

Weevils of the genus *Ceutorhynchus* Germ associated with oilseed rape in northern Serbia

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Received: October 1, 2015

Accepted: October 16, 2015

SUMMARY

Our research of the genus *Ceutorhynchus* associated with oilseed rape was conducted in northern parts of Serbia (Stari Žednik, Subotica). A specific assemblage of eight weevil species was found. The most numerous were stem weevils *Ceutorhynchus napi* with 81% of all trapped specimens, followed by *C. pallidactylus* with 18%. The remaining six weevil specimens were *C. obstrictus*, *C. erysimi*, *C. minutus*, *C. picitarsis*, *C. sulcicollis* and *C. typhae*, comprising 1% of all trapped insects. Stem weevils *C. napi* and *C. pallidactylus* began to immigrate into the oilseed rape fields in autumn, as early as November 10 (BBCH 17-18). The maximum flight was recorded at the beginning of oilseed rape stem elongation (BBCH 22-25) on March 23. A new generation of *C. pallidactylus* emerged from oilseed rape fields in June (BBCH 76-88), while individual specimens occurred during the autumn. The majority of *C. napi* emerged in March next year, sporadically until May 7. As a consequence of *C. napi* dominance insecticide treatment should be performed earlier than usual, i.e. when *C. pallidactylus* is the primary target.

Keywords: Oilseed rape; Weevils; *Ceutorhynchus*; Serbia

INTRODUCTION

The genus *Ceutorhynchus* is one of the largest in the family Curculionidae, with over 382 species known (Colonnelli, 2004). The majority of species occur across the Palearctic and about 70% of the species are concentrated in the western parts of the region. Over 100 species are known in Europe (Korotyaev, 2008). Every year, this number rises as new species are described (Colonnelli, 2005; Krátký, 2012). Preferable host plants for many

Ceutorhynchus species belong to the family Brassicaceae. Wild and especially cultivated Brassicaceae are widespread in Europe, the oilseed rape (OSR) being the most prominent species in the family, growing on about 5 million hectares. Due to its beneficial role in plant rotation and conservation of biodiversity, and its being a source of biofuel and edible oil for their ever increasing demands, further expansion of OSR appears realistic in the future. However, increasing OSR production area leads to increasing threats from *Ceutorhynchus* weevil populations (Günthart, 1949).

Ongoing climate changes can influence the phenology and abundance of weevils. Adaptation of different species to climate changes may vary from their becoming rare to excessive abundance (Putten et al., 2010). Thus, climate change may also lead to a change in insect abundance and distribution. The region of northern Serbia has been predicted to sustain significant climate change in the future, and records about these insects' present status are important. The aim of this study was to research the genus *Ceuthorhynchus* in OSR fields in northern Serbia, where its production is concentrated, although not extensive at present.

MATERIAL AND METHODS

Experimental site: The trial was set up in northern Serbia (Stari Žednik, Subotica, GPS coordinates: N45 57.280 E19 37.554). The soil is calcic chernozem, loamy type texture. The climate is mild continental with mean annual temperature of 11.2°C and annual precipitation of about 530 l/m². Global climate change has already severely affected this area and the most prominent impact is expected to occur by the end of the 21st century (Rubel & Kottek, 2010).

Experimental fields: Three commercial experimental fields of 1 ha each were drilled with OSR cv. Excalibur on September 17, 2010, and with winter wheat (WW) in the following growing season, on 20 October 2011. The fields had never been planted with oilseed rape before. The OSR fields were managed in accordance with conventional, integrated and organic production requirements. No herbicides, foliar fungicides or molluscides were applied over the OSR growing period. On March 25, 2011, the conventionally managed OSR field was sprayed with chlorpyrifos + cypermethrin (500 g/ha a.i. + 50 g/ha) and the field with integrated management with cypermethrin (40 g/ha a.i.). The organic field was sprayed with spinosad (96 g/ha a.i.) on April 6, 2011. A standard tractor sprayer with 300 l water/ha was used. The fallow period lasted from the OSR harvest on June 21 until October 20, 2011 when WW was sown. The succeeding WW crop was managed without any insecticide treatments and was the same in three experimental fields.

