EPPO Datasheet: *Sirex ermak*

Last updated: 2024-02-02

IDENTITY

Preferred name: *Sirex ermak*
Authority: (Semenov-Tian-Shanskij)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Hymenoptera: Siricidae
Other scientific names: *Paururus ermak* Semenov-Tian-Shanskij
Common names: blue-black horntail, blue-black woodwasp
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EPPO Categorization: A2 list
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EPPO Code: SIRXER

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Notes on taxonomy and nomenclature

Benson (1963) considered *Sirex ermak* was a subspecies of *S. juvencus*, and he proposed to distinguish between *S. juvencus ermak* (Semenov) and *S. juvencus juvencus* L. based on a distinct range (Eastern Siberia vs. Europe) and the colour of adult legs (black vs. reddish-brown). However, other specialists did not support this opinion and continued treating *S. ermak* and *S. juvencus* as two separate species (Stroganova, 1963, 1968; Byalaya, 1966; Verzhutskij, 1973; Zhelochovtsev & Zinovjev, 1996; Zhelochovtsev *et al.*, 1988; Sundukov & Lelei, 2012; Sundukov, 2013, 2017; Gao & Shi, 2021).

HOSTS

Sirex ermak develops on coniferous trees from the family Pinaceae. The preferred hosts are *Larix* species (e.g. *L. sibirica, L. gmelinii, L. dahurica*) (Gussakovskij, 1935; Byalaya, 1966; Mamaev & Kravchenko, 1974; iitasaari, 1988; Orlinski, 2006; Agafonova & Antonov, 2014). Species of *Picea, Abies, Pinus* are also suitable hosts (Pavlovskij & Shtakelberg, 1955; Stroganova, 1963, 1968; Byalaya, 1966; Tkacz *et al*., 1991; Vorontsov, 1981; Sundukov & Lelei, 2012; Kostyunin, 2015; Sundukov, 2017). *S. ermak* can be found on coniferous species from different genera in the same region (Stroganova, 1968). Nevertheless, its abundance on certain hosts seems to show some geographical linkage. In the European part of Russia, it mainly attacks *Picea obovata* (Sundukov & Lelei, 2012). In Western Siberia (Tomsk Oblast, Kemerovo Oblast), it was found mostly on *Abies sibirica* (Stroganova, 1963; Krivets & Chemodanov, 2005). In Eastern Siberia in the Baikal region (Irkutsk Oblast and Buyratia Republic), *S. ermak* was documented exclusively on *Larix* spp. (Agafonova & Antonov, 2014), whereas in the Russian Far East, it was recorded as one of the notable pest of pines, *Pinus sylvestris* in Zabaykalsky Krai (Talman, 1948), *Pinus koraiensis* and spruces (*Picea ajanensis, Picea koraiensis*) in Primorsky Krai (Ivlev & Kononov, 1974). In China, it was documented as a pest of *Picea* species (*P. obovata, P. crassifolia, P. schrenkiana*) (Gao & Shi, 2021).

