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Data Sheets on Quarantine Pests

Popillia japonica

IDENTITY

Name: *Popillia japonica* Newman
Taxonomic position: Insecta: Coleoptera: Scarabaeidae
Common names: Japanese beetle (English)
Hanneton japonais (French)
Japankäfer (German)
Escarabajo japonés (Spanish)
Scarabeo giapponense (Italian)
Japanbille (Danish and Norwegian)
Japanbagge (Swedish)
Bayer computer code: POPIJA
EPPO A1 list: No. 40
EU Annex designation: I/A2

HOSTS

In the USA, *P. japonica* has been recorded feeding on at least 295 species of plants. Economic damage has been recorded on 106 of these species. The food preference of the beetles changes during the year but preferred hosts include species of: *Acer, Aesculus*, *Betula*, *Castanea*, *Glycine*, *Juglans*, *Malus*, *Platanus*, *Populus*, *Prunus*, *Rosa*, *Rubus*, *Salix*, *Tilia*, *Ulmus* and *Vitis*. For a comprehensive list, see Fleming (1972b). In Japan, the host range appears to be smaller than in North America.

Within the EPPO region the host range of *P. japonica* would be similar: *Malus*, *Prunus*, *Rubus* and *Vitis*, with their wide distribution and intensive cultivation, would especially provide favourable food sources for the Japanese beetle.

GEOGRAPHICAL DISTRIBUTION

P. japonica originates from northeastern Asia where it is native in northern China, Japan and in the Far East of Russia. It was introduced into North America and has become a more serious pest in the USA than in its area of origin. For more information, see Balachowsky (1962), USDA (1975).
EPPO region: Absent, except for one island in the Azores (Portugal), where the pest has spread from a USA air base; Russia (Far East).
Asia: China (northeast; unconfirmed), Hong Kong, India (unconfirmed dubious record from northern India), Japan (including Hokkaido), Korea Democratic People's Republic (unconfirmed), Korea Republic (unconfirmed), Russia (only Far Eastern parts, Kurile Islands).
North America: Canada (Nova Scotia, Ontario, Quebec; under eradication), USA (all states of eastern seaboard, and many other states east of the Rocky Mountains; California).
EU: Absent.

Distribution map: See CIE (1978, No. 16).

BIOLOGY

P. japonica overwinters as a larva (usually 3rd instar) in a cell, about 15-30 cm deep in the soil. In the spring, when the soil temperature exceeds 10°C, the larvae resume feeding on plant roots at about 5 cm depth. Pupation usually occurs after a few weeks' feeding and the beetles emerge in late May to early July, depending on latitude. The average life of the adults is 30-45 days and the eggs are laid in the soil. After hatching from the eggs, the larvae feed in the soil. Normally, there is one generation per year but, at the northern edge of its range, a few individuals may need 2 years to complete the life cycle.

DETECTION AND IDENTIFICATION

Symptoms

Symptoms caused by adults of *P. japonica* are easily recognized (defoliation). The beetle skeletonizes the leaves by chewing out the tissue between the veins and leaving a vein skeleton. Leaves may turn brown and fall. On flower petals, the beetles consume large and irregularly shaped parts. Infestation of maize is shown by the increased appearance of embryonic and malformed kernels (Fleming, 1972b).

The larvae simply cause feeding damage to the roots of host plants, and the symptoms caused are not at all specific (Fleming, 1972b).

Morphology

Larva

Can be distinguished from other common scarabaeid larvae by the V-shaped arrangement of the last two rows of spines on the ventral surface of the last abdominal segment (for comparative figures, see Fleming, 1972a).

Adult

Beetle, about 12 mm long, very similar to *Phyllopertha horticola*. It can be distinguished from the latter by its shiny golden green thorax, lateral tufts of white hair on the abdomen, and two patches of white hair on pygidium.

Detection and inspection methods

Traps containing food-type lures and/or sex attractants have been widely used in the USA to monitor populations.

MEANS OF MOVEMENT AND DISPERSAL

The adults disperse locally by flight. In international trade, *P. japonica* adults have been intercepted on agricultural produce, on packaging and on ships and aircraft. Larvae may be transported in soil around the roots of plants for planting.