Sampling and identification: All sampling of *Ceuthorhynchus* specimens was performed at 8 points set up 50 m apart in the middle of each field. The *Ceuthorhynchus* weevil specimens were sampled using yellow water traps (YWTs) and emergence traps, while

the presence of larvae was assessed by plant dissection. The collected weevils were identified according to Hoffmann (1954), Smreczyński (1974) and Freude et al. (1983).

Yellow water traps: Yellow water traps were used to monitor the autumn and spring immigration of adult *Ceutorhynchus* weevils into the OSR fields. From October 2, 2010 (BBCH 12-13) three YWTs were set up in each field and checked 4 times until the end of November (BBCH 18-19). The sampling was discontinued in December. From January 2011, four traps were placed in each field and the sampling period was extended to 2-4 week intervals. In the spring, sampling was conducted again at 7-days intervals until May 15, 2011. The traps were mounted on a holder and continuously raised up to be always above crop level.

Plant dissection: Randomly sampled OSR plants were dissected in the laboratory on November 10, 2010 (BBCH 17-18) and November 30, 2010 (BBCH 18-19). In total 480 plants were dissected (240 plants in each procedure). To check the presence of weevil larvae, each leaf stalk and plant root was dissected. In the spring of 2011, 432 OSR plants were sampled and dissected, i.e. on April 12 (BBCH 55-57), April 19 during the full flowering stage of OSR (BBCH 63-65), and at the end of flowering on May 3 (BBCH 69-71).

Emergence traps: The emergence of a new generation of *Ceutorhynchus* imagines was monitored using emergence traps (www.ecotech-bonn.de) with a pitfall trap inside each. The sampling with emergence traps continued from the end of OSR flowering (BBCH 68) until harvest on June 21, 2011, then during the fallow period and the growing period of WW (October 20, 2011-June 21, 2012). The emergence traps were checked every 7 to 14 days.

RESULTS

Species composition and abundance: Eight species of the genus *Ceutorhynchus* (Germar 1824) (Curculionidae, Ceutorhynchinae Gistel, 1856) were detected in OSR during the 2010/2011 growing season. These species are as follows: *Ceutorhynchus obstructus* (Marsham 1802), *C. erysimi* (Fabricius 1787), *C. minutus* (Reich 1797), *C. napi* (Gyllenhal 1837), *C. pallidactylus* (Marsham 1802), *C. picitarsis* (Gyllenhal 1837), *C. sulcicollis* (Paykull 1800) and *C. typhae* (Herbst 1795). Based on a total of 3386 specimens checked in the laboratory, we concluded that their abundance

varied greatly. The most numerous was *C. napi* that accounted for 81% of all collected specimens (2712 insects). The second most numerous was *C. pallidactylus* with 18% share (609 insects). The remaining 6 species were detected sporadically and their frequency was 1% of all collected specimens. Among them, 14 insects belonged to the species *C. obstructus*, 14 were *C. picitarsis*, 6 were *C. erysimi*, 11 were *C. minutus*, 3 were *C. sulcicolis* and 17 insects were *C. typhae* (Figure 1). The largest number of specimens (55%) was collected in the field with organic management, while the counts of weevil specimens in the other two management systems were similar – 23.2% in the conventional and 21.7% in the integral management system.

