Евразиатский энтомол. журнал 25(1): 14–18
doi 10.15298/euroasentj.25.01.04

© EUROASIAN ENTOMOLOGICAL JOURNAL, 2026

The risk of invasion of the corn bark-beetle *Pagiocerus frontalis* (Fabricius, 1801) (Coleoptera, Curculionidae) to the European part of Russia

Опасность проникновения кукурузного короеда *Pagiocerus frontalis* (Fabricius, 1801) (Coleoptera, Curculionidae) в Европейскую Россию

A.V. Petrov*, S.Yu. Mukhanov, O.A. Kulinich**, ***, E.N. Arbuzova****
А.В. Петров*, С.Ю. Муханов, О.А. Кулинич**, ***, Е.Н. Арбузова****

* Institute of Forest Science, Russian Academy of Sciences, Sovetskaya Str. 21, Moskovskaya Oblast, Uspenskoe 143030 Russia. E-mail: hylesinus@list.ru

* Институт лесоведения РАН, ул. Советская 21, Московская область, Успенское 143030 Россия.

** FGBU «All Russian Plant Quarantine Center» (FGBU «VNIIKR»), Ramenskoye, Moskovskaya Oblast, Bykovo 140150 Russia. E-mail: e.n.arbuzova@mail.ru

** ФГБУ «Всероссийский центр карантина растений» (ФГБУ «ВНИИКР»), м.о. Раменский, Московская область, Быково 140150 Россия.

*** Institute of Ecology and Evolution imeni A.N. Severtsova RAS, Center of Parasitology IEE RAS, Leninskii Prosp. 33, Moscow 119071 Russia. E-mail: okulinich@mail.ru

*** Институт проблем экологии и эволюции им. А.Н. Северцова РАН, Центр паразитологии ИПЭЭ РАН, Ленинский проспект 33, Москва 119071 Россия.

Key words: Trophic specialization, carpophagous insect, corn bark-beetle, pest of corn and avocado.

Ключевые слова: пищевая специализация, карпофаг, кукурузный короед, вредитель кукурузы и авокадо.

Abstract. Observations on the biological characteristics of the corn bark-beetle *Pagiocerus frontalis* (Fabricius, 1801) were conducted in its native range and the possibility of its spread across Europe was analyzed. Under laboratory conditions, the population growth dynamics of the pest's offspring on corn kernels were tracked, and experiments were conducted to study the environmental factors limiting the pest's distribution in northern latitudes.

Резюме. Проведены наблюдения за биологическими особенностями кукурузного короеда *Pagiocerus frontalis* (Fabricius, 1801) в условиях автохтонного ареала и проанализирована возможность расселения этого вида на территории Европы. В лабораторных условиях прослежена динамика роста численности потомства вредителя на зерновках кукурузы и проведены эксперименты по изучению экологических факторов, ограничивающих распространение вредителя в северных широтах.

Introduction

The global fauna of extant species of Scolytinae (Coleoptera: Curculionidae) comprises more than 6500 species [Wood, Bright 1992; Bright, Skidmore, 1997; Bright., Skidmore, 2002]. The feeding habits of the beetles' larvae in this subfamily allow us to divide them into four main trophic groups: xylo-phloeophages (feeding on the conductive and storage tissues of plant trunks, branches, and roots), xylo-mycetophages (feeding on fungi and wood tissues destroyed by fungi), phytophages (feeding on the conductive tissues of leaves), and carpophages (feeding on generative shoots and seeds) [Wood, 1982; Kirkendall et al., 2015; Petrov, 2017]. The last two food groups are represented by a small number of species, but some species are dangerous pests. Insects that damage fruits and seeds include the corn bark-beetle, *Pagiocerus frontalis* (Fabricius, 1801). Repeatedly mentioned as a pest of corn and avocado fruits [e.g. Bright, 2019; Rodriguez-Sanchez et al., 2022].

The native range of the corn bark-beetle covers the southern regions of North, Central, and South America and the Caribbean islands [Wood, 1982, 2007; Bright, 2019]. The analysis of the it's biological characteristics has shown that it is a potentially dangerous invasive alien for Europe.

Materials and methods

To study the biology of the corn bark-beetle and collect entomological material, expeditions were conducted by employees of the FGBU «VNIIKR» in the mountainous regions of Peru (Junin and Ayacucho regions) in 2021 and 2024. Beetles were collected manually during reconnaissance surveys of agricultural ecosystems and agricultural product warehouses in the surroundings of the village of Casablanca and Muqui (Junin region) and near the village of Paucara (Ayacucho region).

