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SHORT COMMUNICATION

FIRST RECORD OF *CLYTRA LAEVIUSCULA* RATZEBURG AS POTENTIAL INSECT PEST OF ENERGY WILLOW (*SALIX VIMINALIS* L.) IN UKRAINE

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Cultivation of short rotation coppice energy willow (SRC EW), *Salix viminalis* L., has a great potential in Ukraine as a source of biomass for biofuel production. Commercial production of this species was recently initiated in the country. The growing of SRC EW in Western and Northern Europe for a long time showed that leaf beetles (Coleoptera: Chrysomelidae) are key pests causing significant biomass reduction. However, data about the pest complex for energy willow growing in Ukraine is not available. Our three-year experiment in Poltava region, Ukraine showed that foliar damage caused by *Clytra laeviuscula* Ratzeburg (Coleoptera: Chrysomelidae) occurred at energy willow plantations in the second year of production, which could have an effect on commercial production. Accordingly, information about seasonal activity, population dynamics, host range and the role of natural enemies in pest regulation are requested for developing pest control program.

Key words: short rotation energy willow, *Clytra laeviuscula* Ratzeburg, pest control

The short rotation coppice energy willow (SRC EW), *Salix viminalis* L., as a source of biomass for biofuel production has been grown extensively for more than 30 years in Sweden, Denmark, the United Kingdom and Ireland (Siren *et al.* 1987; Kendall & Wiltshire 1998) and about 20 years in Poland (Kowalik 1994) and the Slovak Republic (Otepka & Haban 2006). This species has been under evaluation for commercial utilisation of *Salix* spp. for several years in Ukraine and current area of cultivation is about 2,000 ha at nine different regions across the country. A substantial increase in production of biofuels is expected over the next 15 years, considering current demands and energy policy issues. According to the recent publication (Geletukha *et al*. 2015), the area of SRC EW's cultivation will increase up to 250,000 ha by 2030 and biomass yield will rise from 0.013 to 1.66 metric tons of the oil equivalent.

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One of the most important challenges the SRC EW producers face is achieving stable and elevated biomass yield over years of plant cultivation. Yield reductions are often impacted by insect pests and plant diseases, which can be especially damaging in clones grown at a large scale and monoculture (Cannell 2004). Leaf beetles (Coleoptera: Chrysomelidae) were reported as key pests, including the brassy willow beetle *Phratora vitellinae* L., blue willow beetle *Phratora vulgatissima* L. and brown willow beetle *Galerucella lineola* F. (Kendall *et al*. 1996; Bjoërkman *et al.* 2000; Ropek 2007). Outbreaks of blue and brown willow beetles were reported in the United Kingdom (Kendall & Wiltshire 1998), and in Sweden, blue willow beetle was more abundant, particularly *S. viminalis* L. (Bjoërkman *et al.* 2003). Leaf beetles overwinter as adults and are bivoltine.

Nevertheless, SRC EW has been growing in Ukraine for a number of years in a large scale, data about the pest complex are not available yet. In our three-year experiment, SRC EW *S. viminalis* L. has been grown in Southeastern Ukraine since 2013 at the experimental field of the Institute of Bioenergy Crops and Sugar Beet in Poltava region. The research site has about 511 mm of annual precipitation (256 mm per vegetation period). The type of soil is podzolized black soil having heavy structure with humus to a depth of 0.45 m and carbonate compensation depth of 0.7–1.0 m; humus content at the arable layer of the soil (0–0.3 m) is about 3.2%. The soil has the following content of nutritional elements: alkali-hydrolysis nitrogen 1 mg, phosphorus 9 mg and potassium exchanging 16.3 mg per 100 g of soil. Soil pH is about 6.0.

The SRC EW was manually planted by 0.15–0.20 m cuttings at two 200 m^2 plots on April 20, 2013. Cuttings were planted at a density of 15,000 units/ha. The fall tillage was done before planting in spring; the height of plants was from 1.0 to 1.2 m in June, 2013. Monitoring of damage (defoliation) was conducted visually at plantation. The methods proposed by Bjoërkman *et al.* (2000) and Martin (2005)

Figure 1. *Clytra laeviuscula* L. adult feeding on the growth point of young shoots of short rotation coppice energy willow

were used. The sampling was done at two randomly selected stems. The percentage of leaf area loss was evaluated visually. Severity of defoliation was classified as <30%, 30–70% and >70% of the leaves that were destroyed by adults.

No pest damage was detected during the first year of plant growth. The first adult beetles observed feeding on the SRC EW *S. viminalis* L. were the *Clytra laeviuscula* Ratzeburg (Coleoptera: Chrysomelidae), which were observed in June, 2014 during the second year of production. Although the *Clytra* spp. has been recorded throughout the Europe, Palearctic region and Near East, there are no records available on SRC EW *S. viminalis* L. growing in Ukraine. Adult beetles were collected and identified using morphological characteristics (Brovdiy 1977). The adult beetles were on an average 9 mm in length and 4 mm in width. They had a black body and orange elytra with four black patches (Figure 1). No other insect was observed to cause damage during examination period.

