and ‘Vulkan’ (Lamparski et al. 2010). Rolbiecki and Rolbiecki (2008) found that marketable yield was lower for the Dutch than for all German cultivars.

The tendency in own investigations of more numerous adults and larvae on the irrigated plants can be
very important for practice. The irrigated plants are more attractive to pests because of better habit and taste. Similar conclusions are presented by Lamparski et al. (2008, 2009) in experiment with different plants.

CONCLUSIONS

1. The most abundant on asparagus cultivars were T-SAB and CAB. These two pests made up over 91% of all settled of asparagus insects.
2. Adults of T-SAB preferred ‘Rambo’ cultivar. The ‘Grolim’ cultivar was seldom attacked by CAB.
3. Adults and larvae of T-SAB as well as CAB preferred drip irrigated asparagus summer stalks.

REFERENCES

Lamparski R., Rolbiecki R., Piesik D. 2009. [Influence of drip irrigation on insects occurrence in cultivation of two cultivars of summer squash (Cucurbita pepo L.).] Infrastruktura i Ekologia Terenów Wiejskich 3: 159-166. [in Polish with English summary]
WYSTĘPOWANIE POSKRZYPEK (CRIOCERIS SPP.)
NA 10 EUROPEJSKICH ODMIANACH SZPARAGA
W ZALEŻNOŚCI OD NAWADNIANIA KROPLOWEGO

Streszczenie