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Аннотация

В насаждениях различных видов самшита в Краснодарском крае выявлен новый для фауны Кавказа инвазивный фитофаг – *Cydalima perspectalis* Walker. В 2013 г. гусеницы этой огневки нанесли фатальные повреждения искусственным посадкам самшита в Большом Сочи и Новороссийске. К настоящему времени огневка уже известна из нескольких локалитетов на Черноморском побережье Кавказа. Приведены первые сведения о биологии фитофага в новых для него местообитаниях.

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THE BOX TREE MOTH – a New Invasive Pest in the Caucasian Forests

Yu. I. Gninenko, Russian Research Institute for Silviculture and Mechanization of Forestry
N. V. Shiryaeva, Sochi National Park
V. I. Shurov, FBU Federal Forestry Agency – Centre of forest health of Krasnodar Krai

The Box Tree Moth, *Cydalima perspectalis* (Walker, 1859) = *Glyphodes perspectalis* (Walker, 1859) (Lepidoptera: Crambidae: Pyraustinae) is native to Eastern Asia where it is associated with indigenous species of wood. Nonetheless, the moth larvae are known to feed on the Purple holly, *Ilex purpurea*, as well as spindle wood, i.e. the Japanese spindle, *Euonymus japonica*, and winged spindle, *E. alatus* [4]. In the Russian Federation, the pest occurs in the southern parts of Primorsky Krai [1]. In 2006, the Box Tree Moth was first detected in Germany. Since then, the pest has been spreading throughout Europe. Currently, it is known to occur in Germany, France, Switzerland, Great Britain, Belgium, Austria, Italy, Hungary, Slovenia and Turkey [5, 6]. The emergence of this new invasive phytophagous insect (Fig. 1) in Europe encouraged research workers to attempt to forecast the probability of its spread using the CLIMEX software [7]. The forecast showed that the moth was capable of spreading throughout the territory of Europe where its host plants are present – from the Mediterranean up to the south of Great Britain and the Scandinavian countries.

Fig. 6. Cydalima perspectalis 3rd instar (October, 2013)

Рис. 6. Гусеница 3-го возраста огневки Cydalima perspectalis (октябрь 2013 г.)

The pest was introduced into Russia's Greater Sochi area with circular-shaped European box, *Buxus sempervirens* L. from Italy in 2012. On September 22, 2012, larvae of the moth were first detected on the European box in a nursery used for temporary storage of plants for planting intended for landscape gardening in the main Olympic Village. By the time of detection, the larvae had already significantly damaged several Buxus plants. The infested plants were treated with "Aktellik". The treatment did not eliminate all the larvae which lead to further spread of *Cydalima perspectalis* onto urban plantings.

In 2013, massive spread of the moth throughout the greater part of Sochi and into the indigenous forests of the Sochi National Park was recorded [2]. There, in the river-valleys from the Psou River in the east and the Psezuapse River in the west, a relic population of *Buxus colchica* Pojark., 1947, listed in the Red Books of the RF and Krasnodar Krai, survived [3]. Small plantations of this species are also known to occur on the northern micro slope of the Caucasus, in the allies of the Kurdjips (Krasnodar Krai) and the Tsistse (Republic of Adygeya) rivers. There, they are confined to the shielded ravines (like Gaumskoe ravine) that form a microclimate characteristic of refugium of Colchian flora.

Larvae of *Cydalima perspectalis* are known to cause significant damage to several Buxus species, including *Buxus microphylla*, *B. sempervirens* and *B. sinica*. In the midsummer of 2013, larvae of the moth severely damaged the ornamental boxus plantations in Sochi which lead to almost complete defoliation followed by rapid dieback (Fig. 2, 3). In Sochi, most severe damage by larvae was observed primarily on *B. sempervirens*, while *B. colchica* and *B. balearica* exhibited less affect. Damage to Buxus colchica caused by the moth larvae was first recorded in Turkey [6].

In the Black Sea coastal region of the Caucasus, the moth may pose a serious threat to natural relic forest stands of *Buxus colchica*. Moreover, Black Sea holly, *Ilex colchica* Pojark., is widely distributed in the undergrowth fir-beech forests in Sochi and Krasnodar Krai's Apsheron region as well as in the neighboring regions of Adygeya. This relict plant may serve as a host to *Cydalima perspectalis* during its naturalization in the Caucasus.

