EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ЕВРОПЕЙСКАЯ И СРЕДИЗЕМНОМОРСКАЯ ОРГАНИЗАЦИЯ ПО КАРАНТИНУ И ЗАЩИТЕ РАСТЕНИЙ
ORGANIZATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES

Data Sheets on Forest Pests

Ceroplastes japonicus

IDENTITY

Name: *Ceroplastes japonicus Green*

Synonym: *Cerostegia japonicus Green*
Ceroplastes floridensis var. japonicus Green.

Taxonomic position: Insecta: Coccidae, Homoptera.
Common name: Japanese wax scale, Japanese soft scale, Tortoise wax scale (English), японская восковая ложнощитовка (Russian)
Bayer computer code: CERPJA

HOSTS

According to different authors, *C. japonicus* damages 95 to 121 plant species. It prefers *Laurus nobilis*, *Diospyros kaki*, *Camellia sinensis* and *Morus* spp. Less preferable are *Prunus laurocerasus*, *Citrus reticulata*, *Citrus unshiu* and some other *Citrus* spp., and then come *Malus* spp., *Magnolia* spp., *Poncirus trifoliata*, *Camellia* spp., Pittosporum, *Crataegus* spp. and other plants. The pest develops on all fruit and many ornamental plants (Yasnosh, 1951, 1952; Dzhashi, 1968; Shutova, 1970; Lobzhanidze, 1975; Katsitadze, 1973, 1977, 1978; Sinadskii, 1982)

GEOGRAPHICAL DISTRIBUTION

EPPO region: Azerbaijan (potential EPPO member, introduced), Georgia including Adzharia and Abkhasia (potential EPPO member, introduced), Great Britain (introduced), south-eastern France (introduced), Italy (introduced), southern Russia (introduced), Slovenia (introduced) (Shutova, 1970; Lobzhanidze, 1975; Katsitadze, 1977, 1978; Dzhashi, 1978; Bassova, 1983b; Voronkova *et al.*, 1986; Orlinskii, 1987; Orlinskii, Bassova & Shahramanov, 1993; Pelizzari, Camporese, 1994; Jancar, Seljak, Zezlina, 1999).

Asia: Azerbaijan (introduced), China, Georgia including Adzharia and Abkhasia (introduced), Japan, Republic of Korea (Yasnosh, 1951; Shutova, 1970; Lobzhanidze, 1975; Katsitadze, 1977, 1978; Dzhashi, 1978; Bassova, 1983b; Voronkova *et al*., 1986; Orlinskii, 1987; Park, Koo & Lee, 1992; Orlinskii, Bassova, Shahramanov, 1993; Pelizzari & Camporese, 1994; Jancar, Seljak & Zezlina, 1999).

EU: Great Britain (introduced), south-eastern France (introduced), Italy (introduced) (Voronkova *et al*., 1986; Pelizzari & Camporese, 1994).

C. japonicus probably originates from Eastern Asia (Japan, China) and is also present in the Republic of Korea. It was introduced and established in Western Georgia (including Adzharia and Abkhasia) and then spread to the south of Russia (Krasnodar territory), central Georgia and Azerbaijan (at the Caspian Sea). The pest was first detected in the north of Italy in 1984 and then widely spread on the territory of the country and to south-eastern France. It was first detected in Slovenia in 1990 on persimmon and erroneously identified as *C. rusci*.

On the territory of the former USSR, the pest was first detected in 1933 on a seedling of *Chaenomeles* spp. originating from a consignment, which had come from Yokogama in 1927. Before the correct identification in 1947 by N. S. Borhsenius (1949) the pest was believed to be *C. rusci* L. *C. japonicus* rapidly spread in subtropical area of the USSR (Abkhasia, Adzharia and the region of Sochi) and in 1978 occupied the territory of 15.000 ha on tea, citrus, laurel, mulberry, grapevine and fruit trees (Yasnosh, 1951; Shutova, 1970; Lobzhanidze,

1975; Katsitadze, 1977, 1978; Dzhashi, 1978; Bassova, 1983b; Voronkova *et al.*, 1986; Orlinskii, 1987; Park, Koo & Lee, 1992; Orlinskii, Bassova & Shahramanov, 1993; Pelizzari & Camporese, 1994; Jancar, Seljak & Zezlina, 1999).