How to cite this article: Petrov A.V., Mukhanov S.Yu., Kulinich O.A., Arbuzova E.N. 2026. The risk of invasion of the corn bark-beetle *Pagiocerus frontalis* (Fabricius, 1801) (Coleoptera, Curculionidae) to the European part of Russia // Euroasian Entomological Journal. Vol.25. No.1. P.14–18. https://doi.org/10.15298/euroasentj.25.01.04 **Published:** 31.iii.2026.

A beetle culture was maintained in the FGBU "VNIIKR" insectarium and reared on corn grain from Peru, the European Union (variety Dilan F1) and the Russian Federation (variety Krasnodarskaya).

The effect of low temperatures on adults (imago) was studied using a KHL-340 "POZIS" refrigerator and a FROSTER-LABEX-530 Kirsch 10331 laboratory freezer.

The beetles were identified with the use of S.L. Wood's identification tables [2007]. Beetles were photographed by A.V. Petrov using a Canon 50D camera with an MP-E 65mm lens. The digital image processing was conducted using the Picolay software.

The present work is registered in ZooBank (www.zoobank.org) under urn:lsid:zoobank.org:pub:827AF881-D0A4-4434-BEA7-2575ABD52A5D

Taxonomic notes

The corn bark-beetle (*Pagiocerus frontalis*) is a beetle belonging to the tribe Bothrosternini (Curculionidae, Scolytinae). The beetles of the genus *Pagiocerus* Eichhoff, 1868 are distinguished from the other Bothrosternini by the shape of the antennal sutures; the rounded lateral edges of the pronotum; their stout body form; and a rostrum that is broadened at the apex and has a length equal to the distance between the eyes [Wood, 1982].

The body length of the beetles is 1.9–3.5 mm, the body is stout, the length-to-width ratio is 1.9, body color ranges from reddish-brown to dark brown (Figs 1, 2). The head has a depressed frons extending from the epistoma to the upper edge of the eyes, the lateral edge of depression has a keel-shaped structure and is elevated; the central area of the epistoma bears a large, apically pointed tubercle. The frons is covered with sparse, short setae, except for longer setae on the elevated lateral areas along the frontal depression. The antenna has a scape and funicle of reddish-brown color; the club is dark brown. The antennal funicle is 7-segmented (including the pedicel), the antennal club is elliptical in shape, its length is 1.8 times greater than its width, at its base, the club has two sutures curved toward its apex. The antenna and the funicle are covered with short, light-colored pale setae.

The pronotum is broad, its length is nearly equal to its width, the pronotum surface is smooth and shining, punctate with deep punctures, setae on the disc of the pronotum are very fine, scarcely noticeable. The elytra are 1.3 times longer than wide, the base of the elytra is slightly elevated with small, fine, acute wrinkles, the striae on the elytral disc have deep rows of large punctures, the interstriae are slightly elevated, their width is equal to or slightly greater than the width of the striae, the surface of the interstriae is coarsely punctate and shiny. The elytral declivity is convex, beginning almost from the central part of the elytra, and covered with short, sparse setae forming rows on the interstriae between the strial punctures.