PEST SIGNIFICANCE

Economic impact

P. japonica is rated so serious a pest in North America that many millions of US dollars have been spent in limiting its spread. It is less of a pest in Japan.

The adult beetles feed on foliage, flowers and fruits. The adults are gregarious and many beetles collect together on a single plant, so individual plants or trees may be completely defoliated, while adjacent ones remain virtually undamaged. The beetles eat out holes between the leaf veins, skeletonizing the leaves. Such injury becomes very evident when orchard or shade trees are attacked. Feeding on flowers, especially roses, can cause loss of blooms. Fruits attacked include early cultivars of apple, peach and plum. Often, many beetles may attack a single fruit and, when beetle populations are large, every fruit on a tree may be covered with beetles. The market value of attacked fruit is reduced or the fruit may not be marketable. Maize is the field crop most seriously damaged in North America. The beetles cut off the maturing silk, preventing pollination; this results in malformed kernels and reduced yield. Beetles are also found in fields of soyabeans, clover and lucerne.

The natural habitat of the larvae is permanent pasture, where their feeding weakens growth and reduces resistance to drought. Most damage to other crops occurs where they follow grass, but the larvae can cause serious damage to strawberry plants and in nursery beds.

Control

The seriousness of the pest and of the economic losses it causes have led to intensive studies of the possibilities of control. Chemical control is possible with chlorpyrifos (Villani *et al.*, 1988) and isofenphos (Niemczyk, 1987). The use of isofenphos to eliminate *P. japonica* larvae from growing medium has been especially successful at a concentration of approximately 12 g a.i./m^3 which induced a 100% larval mortality up to 250 days after incorporation (Ladd & Lawrence, 1986).

Several scientists have examined the possibilities of biological control, in particular through entomogenous nematodes (e.g. Shetlar *et al.*, 1988; Villani & Wright, 1988). *Neoaplectana carpocapsae* (Steinernematidae) and *Heterorhabditis heliothidis* (Heterorhabditidae) were especially successful in suppresssing the Japanese beetle. Comparisons for the control of 3rd-instar larvae between *H. heliothidis* and isofenphos and chlorpyrifos showed that the nematode induced more than 90% larval mortality of *P. japonica* while isofenphos and chlorpyrifos induced 84 and 71%, respectively (Wright *et al.*, 1988).

The use of traps to control *P. japonica* has been considered ineffective or at least questionable. Small-scale trapping even increased the defoliation damage caused by *P. japonica* because of the increased attractiveness of the area to the beetle (Gordon & Potter, 1986).

Phytosanitary risk

P. japonica is regarded as an A1 quarantine organism for EPPO (OEPP/EPPO, 1980) and is also of quarantine significance for CPPC, JUNAC, NAPPO and OIRSA. Bourke (1961) analysed the climatic suitability of Europe for the establishment of *P. japonica*. He concluded that *P. japonica* could not become established in the Mediterranean area, because of lack of summer rainfall, and that the risk was low in the UK, Ireland or in continental Europe north of about 53°N, because the summers are too cool. The low summer rainfall in central Europe would similarly limit the potential of the pest. The area of moderate suitability covers most of Europe between latitudes 43°N and 53°N east to longitude 30°E. Within this area, the most favourable climates occur in the valleys of the Alps and Carpathian mountains and adjoining highlands where both summer rainfall and temperatures are sufficiently high. Mayer (1962) and Primault (1962) also analysed the potential for establishment in parts of Europe. Once established in certain European areas *P. japonica* could cause enormous damage and significant economic losses.

PHYTOSANITARY MEASURES

Removal of soil from roots of nursery stock should also remove larvae. If necessary, soil may be fumigated or treated with insecticide. Beetles are usually eliminated from fruit by commercial grading, and further routine treatment of plants and produce is not usually practicable. Aircraft may be disinfected by spraying passenger and baggage compartments with insecticide.

EPPO suggests that countries may prohibit the importation of plants with roots from countries where *P. japonica* occurs. If they are imported, consignments should have close attention from inspection services, and this should extend to the packing materials. To prevent the introduction of larvae, EPPO recommends (OEPP/EPPO, 1990) that these consignments should have been planted in inorganic growing medium or in a growing medium which was treated by an EPPO-approved procedure, and kept under conditions which prevent reinfestation.

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