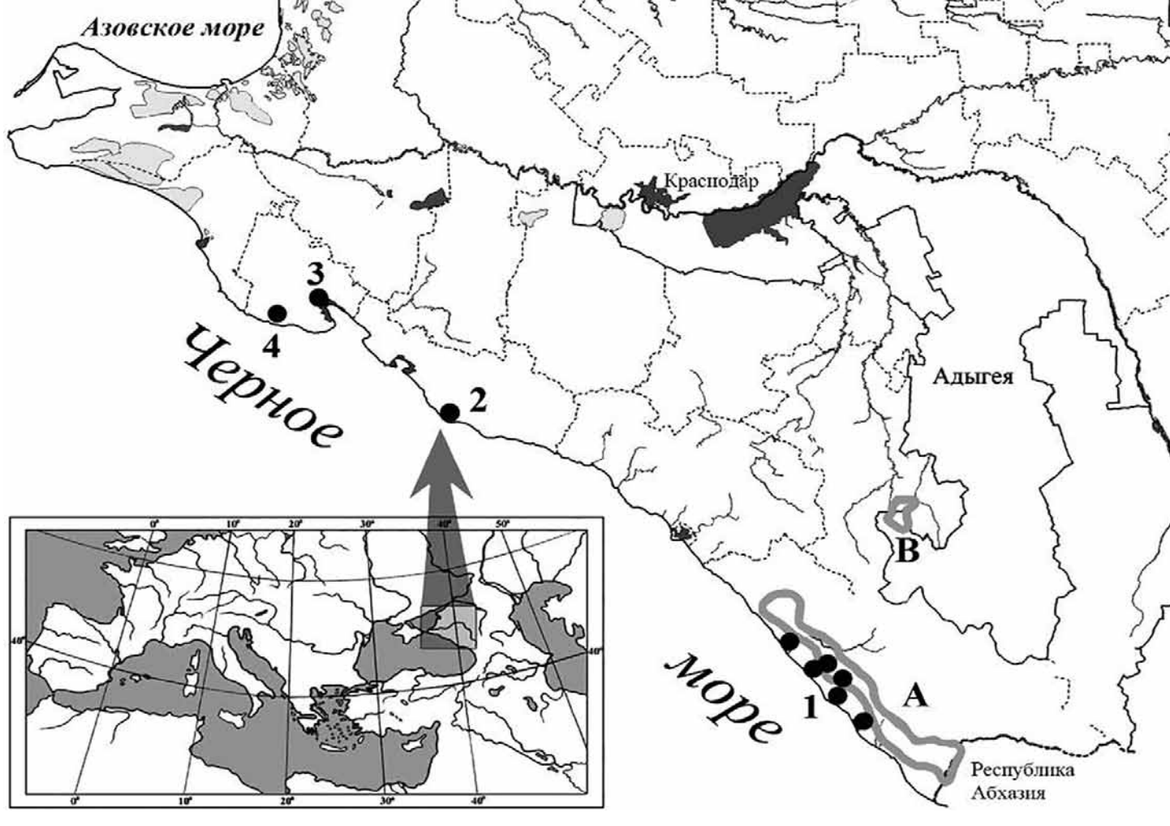

Fig. 7. Scale of Cydalima perspectalis invasion in Krasnodar Krai by 15.11.2013:
A, B – relict habitats of Buxus colchica;
Dots represent detections of the moth:
1 – Greater Sochi, 2 – Cape Idokopas;
3 – Novorossiysk, 4 – village of Abrau Durso

Рис. 7. Масштаб инвазии Cydalima perspectalis в Краснодарском крае к 15.11.2013 г.:
A, B – участки реликтового ареала Buxus colchica;
точками показаны находки огневки:
1 – Большой Сочи, 2 – мыс Идокопас;
3 – г. Новороссийск, 4 – пос. Абрау-Дюрсо

Currently, the data on biological characteristics of *Cydalima perspectalis* in the Caucasus are incomplete. 2012-2013 initial observations in Sochi region show that the pest produces 2-4 generations per year. Upon com-

An invasive phytophagous insect, Cydalima perspectalis Walker, new to the fauna of the Caucasus, was detected in boxwood plantations of various species in Krasnodar Krai. In 2013, larvae of the moth caused lethal damage to artificial plantations of boxwood in Greater Sochi and Novorossiysk. Currently, the pest is known to occur in several localities in the Black sea costal region of the Caucasus. First data on the pest biology in new areas are provided.

Рис. 8. Дефолиация самшита колхидского в результате развития Cylindrocladium buxicola. Скалы Гуамского ущелья (октябрь 2013 г.)

Fig. 8. Defoliation of Buxus colchica caused by Cylindrocladium buxicola. Guamskoe Valley rocks (October, 2013)

pletion of feeding, the larvae pupate in webby cocoons located in dry foliage of affected box tree branches (Fig. 4).

Eggs may overwinter in leaves. However, the majority of pests remained 2nd and 3rd instars under natural conditions of Sochi in late October 2013. 2nd instars developed typical double-layer (chamber) very dense cocoons between young leaves at terminal buds where they molted; they remained physically active but feeding was not observed (Fig. 5). However, a small number of the larvae feed on the Buxus shoots (Fig. 6). Similar behavior was observed in gardens in mid-November: larvae actively crawled but only a fraction of them fed.