BIOLOGY

The development of *C. japonicus* depends much on the host plant and the place of feeding on the plant. The sex rate (females: males) varies from 1: 4 on apple tree to 1: 1 on kaki, tangerine and leaves of laurel, and to 2,5: 1 on mulberry and 1000: 1 on branches of laurel. The fecundity also varies much: 395 eggs per female in average, 534 on apple tree, 844 on tangerine, 1319 on laurel, 1564 on mulberry, 1916 on tea and 1952 on kaki.

In subtropics of the USSR, *C. japonicus* develops 1 generation per year. On deciduous plants, larvae move from leaves to branches before leaves fall in autumn. On branches, they may form numerous dense colonies and turn into mature females. Mated mature females are overwintering on branches and leaves. The oviposition begins in the middle of May and continues more than a month till the end of June. Neonate larvae appear during a month: from the middle of June till the middle of July. Neonate larvae are not covered by wax till the beginning of feeding. They are very mobile in the first 1 or 2 days, then they fix themselves along nerves of leaves or on green annual shoots and a wax cover is formed (Fig 1). The sexual dimorphism appears only in third instar and is very spectacular. Female larvae sometimes change places of feeding and prefer sunny locations, whereas male larvae stay fixed all their life. Third instar larvae mute to adult insects. The pest reaches maturity in the beginning of September. Males are winged but don't fly well. They live 3 – 4 days. The flight of males lasts till the end of October, when the mating occurs. After mating males die.

The optimal conditions for the development of *C. japonicus* are: temperature 24 – 27ºC and air humidity 75 – 80%. The lower temperature threshold for the development of the scale is +12ºC, the higher - +35ºC. Temperatures higher than +15ºC are needed for the development of eggs, more than +18ºC – for the oviposition. At the temperature of +24ºC, eggs develop during 26- 29 days, first instar larvae – 33 days, second instar larvae – 14 – 15 days, third instar larvae – 22 days, nymphs – 9 – 12 days. The oviposition lasts during about a month. *C. japonicus* is a cold-resistant species. Its usual mortality on citrus in subtropics of the former USSR doesn't exceed 13%. The pest survives frosts better than citrus plants. It may establish in a zone with average minimal temperature of winter equal to -10ºC and probably even lower, and may occupy almost all the area of distribution of mulberry. The pest spreads with plants for planting, sometimes with fruits, and naturally with first instar larvae (Borhsenius, 1950, 1973; Yasnosh, 1951, 1952; Dzhashi & Dzhashi, 1968; Shutova, 1970; Batiashvili, Lobzhanidze, 1975; Lobzhanidze, 1975; Katsitadze, 1973, 1977, 1978; Dzhashi, 1978; Sinadskii, 1982; Bassova, 1983b; Orlinskii, 1987; Park, Koo & Lee, 1992; Orlinskii, Bassova & Shahramanov, 1993; Pelizzari & Camporese, 1994).

DETECTION AND IDENTIFICATION

Symptoms

Females and larvae of *C. japonicus* are easily detected on leaves and branches. Host plants are covered by black fungi (?) developing on honeydew excreted by wax scales.

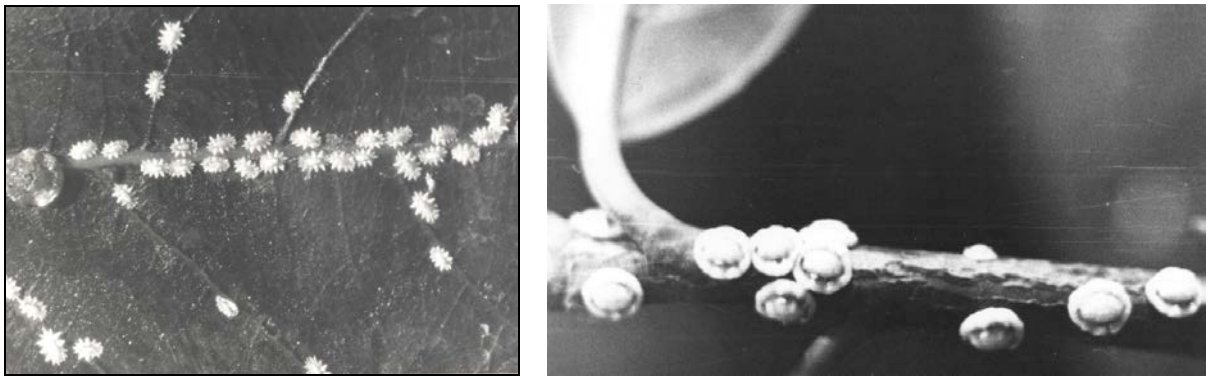

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Fig. 1 Larvae and females of *C. japonicus* on a leaf (1) and a shoot (2) of tangerine (Bassova, 1983b)

Morphology

Eggs

Eggs of *C. japonicus* are less than 0,5 mm long. One female may lay till 2500 eggs. Small females lay 400 – 500 eggs.