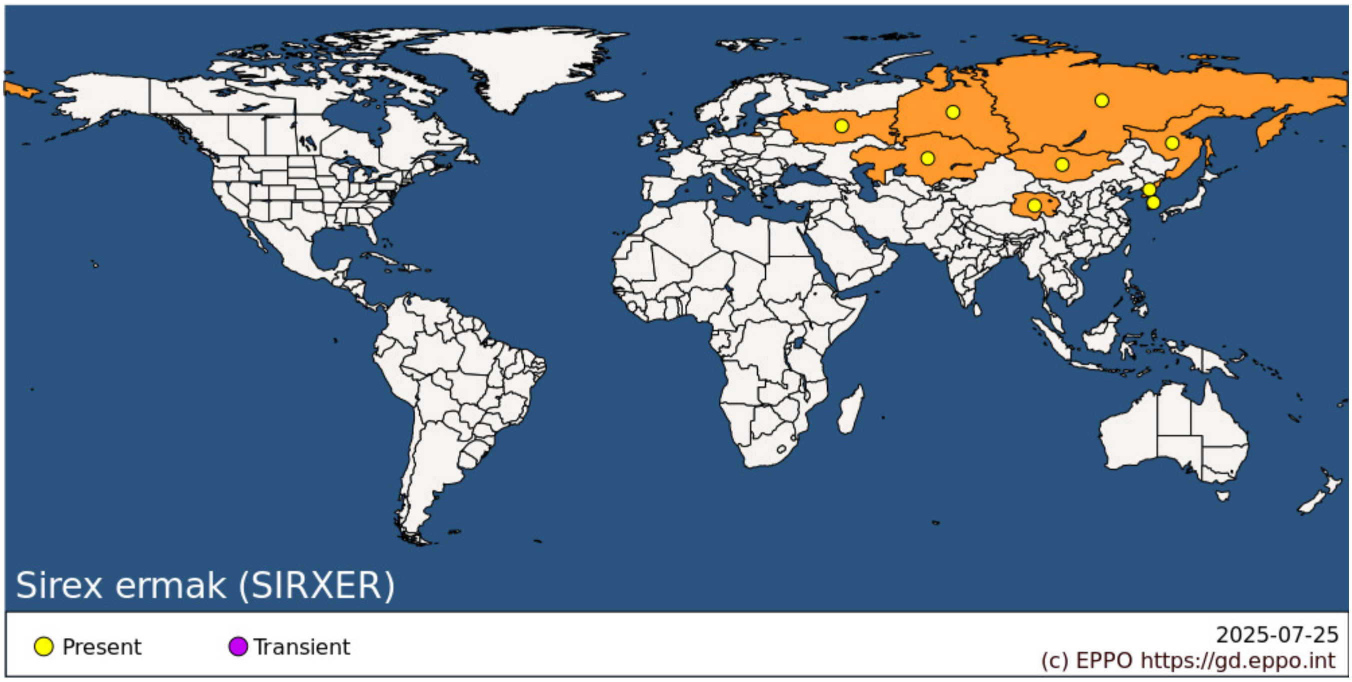
Host list: *Abies holophylla*, *Abies nephrolepis*, *Abies sibirica*, *Abies sp.*, *Larix gmelinii var. gmelinii*, *Larix gmelinii*, *Larix sibirica*, *Larix sp.*, *Picea crassifolia*, *Picea jezoensis subsp. jezoensis*, *Picea jezoensis*, *Picea koraiensis*, *Picea obovata*, *Picea schrenkiana*, *Picea sp.*, *Pinus koraiensis*, *Pinus sibirica*, *Pinus sp.*, *Pinus sylvestris var. mongholica*, *Pinus sylvestris*

GEOGRAPHICAL DISTRIBUTION

Sirex ermak is a Central-Eastern Palearctic species. It is found in forest-steppes, taigas, floodplains and subalpine forests, and woodlands (Agafonova & Antonov, 2014; Kostyunin, 2015). In the mountains, *S. ermak* has been recorded up to the forest line frontier (Byalaya, 1966).

S. ermak is distributed over a wide area in Russia. Its main range lays in the Asian part of the country, i.e. in Western and Eastern Siberia and the Russian Far East, including Kamchatka, Sakhalin, and southern Kuril Islands (Gussakovskij, 1935; Talman, 1948; Pavlovskij & Shtakelberg, 1955; Stroganova, 1968; Mamaev & Kravchenko, 1974; Ivlev & Kononov, 1974; Vorontsov, 1981; Zhelochovtsev & Zinovjev, 1996; Orlinski, 2006; Sundukov & Lelei, 2012; Sundukov, 2013, 2017; Kostyunin, 2015). The most western findings of the species have been made in the European part of the country, in central regions, Kaliningrad and Moscow Oblasts according to Zhelohovtsev *et al.* (1988) and Zhelochovtsev & Zinovjev (1996). Other authors (e.g. Sundukov & Lelei, 2012; Sundukov, 2017) cited these records from the studies of Zhelochovtsev (Yu.N. Sundukov, Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences: personal communication, Vladivostok, Russia, 2023). It remains unclear whether *S. ermak* is native or introduced in these regions. Furthermore, its establishment in the European part of Russia still needs to be confirmed by further studies. The recent record of *S. ermak* in Saratov Oblast, the region on south-west of the European part of Russia, in 858 km from Moscow (Volodchenko, 2019) is erroneous and should be attributed to *Sirex juvencus* (L.) (A.N. Volodchenko, Saratov State University, Saratov, Russia: personal communication, 2023).