Emergence and flight in autumn generation adults lasts from mid-September to late October. Perhaps, the latest generation of *Cydalima perspectalis* develops with timing of certain phases being partially overlapped. For instance, in late October, late pupae and third-generation females occurred in nature, as well as 1st and 3rd instars of the next "wintering" generation.

Generally, the development cycle of this species and the total number of complete generations per season in the Caucasus are yet to be determined. However, its polyvoltinism in mild climate of the Black Sea coast poses additional threat to local *Buxus colchica*. In the local Lepidoptera fauna of the Northwest Caucasus, species developing in winter evergreens are known to occur (*Gelechia senticetella* (Staudinger, 1859); Gelechiidae).

Damage caused by the moth to *Buxus significantly* reduces its general condition, causing weakening, suppression and dieback of the plants.

Later, credible information was received from Novorossiysk forestry workers on massive reproduction of the moth in artificial green areas in the city of No vorossiysk in the summer of 2013. Due to severe damage caused by the moth, urban services had to remove most of the boxwood plantings. As in Sochi, back in 2012, *Cydalima perspectalis* did not cause any damage in Novorossiysk.

In order to verify these reports, in November 2013, FFA of Krasnodar Krai conducted another survey of the entire Black Sea coast of Krasnodar Krai, from Anapa to the administrative boundaries of the resort town of Sochi.

In this part of the Black Sea region, with a relatively dry sub-Mediterranean climate, native populations of *Buxus colchica* do not occur, but *Buxus sempervirens* is often used for landscaping in residential areas and numerous recreation centers. During the surveys of dozens of green plantings, *Cydalima perspectalis* was detected in the village of Abrau Durso (Novorossiysk) near the famous champagne factory, as well as in a government facility of limited access located in Molokanova Shchel (Cape Idokopas).

There is little doubt that the moth spread into the valley Abrau from Novorossiysk, where it had been introduced with plants for planting through the largest port. According to the facility personnel, the pest spread into Molokanova Shchel with boxwood seedlings imported from Italy. During the survey in 2013, the distribution of the moth in the Black Sea coastal region of Krasnodar Krai was determined (Fig. 7).

Detection surveys for the species on the northern macro slope of the Caucasus conducted in late October in Guamskoe Valley (Fig. 7) did not reveal the presence of *Cydalima perspectalis*. However, in this valley, as in the valleys of Sochi, large areas of *Buxus colchica* died due to fungal infestation with *Cylindrocladium buxicola* in 2012-2013. The pest has not yet been found in Krasnodar. According to information provided by colleagues (V. Proklov, personal communication), *Cydalima perspectalis* has been found in the Chechen Republic, where it caused damage in 2013. Since no *Buxus colchica* occurs in the Eastern Caucasus, there, the pest develops on adventive boxwood which is as part of urban green plantations.

The poor condition of native *Buxus colchica* plantations in the mountain valleys of Krasnodar Krai, observed even before introduction of *Cydalima perspectalis*, is aggravated by infestation of *B. colchica* with a pathogenic epiphytic fungus *Cylindrocladium buxicola* in 2010-2013. The latter causes local defoliation of *Buxus colchica* plantations on both sides of the Greater Caucasus Mountain Range (Fig. 8).

Urban ornamental boxwood plantings in Sochi almost completely lost their aesthetic value by mid-summer of 2013 and turned into disfigured hedges of bare skeleton-like branches or chunks braided with webs of yellowed leaves (see Fig. 2). In Sochi, feeding of the moth larvae on leaves of plants other than boxwood has not been observed.

A survey, carried out by the Federal Forestry Agency (FFA) of Krasnodar Krai and FBU "Roslesozashchita" in October 2013, detected the moth not only in artificial stands in Greater Sochi, but further eastwards - up to the valley of the River Shah (village Golovinka).

The introduction of *Cylindrocladium buxicola* and *Cydalima perspectalis* – the two most harmful invasive species – into the Western Caucasus calls for immediate action to protect *Buxus colchica* in the wild, prevent their further spread and develop ways to reduce their damage in natural stands. Adequate measures to protect *Buxus colchica* should be taken immediately; otherwise it will become extinct in the Caucasus.

Acknowledgement

We are grateful to V. Filippov (Sochi) and V. Proklova for information on the distribution and biology of *Cydalima perspectalis*, as well as all FFA specialists of Krasnodar Krai for timely performing field studies.

Abstract

An invasive phytophagous insect, *Cydalima perspectalis* Walker, new to the fauna of the Caucasus, was detected in boxwood plantations of various species in Krasnodar Krai. In 2013, larvae of the moth caused lethal damage to artificial plantations of boxwood in Greater Sochi and Novorossiysk. Currently, the pest is known to occur in several localities in the Black sea costal region of the Caucasus. First data on the pest biology in new areas are provided.

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