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Cydalima perspectalis Walker (Lepidoptera: Crambidae) Presence and Distribution in Montenegro

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Abstract

Box tree moth, *Cydalima perspectalis* was detected for the first time in June 2014 when severe devastation of *Buxus* sp. was noticed in urban area of the city of Herceg Novi. In the next several months, the pest rapidly spread along the Montenegro seacoast. The tendency of spreading was continued in the following years. Severely infested box trees were completely dried out, while on those that still were partially green, leaves were markedly chewed and webbed by silk together with twigs. Damages are usually noticed late because young larvae are deeply hidden among *Buxus* twigs and leaves. Mature larvae can completely defoliate *Buxus* bushes and plants can lose all the leaves within a short period. Morphological features of development stages of the pest were observed in laboratory. Since box trees are traditionally important horticultural plants in Montenegro, this pest could be a serious problem for landscaping and nursery production.

Key words: box tree moth, *Buxus* sp., spreading, damages

Introduction

The box tree moth *Cydalima perspectalis* Walker is an invasive alien species of *Buxus* sp. originating from East Asia. It has been placed in several different genera: *Palpita* (Hübner, 1808), *Diaphania* (Hübner, 1818), *Glyphodes* (Guenée, 1854) and the *Neoglyphodes* (Streltzov, 2008). (http://www.cabi.org/isc/datasheet/118433).

Recent taxonomic revision suggests that *C. perspectalis* belongs to a monophylum including the genera *Glyphodes*, *Palpita* and *Diaphania* (Mally and Nuss, 2010). In Europe, it was reported for the first time in 2006 in southwestern Germany (Krüger, 2008). Since then it has been recorded in many European countries (Switzerland, Netherlands, Austria, France, United Kingdom, Ireland, Liechtenstein, Belgium, Italy, Hungary, Czech Republic, Romania, Slovenia, Turkey, Croatia, Slovakia, Denmark) (Bella, 2013). Recently, the species has been found in the area of the Balkans (Serbia, Bosnia and Herzegovina, *Former Yugoslav Republic of Macedonia*, Greece) (Glavendekić, 2014; Ostojić et al., 2015; Načeski et al., 2015; Strachinis et al., 2015), as well as in Black Sea coast of Russia (Karpun et al., 2013).

C. perspectalis larvae feed on the leaves of box trees resulting in their defoliation. In addition to the leaves, the larvae can attack the tree-bark, causing dryness and death of the trees. Therefore, this pest may present a particularly serious threat for these ornamental plants in private and public gardens (EPPO, 2012).

In European countries and Turkey it only damages box trees (*Buxus sempervirens*, *Buxus balearica*, *Buxus microphylla*, *Buxus sinica*, *Buxus colchica*). However, in an area of origin *C. perspectalis* is also found on euonymus (*Euonymus japonicus* and *Euonomus alatus*) and *Ilex pupurea* (Korycinskaand Eyre, 2011; Hizal et al., 2012).

Buxus is an ornamental plant commonly grown in nurseries, public and private gardens in Montenegro. Having in mind that *C. perspectalis* could be a serious threat of *Buxus* sp. in urban landscape, nursery production, gardens and parks this paper provides an update of distribution of the pest in Montenegro. Detailed morphological features are also described in the paper.

Material and Methods

During June 2014 symptoms of severe devastation of *Buxus* sp. were noticed in the urban area of the city of Herceg Novi (Hrnčić and Radonjić, 2014). Certain shrubs seemed as if completely dried. During visual observation of infested plants presence of few centimeters long green to dark-green larvae with black and white stripes were found. Also, greenish pupae and several moths with triangle wings and dark brown band at the outer margin of the wing were also noticed. Morphological features of development stages assumed this species is the box tree moth *Cydalima perspectalis*. Infested twigs together with mature larvae and pupae were cut from box trees and brought to the laboratory for further observation and rearing in experimental cage. Collected material were observed in cage 30x30x60 cm until adults ecloded.

Small box pot trees around 30 cm high were put in cage to support egg laying and further pest development. Identification based on external morphology was done. Additionally, during the period of mid July–August when temperatures in our laboratory ranged from 25-30^{o}C, the development of one generation was observed. A quick follow-up monitoring of box tree in the remaining part of the seacoast was carried out, as well as in area around the city of Podgorica. All development stages of this species as well as infested box trees were photographed. Visual inspections were continued throughout the following years in the period from May to October and covered a wider area of Montenegro, where box trees are usually grown.

Results and Discussion

Adults which ecloded from sampled pupae were morphologically the same as adults found in natural conditions in Herceg Novi. All ecloded moths are mostly white, with a dark brown head and posterior end of the abdomen and with white, iridescent wings bordered with broad dark brown band at the outer margin. On the forewings, there is a characteristic white spot in the discoidal cell (Fig. 1). According to Korycinska and Eyre (2011) in a less common colour form, wings are almost completely brown. This form was not found in our samples. Ecloded adults laid eggs on box tree leaves in the experimental cage without any previous artificial died or water supply.

Fig. 1. Adult of *C. perspectalis*
Имаго C. perspectalis

Eggs are round shaped, around 1mm in diameter overlapped one over other, placed in a small clusters on both sides of the leaf. *Freshly laid eggs are pale yellow, not easily seen. Just before hatching the black spot (future head of the larvae) became markedly visible* (Fig. 2).