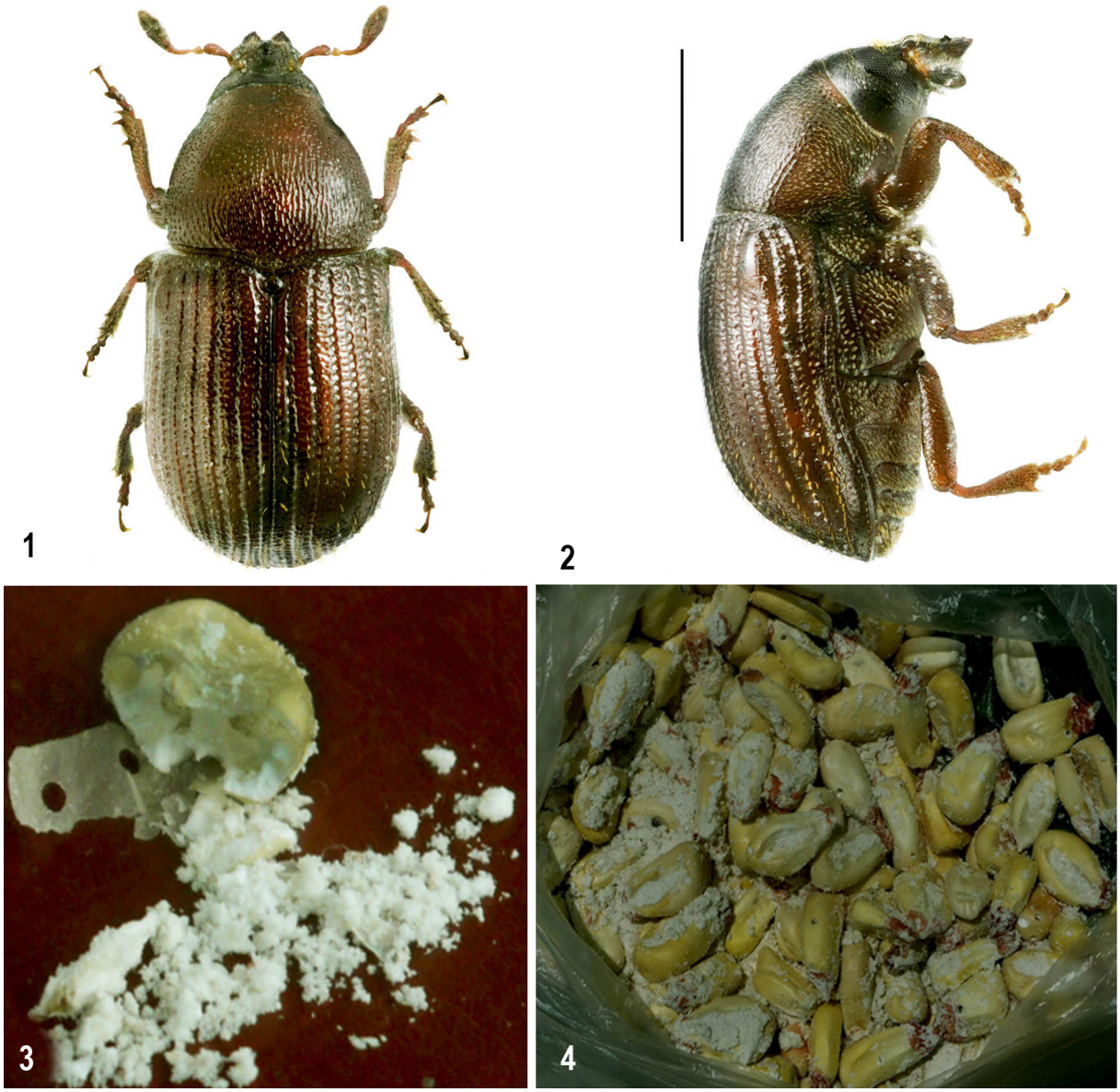
The abdomen is directed horizontally from the metathorax to the apex of the elytra. The sternites are covered with short, appressed setae. The outer edge of the tibiae has a forked (bifid) tubercle at the apex. Males and females are externally indistinguishable.

Results and discussion

Carpophagous species *Pagiocerus frontalis* that develops on plants of the families Poaceae and Lauraceae, but is less commonly found on seeds of other plant families: Annonaceae, Boraginaceae, Rubiaceae [Cordoba, Atkinson, 2018; Eidt-Wendt, Schulz, 1990; Atkinson, Peck, 1994; Okello et al., 1996; Castro-Ccoscco, Mejía-Espinoza, 2011; Soto et al., 2013; Kirkendall et al., 2015; Kirkendall, 2018; Bright, 2019; Martínez et al., 2021; Rodriguez-Sanchez et al., 2022]. Isolated instances of damage by this bark-beetle to a wide range of substrates have been recorded, such as fruits and coffee beans, with beetles also reported to bore into the plastic packaging of fruits [Wood, 1982; Eidt-Wendt, Schulz, 1990; Castro Ccoscco, Mejía-Espinoza, 2011; Kirkendall et al., 2015]. Within its native range, the species causes significant damage to yields of corn (*Zea mays*) (Figs. 3, 4) and avocado (*Persea*) crops. It most frequently colonizes avocado fruits that are lying on the ground. Up to 30 beetles have been counted penetrating a single avocado fruit [Avila et al., 2021].