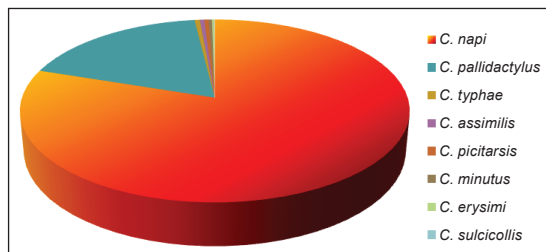


Figure 1. Species of the genus *Ceutorhynchus* associated with oilseed rape

Records of *Ceutorhynchus* species trapped in YWTs: The two most numerous weevil species have similar immigrating flight patterns. Rape stem weevil (*C. napi*) and cabbage stem weevil (*C. pallidactylus*) began to immigrate into the oilseed rape fields in autumn, i.e. during November (BBCH 16-17). The number of adults caught in YWTs during autumn was small. In our experimental fields, we recorded the mean number of up to 1 cabbage stem weevil and up to 2 rape stem weevils per YWT. In total, during the autumn immigration there were 11 *C. pallidactillus* and 5 *C. napi* imagines. Over the following period until February 12, 2011 (BBCH 19-20) up to 15.8 cabbage stem weevils and 22.8 rape stem weevils were found per YWT/week. Massive flight of both species started during the later half of March and was at its maximum on March 23 (BBCH 22-25). The maximum mean number of cabbage stem weevils was 72.3 per YWT/week while the mean number of rape stem weevils was 148.8 per YWT/week. By April 15 (BBCH 55-57), the flight of *C. pallidactylus* was over, whereas a few more individuals of *C. napi* were caught until April 27. During the whole sampling period from January 30 until April 7, 2011, the ratio of male/female

specimens of *C. napi* collected in YWT was 1.3:1, while *C. pallidactylus* had a respective ratio of 0.8:1. *C. obstructus* insects immigrating into the OSR fields were found in YWTs in the spring of 2011. A total number of 14 specimens (11♂♂/3♀♀) was caught in YWTs traps in 3 fields on April 7, 2011 (BBCH 55-57). *C. picitarsis* was recorded in YWTs during weevil immigration into the OSR fields in the spring of 2011. On March 23 and March 30, 2011, five specimens (2♂♂/3♀♀) and 9 specimens (5♂♂/4♀♀), respectively, were trapped in 12 YWTs. *C. typhae* was also found in the YWTs, 12 specimens were captured on March 30 (6♂♂/6♀♀) and 5 on April 7, 2011 (5♂♂). Three *C. erysimi* males were found in a YWT on March 23, 2011, and another 3♂♂ on May 26, 2011. *C. minutus* was represented by 11♀♀ on March 23, 2011, while *C. sulcicolis* (3♀♀) was recorded on March 30, 2011.

Weevil larvae in OSR stems, leaf petioles and pods: Our autumn assessment of stem weevil larvae by dissection of OSR stems and leaf petioles, performed on November 10 (BBCH 17-18) and November 30, 2010 (BBCH 18-19), showed that weevil larvae were not present. Weevil larvae were found in OSR plants in the following spring, from April 12 (BBCH 19-20) to May 3, 2011 (BBCH 55-71). Dissection of OSR pods (BBCH 71-73) revealed the presence of a single cabbage pod weevil larva. The mean number of *Dasyneura brassicae* Winn. larvae in the dissected pods ranged from 3.6 up to 26.3 larvae per pod. This indicates that *C. obstructus* is of no relevance to the infestation of OSR by brassica pod midge (*D. brassicae*).

Records of new generation weevils in emergence cages: The emergence of a new generation of *C. pallidactylus* weevils occurred from May 26 until June 5, 2011, when OSR was at the ripening stage (BBCH 79-80), and ended by June 21 when OSR was at the final growth stage (BBCH 87-88). A great majority of new generation *C. pallidactullus* weevils emerged from the OSR field in June. Later in the season, only one imago of *C. pallidactylus* was found on September 9, 2011 and one more on November 14, 2011 in the same field, which was by that time sown with winter wheat. On March 26, 2012 a single weevil was again found in an emergence cage.

In the spring of 2012, a new generation of *C. napi* weevils emerged in the subsequent winter wheat crop. The emergence traps revealed weevil emergence from March 5 until April 2, 2012. Two weevils emerged until May 7, 2012. The peak of emergence in the sampling period occurred from March 12 to March 19, 2012.

DISCUSSION

The weevil species assemblage that we found in our experimental OSR fields is typical for OSR crop stands throughout Europe (Alford et al., 2003; Grantiņa et al., 2011; Milovac et al., 2010; Toshova et al., 2009; Vaitelytė et al., 2013; Williams & Cook, 2010). However, the abundance of weevils and their consequential economic significance are quite different. Our results show that two stem weevils are the most numerous and therefore most significant weevil pests of oilseed rape in the region of northern Serbia. The most frequent species was *C. napi*, which accounted for 81% of the total number of recorded weevils, and it was followed by *C. pallidactylus* with 18%. These two species comprise 99% of the total 3386 weevil specimens collected and checked in the laboratory. Other weevils that are widespread throughout Europe, such as *C. obstrictus*, were not abundant in our OSR fields and hence of no economic importance since only 14 specimens were found. Dissection of the sampled pods showed a low percentage of infestation with *C. obstrictus* as only one larva was found. The low level of infested pods is consistent with a very small number of *C. obstrictus* weevils found in YWTs. Compared with 11.6% of pods infested by *Dasyneura brassicae* Winn. such a small number of *C. obstrictus* is not supporting the synergism between these two species (Graora et al., 2015). This indicates that infestation with *C. obstrictus* does not necessarily accompany OSR infestation with brassica pod midge.