Larva

Neonate larvae of *C. japonicus* hatching from eggs have well developed legs and antennae. They move actively searching suitable places for feeding. Than they fix themselves on the surface of plants and turn into immovable larvae, which have a form of small stars (Fig. 1 & 2). The body of a larva is red and is covered by 8 whitish conic wax scales (3 pairs of which are lateral, one is frontal and one is anal) (Shutova, 1970).

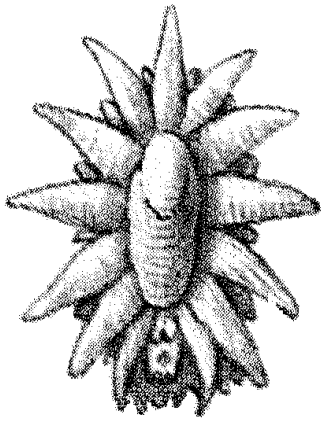

Fig. 2 Larva of *C. japonicus* (Shutova, 1970)

Pupa

The stage of pupa doesn't exist.

Adult

The adult female of *C. japonicus* is oval, 1,75 – 4,2 mm long, dorsal side is prominent, ventral side is flat. The upper side of the body is covered by a thick layer of wax, which is usual for all *Ceroplastes* species. The surface is more prominent in the centre and less prominent at the borders. For more young specimens, it is possible to see that the wax cover is composed of 8 separate scales, but they merge while females become older. The wax cover of live females is pink, lighter at the borders. The body under the wax cover is cherry-red. Two snow-white protuberances are situated on the back side of the wax cover, two – on each lateral side. At the bases of white protuberances, the colour of the wax cover is darker because the layer of wax is thinner and the dark red body is seen through it. Legs and 7-segmented antennae are clearly seen on the flat ventral side of the scale. The female lays eggs under its body. During the oviposition, the body is pressed toward the dorsal side. At the end of the oviposition, the female is transformed in a capsule filled by eggs (Shutova, 1970).

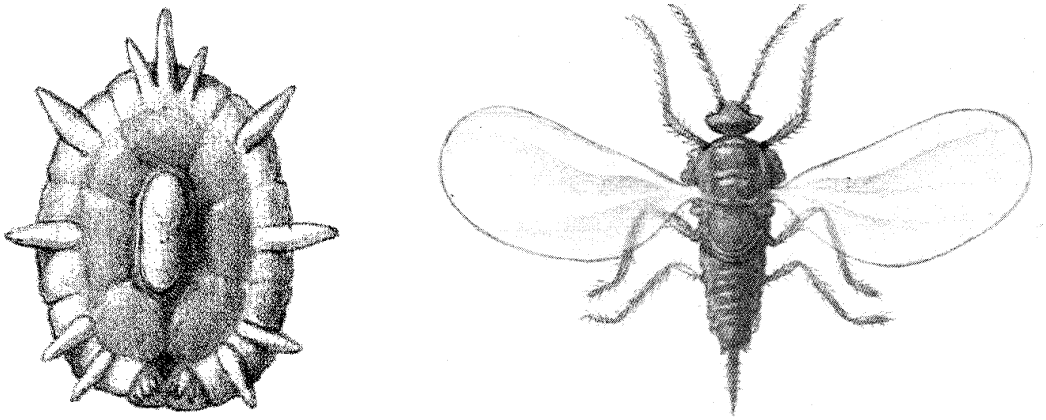

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Fig. 3 Female (1) and male (2) of *C. japonicus* (Shutova, 1970)

More detailed morphological description is published by Pelizzari & Camporese (1994).