According to our observations in the mountainous regions of Peru, the corn bark-beetle has one generation per year on *Zea mays*. The beetles infest corn ears with kernels at the milk stage. The females lay eggs on individual kernels in cavities they gnaw out. The successful pest colonization of plants can be preceded by short-term droughts, but more often, the bark beetle infests corn crops without any external signs of physiological weakening. There is no evidence for the distribution of pathogenic biota by the corn bark beetle. The insect pest causes maximum damage to corn stocks during storage of infested kernels in the storage facilities. At this stage, *P. frontalis* acts as a stored product pest, gnawing out holes in the seeds and reducing them into unusable frass [Castro Ccoscco, Mejía-Espinoza, 2011; Eidt-Wendt, Schulz, 1990]. Within stored corn grain, the pest is capable of rapidly increasing its population. A single female can lay up to 80 eggs; under optimal conditions (temperature 14–20 °C) the bark beetle larvae complete their development in 3–4 weeks, and the entire grain stock can be destroyed within 3–4 months [Eidt-Wendt, Schulz, 1990; Leathers, 2015].

The species is widespread on the American continent from North Carolina (USA) in the north to Chile and to Argentina in the south (Fig.5) [Gómez, Aguilera, 1982; Cordoba, Atkinson, 1990; Atkinson, Peck, 1994; Okello et al., 1996; Castro-Ccoscco, Mejía-Espinoza, 2011; Soto et al., 2013; Kirkendall, 2018; Bright, 2019; Martínez et al., 2021]. In agricultural ecosystems with corn in North and Central America and the Caribbean states, *P. frontalis* has been recorded at altitudes ranging from 300 to 900 m a.s.l; in South American countries — it is found at altitudes from 980 to 3400 m a.s.l. In Ecuador, the bark beetle reproduces massively in agrocenoses at



Figs 1–4. External appearance of *Pagiocerus frontalis* (Fabricius) and damaged plants: adult beetle (1, 2) and damaged corn (3, 4). 1 — dorsal view; 2 — lateral view; 3 — damaged corn kernels; 4 — mass infestation of corn kernels by corn bark-beetles. Scale bar 1–2 — 1 mm.

Рис. 1–4. Внешний вид *Pagiocerus frontalis* (Fabricius) и наносимых им повреждений: взрослый жук (1, 2) и повреждённая кукуруза (3, 4). 1 — вид сверху; 2 — вид сбоку; 3 — повреждения на зерновке кукурузы; 4 — массовое заселение зерновок кукурузы жуками кукурузного короеда. Масштаб: 1–2 — 1 мм.

altitudes of 1500–2600 m a.s.l., with an average daily temperature of 14–18.5 °C [Wendt, Schulz, 1990], and in Peru at altitudes of 2500–3340 m a.s.l., with an average daily temperature of 14–19 °C. In the mountainous regions of Colombia, the corn bark-beetle aggregates in large numbers in corn areas cultivated in the foothills with a subtropical climate and in the high-altitude areas with a temperate climate [Eidt-Wendt, Schulz, 1990; Castro Ccoscco, Mejía-Espinoza, 2011].

At the beginning of the 21st century, the corn bark-beetle was recorded in Switzerland. The emerging population in this introduced range was eradicated [Sanchez et al., 2020, 2023]. In 2021, the pest was discovered in Germany (Hamburg), in corn from Peru, which led to an express pest risk analysis [Schrader, Adler, 2021]. The analysis concluded that this species of bark-beetle poses a threat to agriculture.

Our preliminary analysis suggests that the establishment of *P. frontalis* is possible in southern regions of Russia. Isolated cases of European corn bark-beetle introductions from South America to the USSR were noted in the 20th century [Stark, 1952; Kryzhanovsky, 1974; Mandelstam, 2019; Kurbatov, Petrov, 2024]. In 2024, a single dead beetle was found in an avocado fruit by one of the authors (A.V. Petrov) in the city of Dolgoprudny, Moskovskaya Oblast. The found specimen has been deposited in the insect collection of the FGBU «VNIIKR» (Entomological Collections Fund, curator S.A. Kurbatov).

The main limiting factor for the distribution of the corn bark-beetle in northern latitudes is low temperatures during the winter months. Previous studies reported 100 % mortality of adults at 0°C [Stark, 1952; Kryzhanovsky, 1974].