In addition to Russia, the species is also known from Eastern Kazakhstan (Sundukov, 2017; Tleppaeva *et al.*, 2017), Northern Mongolia (Zhelohovtsev *et al.*, 1988; Orlinski, 2006; Sundukov & Lelei, 2012; Kostyunin, 2015; Sundukov, 2017), North-Eastern China (Zhelohovtsev *et al.*, 1988; Sundukov & Lelei, 2012; Sundukov, 2017; Gao & Shi, 2021), and Korea (Kostyunin, 2015).



EPPO Region: Kazakhstan, Russian Federation (the) (Central Russia, Eastern Siberia, Far East, Western Siberia)
Asia: China (Qinghai), Kazakhstan, Korea, Democratic People's Republic of, Korea, Republic of, Mongolia

BIOLOGY

In the Asian part of Russia, the flight period of *S. ermak* is from July/August to September (Stroganova, 1963, 1968; Byalaya, 1966; Verzhutskij, 1973; Kostyunin, 2015). During the day, intensive flight is observed in the afternoon from 15:00 to 18:00. At other times, adults usually stay in the shadow and in humid sites of the forest (Stroganova, 1963, 1968). Byalaya (1966) observed that *S. ermak* adults prefer well insulated and warm spots in the forest. Adults do not need additional maturation feeding and can survive up to 14 days (Byalaya, 1966). Soon after emergence, females are ready to mate, and they lay eggs the day after copulation. They insert their flexible ovipositors deeply into the wood of the main trunk (e.g. with a diameter of 15-30 cm with medium or thick bark) and lay eggs (Byalaya, 1966; Stroganova, 1968). A female lays one egg (occasionally two) in each hole; females carry from 115 eggs (small-sized females) to 374 eggs (larger individuals) (Byalaya, 1966). While ovipositing, females infect trees with spores of symbiotic wood rotting basidiomycete fungi (*Amylostereum* spp.), which are usually present in special organs called 'mycangiae' that are situated at the base of the ovipositor (Byalaya, 1966). Neonate larvae usually hatch in 42–28 days (Byalaya, 1966). They make galleries in wood, and fill them with fine sawdust. The total length of larval galleries varies from 5 to 25 cm, with a depth ranging from 0.5 to 6 cm beneath the wood surface (Byalaya, 1966; Verzhutskij, 1973). Larval development takes 1.5–2 years (Stroganova, 1963). Pupation usually occurs in June. Larvae prepare pupation cells deep in the wood (3–4 cm beneath the surface). Pupae develop within 16-25 days; the total degree-days required for pupal development lies between 280°C and 416°C (Byalaya, 1966). Emergence holes are free from sawdust. The life cycle of *S. ermak* usually takes 2 years, rarely 3-4 years (Stroganova, 1963, 1968; Byalaya, 1966; Verzhutskij, 1973).

DETECTION AND IDENTIFICATION

Symptoms

S. ermak causes tree dieback, which is easily detected by the observation of wilting needles. Emergence holes in trunks are signs of the presence of the pest (Stroganova, 1968); these are most often situated in the lower part of the tree crown (Ivlev & Kononov, 1974). *S. ermak* often attacks trees together with *Serropalpus barbatus* (Coleoptera: Melandryidae), a beetle widely spread in Europe and Asia, which can be used as indicator of the presence of *S. ermak* (Stroganova, 1968). It is not unusual to see *S. ermak* adults resting on tree trunks; they can be found in the lower part of the tree crowns (Stroganova, 1968).

Morphology

Eggs

The egg of *S. ermak* is white, oval-elongated, with a semi-transparent cover (Stroganova, 1968).

Larva

Larvae of *S. ermak* are white, cylindrical, 15–28 mm long, slightly S-form curved, with a slightly sclerotized round yellowish head (Stroganova, 1968; Byalaya, 1966). The head is covered with dense bristles. Abdominal legs are not developed. Antennae with 4–9 bristles. On the anal tergite, there is a longitudinal ?ssure between two small protuberances. The lateral part of the anal segment is half-covered with bristles. A sclerotized thorn is situated on the top of the abdomen (Stroganova, 1963; Verzhutskij, 1973; Mamaev & Kravchenko, 1974; Vorontsov, 1981). Larvae moult three times (Byalaya, 1966).