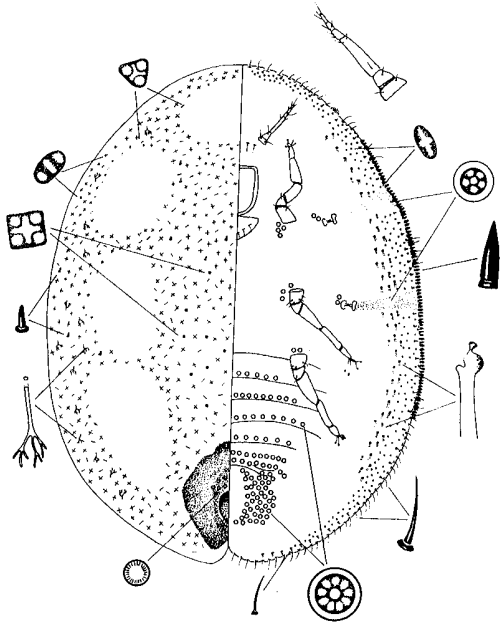

Fig. 4 Structure of a female of *C. japonicus* (Pelizzari & Camporese, 1994)

MEANS OF MOVEMENT AND DISPERSAL

C. japonicus spreads mainly with plants for planting. Natural spread to very short distances is possible with neonate larvae.

PEST SIGNIFICANCE

Economic Impact

C. japonicus is one of the main pests of citrus crops on the territory of the former USSR and the main pest of laurel and mulberry, an important pest of many ornamental and forest trees and shrubs. The pest damages much its host plants making multiple pricks and sucking sap. It excretes big amount of honeydew, on which several species of black fungi develop covering the surface of plants. The scale stresses much its host plants, reduces yield and the quality of fruits. The heavy infestation leads to the death of branches and, sometimes, plants (Dzhashi & Dzhashi, 1968; Shutova, 1970; Bassova, 1984; Bassova & Orlinskii, 1985; Orlinskii, 1987, 1989, 1990; Orlinskii, Bassova & Shahramanov, 1993; Pelizzari & Camporese, 1994; Jancar, Seljak & Zezlina, 1999).

Environmental Impact

Damaging large range of ornamental plants, *C. japonicus* disturbs city ecology and city environment. Its damage also leads to the pollution due to black fungi developing on honeydew excreted by wax scales.

Control

Chemical control of *C. japonicus* is not effective enough because the pest is well protected by the wax cover. Biological control of the scale is the most efficient. A large range of natural enemies makes the pest not important in its natural area of distribution. The introduction and establishment of predators and parasitoids often gives beneficial economical and ecological effect. The following hymenopterous parasitoids present the highest interest: *Anicteus beneficus* Ishii, *A. ohgushii* Tach., *A. rarisetus* sp. nov., *Coccophagus hawaiiensis* Timb., *C. yoshidae* Nak. (Hymenoptera, Aphelinidae), *Microterys clauseni* (Hymenoptera, Encyrtidae), *M. ericeri* Ishii, *Tetrastichus muracamii* sp. n. (Hymenoptera, Chalcidoidea). Some Coccinellid predators, e.g. *Rhyzobius forestieri*, may also present interest for classical biological control. Good results were obtained with the use of a

predator of scale eggs *Scutellista coerulea* Motsch. (Hymenoptera, Pteromalidae). The study of this natural enemy and field trials after its introduction to Georgia and Azerbaijan showed its high efficiency in control of *C. japonicus* and other soft scales. The use of entomopathogenic micro-organisms, e.g. *Fusarium* fungi, is also possible. (Shutova, 1970; Yasnosh & Loik, 1980; Sugonyaev, 1983; Bassova, 1983a, 1983b, 1984; Takabayashi, Takahashi, 1985; Bassova & Orlinskii, 1985; Orlinskii & Bassova, 1986; Zeng, Wang, Chen, 1990; Kravchenko, 1991; Orlinskii, Bassova & Shahramanov, 1993; Canovai & Raspi, 1999).
Methods of detailed and express sampling of *C. japonicus* and other arthropod pests on citrus crops were elaborated in Russia (Orlinskii, 1987, 1989, 1990).

Phytosanitary risk

As far as it is known, *C. japonicus* is not declared a quarantine pest by any regional plant protection organization. It is included into national lists of quarantine pests by Ukraine and Belarus. The pest causes serious damage to fruit, subtropical, forest and ornamental plants in countries where it was introduced including several EPPO countries: Great Britain, south-eastern France, Italy, southern Russia and Slovenia. The pest is able to establish in many EPPO countries, first of all in the Mediterranean region, and very likely to cause serious damage to many cultivated and forest trees and shrubs, which are economically and ecologically important plants there.

PHYTOSANITARY MEASURES

To prevent introduction of *C. japonicus* to many EPPO countries, the effective measure would be to prohibit import of plants for planting and cut branches of host plants from countries and areas of its present distribution. Phytosanitary inspection at the borders can detect larvae and females of the pest on the imported regulated articles.

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Dr. Tatiana Bassova, entomologist.

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