To determine the lethal low temperatures for *P. frontalis*, we used 1,200 beetles collected in the highlands of Peru (3,335 m above sea level), where the temperature drops to +2 °C in June (Junin and Ayacucho regions). The beetles were collected from infested corn kernels of Peruvian and Russian corn varieties. The infested corn was placed in cardboard boxes and cooled in a freezer for an exposure period of 3 days. The beetles were cooled to 0 °C, –5 °C, –7 °C, –10 °C, and –15 °C. We found that 80 % of the beetles survived at 0 °C; 21 % at the temperature –5 °C and individual specimens remained alive at –7 °C. The 100 % mortality of imago was observed when infected corn kernels were cooled to –15 °C. The survival rate of adults in corn kernels decreased when the exposure time at –5 °C was extended to 7 days. Our observations demonstrate the potential for acclimatization of the corn bark-beetle in the southern regions of Russia (in the Krasnodarskii and Stavropolskii Krai), where climatic conditions are comparable to the mountainous regions of Peru. We also found that under laboratory conditions, the beetles successfully colonize the kernels of Russian corn varieties. We did not conduct cooling of beetles in avocado fruits. It is possible that beetles from lowland and foothill populations are more sensitive to low temperatures.

Conclusions

The ability of corn bark beetle imago to survive at sub-zero temperatures increases the risk of invasion by this dangerous pest and the establishment of stable populations on the territory of Krasnodarskii and Stavropolskii Krai, where 30 % of the grain corn cultivated areas of the Russian Federation is concentrated. The invasion route for pest to Europe is possible through infected corn seeds or avocado fruits introduced from the American continent.

Acknowledgements

The authors express most sincere gratitude to Dr. R.A. Beaver (Chiangmai, Thailand) for critical proofreading of the text and improvement of the language.

References

Avila N.D., Velasco C.R., Campos J.C., Solorio A.B., Miranda J.L.D., Virgen M.O.E. 2021. *Pagiocerus frontalis* (Fabricius) (Coleoptera: Curculionidae: Scolytinae) associated with avocado *Persea americana* Miller (Lauraceae) fruit in Nayarit, Mexico // Florida Entomologist. Vol.104. No.4. P.320–321. https://doi.org/10.1653/024.104.0409

Atkinson T.H., Peck C. J. 1994. Annotated checklist of bark and ambrosia beetles (Coleoptera: Scolytidae and Platypodidae) of tropical southern Florida // Florida Entomologist. Vol.77. No.3. P.313–329. https://doi.org/10.2307/3496101



Fig. 5. Distribution map of *Pagiocerus frontalis* (Fabricius). Designations: blue dots — native range, red dots — introduced range in Germany and Switzerland.

Рис. 5. Карта распространения *Pagiocerus frontalis* (Fabricius). Обозначения: голубые точки — автохтонный ареал, красные точки — интродукция в страны Европы Германию и Швейцарию.

Bright D.E. 2019. A taxonomic monograph of the bark and ambrosia beetles of the West Indies (Coleoptera: Curculionoidea: Scolytidae). Studies of West Indian Scolytidae (Coleoptera) 7 // Occasional papers of the Florida State Collection of Arthropods. Vol.12. P.1–491.

Bright D.E., Skidmore R.E. 1997. A catalog of Scolytidae and Platypodidae (Coleoptera), Supplement 2. Ottawa, ON, Canada: NRC Research Press. P.1–368.

Bright D.E., Skidmore R.E. 2002. A catalog of Scolytidae and Platypodidae (Coleoptera), Supplement 2. Ottawa, ON, Canada: NRC Research Press. P.1–523.

Castro Ccoscco R.M., Mejía-Espinoza K. 2011. Preferencia alimentaria de Pagiocerus frontalis en variedades de maiz en el distrito de — provincial de Calca. Universidad Nacional de San Antonio Abad del Cusco. Tópicas científicas. P.1–34.

Córdoba S.P., Atkinson T.H. 2018. New records of Scolytinae (Coleoptera: Curculionidae) from Argentina // The Coleopterists Bulletin. Vol.72. No.2. P.376–380. https://doi.org/10.1649/0010-065X-72.2.376

Eidt-Wendt J., Schulz F.A. 1990. Studies on the biology of *Pagiocerus frontalis* (Fabricius) (Coleoptera Scolytidae) infesting stored maize in Equador // Proceedings of the Fifth International working conference on stored-product protection. Bordeaux. P.61–69.

Gómez D.L., Aguilera P.A. 1982. Biología de *Pagiocerus frontalis* (Fab.) (Coleoptera: Scolytidae) en la I Región de Chile // Idesia (Chile). Vol.6. P.79–92.

Kirkendall L.R. 2018. Invasive bark beetles (Coleoptera, Curculionidae, Scolytinae) in Chile and Argentina, including two species new for South America, and the correct identity of the *Orthotomicus* species in Chile and Argentina // Diversy. Vol.10. No.40. P.1–20. https://doi.org/10.3390/d10020040

Kirkendall L.R., Biedermann P.H.W., Jordal B.H. 2015. Evolution and diversity of bark and ambrosia beetles. Bark Beetles Biology and Ecology of Native and Invasive Species. P.85–156.