Pupa

Pupae of *S. ermak* are free, elongated, 18–25 mm long, tapered towards the rear, with a small sclerotized thorn at the top of the abdomen (Stroganova, 1968; Byalaya, 1966).

Adult

The adult of *S. ermak* is a large thick-waisted cylindrical insect with a black body and black round head with metallic blue re?ections on the back part, covered by long dense hairs (Stroganova, 1963, 1968; Verzhutskij, 1973). The thorax is black with metallic blue re?ections, wrinkled and covered by long dense hairs. The front angles of the pronotum are acute, the back end of the pronotum is rounded. Mesopleurae are bright and sparsely punctuated. The abdomen is slightly wrinkled; the 1st tergite has a deep transversal fissure. In females, the abdomen is uniformly black with a blue shade, whereas in males the 4th-6th segments of the abdomen can be reddish (Gussakovskij, 1935), especially in the populations from Eastern Siberia (Stroganova, 1963; Verzhutskij, 1973). Antennae are black (in females), or brownish or yellowish at the first half from the base (in males), relatively thin, with 20 segments; the 1st segment is a little widened and ?attened at the top (Byalaya, 1966; Stroganova, 1968; Verzhutskij, 1973). Wings are transparent slightly darkened at the top (especially close to the pterostigma), with a grey edge; the wing veins are dark brown. In females, legs are black with metallic blue re?ections, except apexes of femora and bases of tibiae and tarsi, which are reddish-brown (Gussakovskij, 1935; Verzhutskij, 1973). Femora are widened, and back tibiae are narrowed in the middle. Females have a stinger-like ovipositor, nearly as long as the abdomen, that extends straight back when not in use (Stroganova, 1968). The following ratios have been determined: length of forewing/ ovipositor: 1–1.38 (Stroganova, 1968), distance between ridges 4 and 5/diameter of ovipositor: 2.20–2.30, distance between ridges 9 and 10/ diameter of ovipositor: 1.75–1.85 (Viitasaari, 1988). These values were suggested for the species identification (Viitasaari, 1988). The female of *S. ermak* is 13–25 mm long; the male is 15–17 mm long (Stroganova, 1963, 1968; Vorontsov, 1981).

Detection and inspection methods

As for other *Sirex* spp., visual inspections can be used to detect the presence of *S. ermak* in tree stands (Maslov *et al.*, 1988). A sign of colonization is the presence of round adult exit holes in the tree trunks of coniferous species (Pinaceae). On weakened trees, bark can be removed in areas where adult exit holes are present to find the characteristic galleries inside the wood and immature insects. Larvae are difficult to distinguish between different *Sirex* species, therefore DNA barcoding seems to be the only option to reliably identify the species on larval stage or insect remnants found in the galleries. At present, 7 DNA barcodes of *S. ermak* are available for comparison in BOLD (**Barcode of Life Data System**), including the DNA barcodes obtained for 4 specimens of *S. ermak*, i.e. for 2 specimens (including the syntype) stored at the Zoological Institute RAS (Saint Petersburg, Russia) and 2 specimens from Sukachev Institute of Forest SB RAS (Krasnoyarsk). These DNA barcodes can be used for the species identification. No pheromone monitoring system has been developed so far. However, the attractants used for wood-boring insects in the USA, containing 1S-alpha-pinene and 1S-beta-pinene (Coyle *et al.*, 2012), or the mix of ethyl alcohol, alpha-pinene, ipsenol, ipsdienol, and 3-carene (Costello *et al.*, 2008) were shown to be attractive for the related species, *S. juvencus*. However, their efficiency to attract *S. ermak* has not been explored yet.