The adult beetles were counted on each of 30 plants every 7–10 days between June, 20 and July, 30, 2014, the SRC EW was researched at five different dates. The mean density of pests per plant varied from 1.0 to 6.4 beetles. The peak of population density was observed on July, 7 when the average density per plant was 6.4. This is illustrated in Figure 2. It was observed that adults damaged the plant by feeding on the leaves, especially located on new shoots and destroyed about 50% of the tree biomass; no immature stages were found on the tree during the sampling period.

Monitoring in spring 2015 showed that five ant colonies were found at the marginal land close to first belt plots surrounding the SRC EW *S. viminalis* L. plots. Those nests were checked for immature stages of *C. laeviuscula* R. and two nests were positive; two larvae were found in one ant colony, and larva and a pupa were found in another one. It has to be mentioned that willow *Clytra* spp. has a specific relationship with ants that is why only adults were found feeding on the plants. The female beetles deposit eggs next to ant colonies and the ants take eggs into their nests. The hatching larvae eat the waste and other detritus left by the ant brood. The adults usually emerged after about two weeks. Another *Clytra* spp., in particular *Clytra quadripunctata* L., may also occur on SRC EW, but there is no record of its damage or outbreaks in our experiment.

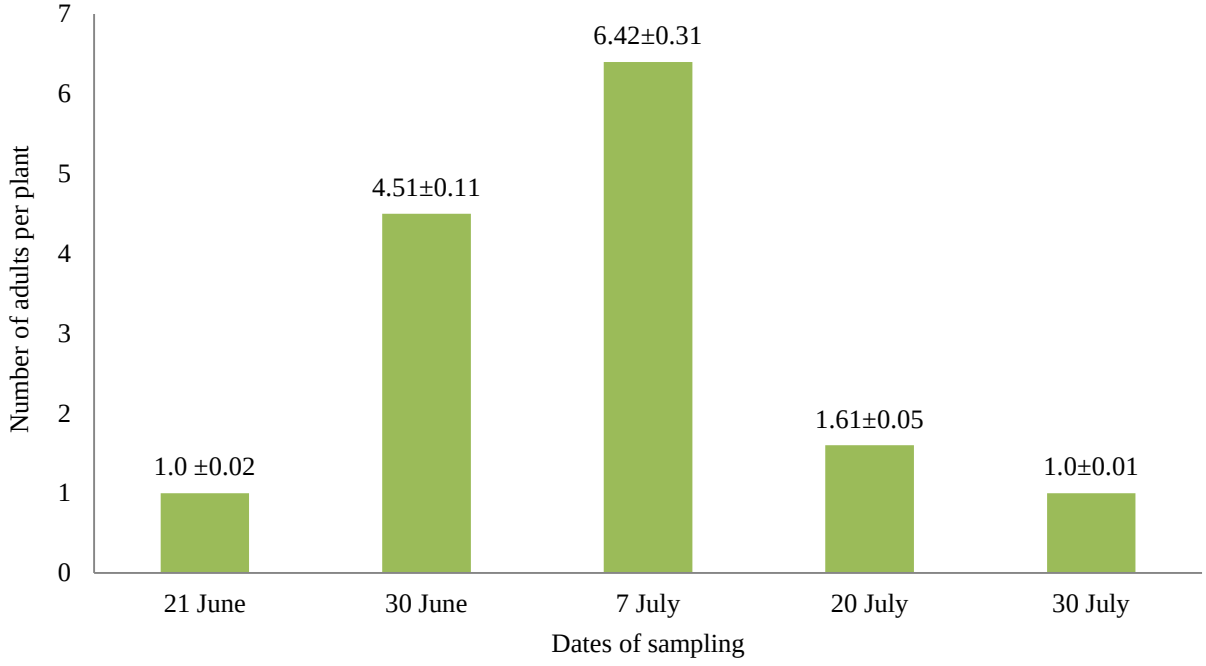

Figure 2. Numbers of *Clytra laeviuscula* L. adults on short rotation coppice energy willow in 2014

The use of chemical insecticides for pest control is of concern because of ecological and human health issues; breeding for pest resistance may be important long-range issues for its control (Peacock *et al.* 2004; Lehrman *et al.* 2012).

It can be concluded that *C. laeviuscula* R. caused damage to SRC EW. That fact was observed in experimental plots in Poltavska region, Ukraine, in year 2014. Up to 50% of the leaf defoliation was caused by adults, and no larval damage was observed. Although the species has been recorded throughout Europe, Palearctic and the Near East, the finding of this beetle is the first record in Ukraine.

It is essential to study the life cycle and biology of this pest recorded at SRC EW *S. viminalis* L. in Ukraine and its connection with ant species. Future research has to be focused on pest monitoring, seasonal activity, population dynamics, host range and understanding the role of natural enemies in pest regulation. Furthermore, monitoring and control measures have to be developed for the pest.

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