Kryzhanovsky O.L. 1974. [Fam. Scolytidae. Bark Bettles] // Insect and mites — pests of agricultural crops. Vol.2. Coleoptera. Leningrad: Nauka. P.293–301. [In Russian].

Kurbatov S.A., Petrov A.V. 2024. Corn bark-beetle *Pagiocerus frontalis* (F.) — a potentially dangerous pest for the territory of Russia // Plant health and quarantine. Vol.1. No.18. P.82.

Leathers J. 2023. California pest ration for *Pagiocerus frontalis* (Fabricius): a scolytid weevil Coleoptera: Curculionidae. Online resource. https://blogs.cdfa.ca.gov/Section3162/?p=553 Accessed 08.X.2023.

Mandelstam M.Yu. 2019. Species that have not formed stable populations. Handbook of alien beetles of the European part of Russia. Livny. P.520.

Martínez O.G., Hernández M.S., Silva S.O., Ontiveros D.S.O. 2021. Weevils (Coleoptera: Curculionidae) of Coahuila de Zaragoza, México // Southwestern Entomologist. Vol.46. No.4. P.947–955. https://doi.org/10.3958/059.046.0415

Okello S., Reichmuth C., Schulz F.A. 1996. Laboratory investigations on the developmental rate at low relative humidity and the developmental temperature limit of *Pagiocerus frontalis* (Fabicius) (Coleoptera, Scolytidae) at high and low temperatures // Anzeiger für Schädlingskunde Pflanzenschutz, Umweltschutz. Bd.69. S.180–182.

Petrov A.V. 2017. [Morphological and behavioral characteristics of tribes Scolytini (Coleoptera, Curculionidae, Scolytinae), associated with mycobiota] // Izvestiya of Sergei Kirov Saint Petersburg Forestry Academy. Vol.220. P.20–32. [In Russian].

Rodriguez-Sanchez E., Giraldo-Kalil L.J., Nufiez-Farfan J. 2022. Diversity of insects associated with the fruits of four tree species of Lauraceae from Los Tuxtlas region, Mexico: an annotated and illustrated taxonomic list // Revista Mexicana de Biodiversidad. Vol.93. P.1–39. https://doi.org/10.22201/ib.20078706e.2022.93.4178

Sanchez A., Chittaro Y., Germann C., Knižek M. 2020. Annotated checklist of Scolytinae and Platypodinae (Coleoptera, Curculionidae) of Switzerland // Alpine entomology. Vol.4. P.81–97. https://doi.org/10.3897/alpento.4.50440

Sanchez A., Chittaro Y., Frey D., Koch B., Holling, Brockerhoff E.G., Ruffner B Knižek M. 2023. Three alien bark and ambrosia beetles (Coleoptera, Curculionidae, Scolytinae) new to Switzerland // Alpine entomology. Vol.7. P.45–55. https://doi.org/10.3897/alpento.7.103269

Schrader G., Adler C. 2021. Express PRA for *Pagiocerus frontalis* // Institute for national and international plant health. 15.IX.2021. Online resource. https://pra.eppo.int/pra/859b6f7c-305a-496a-88cc-010bb453ef5b Accessed 10.X.2023.

Soto H.M., Martínez O.G., Carbajal C.C. 2013. Fauna de Curculionidae (Coleoptera) en huertas de aguacate Hass (*Persea americana* Mill) en Xalisco, Nayarit // Dugesiana. Vol.20. No.2. P.93–98. https://doi.org/10.32870/dugesiana.v20i2.4847

Stark V.N. 1952. [Coleoptera. Bark Beetle] // [Fauna URSS]. Vol.31. Moscow, Leningrad: Publishing house of URSS Academy of Science. P.462. [In Russian].

Wood S.L. 1982. The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae) a Taxonomic Monograph // Great Basin Naturalist Memoirs. Vol.6. P.1–1359.

Wood S.L. 2007.The bark and ambrosia beetles of South America (Coleoptera: Scolytidae). 900 p.

Wood S.L., Bright D.E. 1992. A catalog of Scolytidae and Platypodidae (Coleoptera), Part 2: Taxonomic index // Great Basin Naturalist Memoirs. Vol.13. P.1–1533.

Поступила в редакцию 5.11.2025