PATHWAYS FOR MOVEMENT

Adult can spread by flying. However, no data on the distance which *S. ermak* adults can cover is available from published sources. Because *S. ermak* may be hidden deep in the wood for long periods (taking into account its 2-year life cycle, exceptionally 3-4 years), it is difficult to detect the pest in the wood, and, thus, it can easily be transported with untreated wood moving in trade, including dunnage and wood packaging material. It is unlikely, however, that it can be transported with plants for planting, since it does not attack seedlings or small trees, which constitute planting material. Potential pathways are wood, dunnage, and wood packaging material (Madsen *et al.*, 2014).

PEST SIGNIFICANCE

Economic impact

S. ermak is an important pest of *Larix* in Siberia and the Far East, and is also known to attack other conifers (*Abies*, *Picea*, *Pinus*). It colonizes mainly stressed trees (usually after 2 years of stress) (Stroganova, 1963). In Siberia, it often attacks weakened forest stands (in particular, *Larix sibirica* stands) after defoliation by *Dendrolimus sibiricus*, leading to tree decline (Stroganova, 1963; Byalaya, 1966; Verzhutskij, 1973). Following *D. sibiricus* outbreaks, mass decline of larch due to colonization by *S. ermak* may be observed within the decade following the beginning of the *D. sibiricus* outbreak (Byalaya, 1966). In China, *S. ermak* often co-occurs with other horntails, such as *Sirex juvencus, S. dux, Urocerus gigas,* and *Xeris spectrum,* infesting weakened or declining spruce stands and, thus, accelerating tree death (Gao & Shi, 2021). *S. ermak* can also infest cut trees and logs with bark in cutting areas and warehouses, rendering them unusable (Stroganova, 1963, 1968; Vorontsov, 1981; Kostyunin, 2015). Furthermore, it can colonize logging residues (Vorontsov, 1981; Kostyunin, 2015). Despite the fact that the galleries of *S. ermak* larvae in wood are relatively short, dead trees cannot be used as commercial timber, because in addition to mechanical damage, such trees suffer from fungal infection. Ovipositing females infect wood with fungal spores (in particular, basidiomycetes, ascomycetes). These fungi develop rapidly spreading radially and growing deep in the wood (Byalaya, 1966; Maslov *et al.*, 1988). Two or three years after the first attack of *S. ermak*, wood becomes unusable because of fungal infection (Pavlovskij & Shtakelberg, 1955; Stroganova, 1965, 1968; Byalaya, 1966; Verzhutskij, 1973).

Control

As for other *Sirex* spp., control measures include sylvicultural and sanitary measures (improving the resistance of forests, cutting and elimination infested trees, use of trap-trees) (Maslov *et al.*, 1988), treatments with chemical and biological products. Natural enemies seem to play an important role in the control of *S. ermak* populations, especially the hymenopterous parasitoids (*Ibalia leucospoides*, *Rhyssa amoena*, *Rhyssa persuasoria*, *Rhyssa superba*, and *Xylonomus* sp.), the parasitoid fly *Erinna cincta*, and certain birds (e.g. *Dendrocopos major*, *D. minor*, *Dryobates* sp., *Dryocopus* sp., *Picus* sp., *Picoides tridactylus*) (Byalaya, 1966; Kolomiets & Bogdanova, 1979). Nevertheless, natural enemies are not widely used against *S. ermak*.

Phytosanitary risk

S. ermak is considered as a serious pest of *Larix* and other conifers (*Abies*, *Picea*, *Pinus*) in the area of its present distribution (Stroganova, 1968). The range of climatic conditions in the area of origin and present distribution of *S. ermak* is large, and it is likely to establish in almost all coniferous forests of the EPPO region where any European conifer tree species (*Larix*, *Abies*, *Picea*, *Pinus*) are found. Northern and central parts of Europe are especially endangered (Orlinski, 2006).

PHYTOSANITARY MEASURES

Recommended phytosanitary measures, for wood of host plant species, could include the following: origin from a pest-free area, or debarking, or freedom from any signs the pest, i.e. the adult exit holes and larval galleries, or heat treatment, or other appropriate treatment. Wood packaging material, including dunnage, should respect ISPM no. 15 (FAO, 2019).

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Datasheet history

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EPPO (2005) *Sirex ermak*. Datasheets on pests recommended for regulation. *EPPO Bulletin* **35**(3), 453-455. https://doi.org/10.1111/j.1365-2338.2005.00853.x

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