Early spring insecticide treatments of OSR primarily target pollen beetles (*Meligethes* spp.) and *Ceutorhynchus*-stem weevils. Usually one treatment is sufficient for these most important pests (Williams, 2010). However, the timing of insecticide treatment greatly depends on which one of the two stem weevil species is dominant. Although *C. pallidactylus* and *C. napi* share a similar phenology, their control can differ regarding the timing of insecticide application (Büchs, 1998). *C. napi* is more destructive, so that simultaneous and highly abundant migration of males and females call for immediate insecticide treatments. On the other hand, *C. pallidactillus* is characterized by protandrous migration and does not require immediate insecticide treatment. There is a need therefore for clarification of stem weevil predominance in any region of interest. If no YWT monitoring is practiced, a delayed insecticide application may miss a significant part of *C. napi* population and thus increase dramatically the infestation of OSR plants. It is therefore necessary to monitor the immigration of stem weevils into OSR fields in springtime very carefully in order

to secure proper timing of insecticide treatments when population density has exceeded action threshold.

Our results also showed that *C. picitarsis* and *C. typhae* were present in low numbers, while other *Ceutorhynchus*-species were even more sporadic. The two species are associated mainly with weeds typical for OSR crop, such as *Capsella bursa pastoris* (L.) Medik. and *Papaver rhoeas* L. Concerning some other *Ceutorhynchini*-species, *Ethelcus denticulatus* (Schrank 1781), *Stenocarus cardui* (Herbst 1784), *S. ruficornis* (Stephens 1831), and *Neoglocianus albovittatus* (Germar 1824) were found as single specimens and were associated with *P. rhoeas*. Of the other weevil species relevant for oilseed rape, we recorded a sporadic presence of *Aulacobaris coeruleascens* (Scopoli 1763) (Curculionidae, Baridinae).

ACKNOWLEDGEMENT

This study was funded by the SEEERA NET. PLUS project 051, and by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Grant No. III 46008

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Rilaši roda *Ceutorhynchus* Germ u asocijaciji sa uljanom repicom na severu Srbije

REZIME

Istraživanje rilaša roda *Ceutorhynchus* koji se nalaze na uljanoj repici je bilo na severu Srbije. Našli smo specifičan skup od osam vrsta rilaša koji se sastojao od dominantne vrste veliki repičin rilaš, *Ceutorhynchus napi*, koji je imao učešće od 81% od ukupno sakupljenih jedinki i od subdominantnog rilaša *C. pallidactylus* sa učešćem od 18%. Preostalih šest vrsta rilaša je sadržao 1% ukupnog broja i to su bile vrste: *C. obstructus*, *C. erysimi*, *C. minutus*, *C. picitarsis*, *C. sulcicollis* i *C. typhae*.

Obe najbrojnije vrste, *C. napi* and *C. pallidactylus*, su rilaši stabla uljane repice i počinju da naseljavaju repicu već u jesen, počevši od 10. novembra (BBCH 17-18). Maksimalni let je registrovan 23. marta na početku izduživanja stabla (BBCH 22-25). Nova generacija *C. pallidactylus* eklodira tokom juna sa polja uljane repice (BBCH 76-88), ali se pojedinačni primerci pojavljuju i tokom jeseni. Većina odraslih *C. napi* eklodira naredne godine u martu, a sporadično sve do 7. maja. Posledica dominantnosti *C. napi* je potreba ranije primene insekticida nego kada je *C. pallidactillus* glavna meta.

Ključne reči: Uljana repica; Rilaši; *Ceutorhynchus*; Srbija