Fig. 2. Eggs of *C. perspectalis*
Jaja C. perspectalis

Larvae were hatched in laboratory four days after the first eggs were laid. Newly hatched larvae are greenish yellow, while the later stages have a green body with dark brown stripes. A fully grown larvae is around 4 cm long, green to dark-green with black and white stripes along the body and black dots on a dorsal side. In all larval stages head is black (Fig. 3).

Fig. 3. Different larval instars
Различити ступњеви развића гусјенице

The pupae are 1.5 to 2.0 cm long, green with dark stripes on the dorsal surface at the beginning and turn brown with a dark pattern before the end of pupation (Fig. 4). Regarding all these morphological features, the presence of new pest *C. perspectalis* was confirmed. Szekelyet al. (2011) and Bella (2013) gave detailed morphological description of the pest.

Fig. 4. Pupae a) beginning of pupation, b) before end of pupation
Лутка а) тек формирана, b) пред крај развића

In our laboratory conditions, where temperatures ranged from 25 to 30^{o} C during mid-July and August, one generation completed its development in 26 days. It is known that in European countries the box tree moth can develop 2 or 3 generations per year with average duration of one generation for about 40 days (Korycinska and Eyre, 2011).

Soon after, the first detection *C. perspectalis* was found in a wider area of Herceg Novi (private gardens) and in urban area of the cities of Tivat, Kotor and Ulcinj. During August 2014, the pest was additionally found in urban area of the cities of Podgorica and Bar. With the exception of Podgorica all other localities are placed along the Montenegro seacoast. These findings indicated a rapid spread of the pest after the first detection. According to Kenis et al. (2013), five years after it was first recorded in Germany and the Netherlands, *C. perspectalis* was officially present in 16 European countries. Although adults are good flyers, the rapid spread of the moth in Europe is mainly due to the trade of ornamental box trees.

In 2015, the spreading of the pest was continued in the same localities and was found for the first time in the city of Budva and the wider area of the city of Danilovgrad. Although the pest was found primarily in urban areas and gardens, it was also recorded in some nurseries in Herceg Novi, Kotor, Bar and Podgorica on *Buxus sempervirens*. In 2016 the pest was found in the area of the city of Cetinje (Hrnčić et al., 2017).

In the northern area of Montenegro (Kolašin and Bijelo Polje), the presence of *C. perspectalis* was not detected (Fig. 5).

Fig 5. Distribution map of *C. perspectalis*in Montenegro
Мапа распрострањења C. perspectalis у Црној Гори

During visual inspection of infested box trees, it was found that certain plants were completely dried out (Fig. 6), while on those that still were partially green, leaves were markedly chewed and webbed by silk together with twigs.

Huge amount of dark green frass was found inside and below of infested box trees as well as different larval instars, pupae, e*xuviae* and adults. It was also observed that eggs were laid on both sides of the leaf.

Fig. 6. Dried box trees
Суве биљке шимшира

Young larvae skeletonised the leaves which, although not destroyed completely, dry out over time (Fig. 7). Damages are usually noticed late because young larvae are deeply hidden among *Buxus* twigs and leaves, unlike mature larvae which are visible in outer area of the plant. Mature larvae can completely defoliate *Buxus* bushes and plants can lose all the leaves within a short period. Symptoms of feeding that indicate presence of the pest are discussed by Hizal et al. (2012), Kenis et al. (2013), Strachinis et al. (2015).

As a result of a quick complete drying of many infested box trees, many owners, particularly on the seacoast, destroyed infested plants and hedges by digging up, although some of those were over 40 years old. Severe infestations as well as destroying of infested plants strongly affected natural urban landscape in the area where the pest was detected.

Fig. 7. Skeletonized leaves of box trees
Скелетирани листови шимшира

This was not the case in the following years because of adequate education and timely implementation of control measures (chemical and mechanical) which resulted in less severe infestations.

Conclusion

C. perspectalis showed very high rate of spreading and invaded the whole southern part of Montenegro within only two years. According to the observed damage and its quick spreading, *C. perspectalis* represents a serious problem for buxus landscaping and nursery production in Montenegro in cases of absence or inadequate implementation of control measures.

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Cydalima perspectalis Walker (Lepidoptera: Crambidae) присуство и распрострањеност у Црној Гори

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Сажетак

Шимширов мољац, *Cydalima perspectalis*, нађен је први пут у јуну 2014. године у градском подручју Херцег Новог када су уочени симптоми снажног напада на жбуновима шимшира. Током неколико наредних мјесеци забиљежено је брзо ширење штеточине на подручју црногорског приморја. Тенденција ширења настављена је и у наредним годинама. Јако нападнути жбунови шимшира били су потпуно суви, док је на онима на којма је било још зелених листова утврђено да су гранчице упредене паучинастим нитима пређе. Штете се обично уочавају касно, јер млађе ларве живе у унутрашњости жбуна између гранчица и листова. Старије ларве изазивају потпуну дефолијацију шимшира који остаје без лишћа за кратко вријеме. Морфолошке карактеристике различитих развојних стадијума анализиране су у лабораторији. Имајући у виду да је шимшир традиционално значајна хортикултурна биљка у Црној Гори ова штеточина може представљати озбиљан проблем за урбане површине и расаднике.

Кључне ријечи: шимширов мољац, *Buxus* sp., ширење, штете

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