Department for Environment Food & Rural Affairs

Plant Pest Factsheet

Japanese beetle

Popillia japonica

Figure 1. Japanese beetle adult © Bruce Marlin

Background

Popillia japonica Newman (Coleoptera: Scarabaeidae) is a chafer beetle, commonly known as the 'Japanese beetle', that is native to Japan. It is highly polyphagous and an important pest of a range of crops and woody plants. It was accidently introduced to eastern North America in about 1911 and since then has become invasive in most of the eastern states, and in the southern parts of Ontario, Canada. It was introduced to the Azores in the 1970s and the first incursion in mainland Europe occurred in autumn 2014, when large numbers of adults were detected near Milan, Italy. It is regulated in the European Union (Annex IAII of the EC Plant Health directive) and if introduced to the UK, it could have an impact on many crops and fruit trees, turf and ornamental garden species and plants of environmental importance.

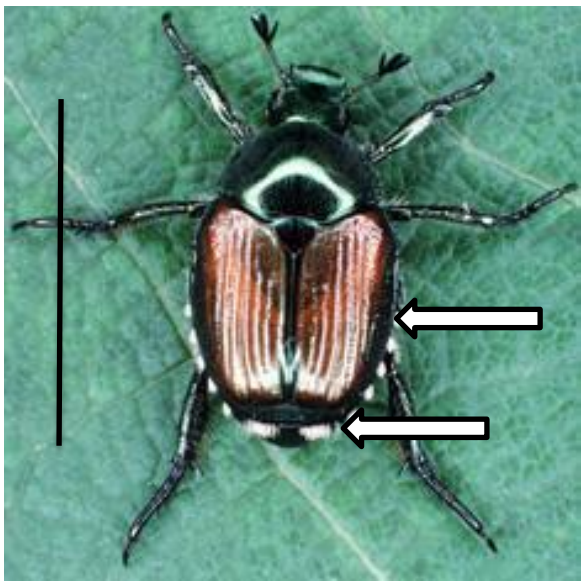

Figure 2. *Popillia japonica* adult; arrows indicate the diagnostic white setal tufts; black scale bar = 10 mm © Lawrence Barringer, Pennsylvania Department of Agriculture

Figure 3. *Popillia japonica* larva © http://entoweb.okstate.edu

Figure 4. Skeletisation of Vaccicium foliage by Japanese beetle adults © Jerry A. Payne, USDA Agricultural Research Service, Bugwood.org

Figure 5. Group of Japanese beetles © D. G. E. Robertson

Figure 6. Defoliation caused by Japanese beetle adult © Steven Katovich, USDA Forest Service, Bugwood.org

Figure 7. Grass turf damaged by Japanese beetle larvae © M.G. Klein, USDA Agricultural Research Service, Bugwood.org

Geographical Distribution

Japanese beetle is native to Japan, and has been introduced to the neighbouring Kunashir Island (Russia), and the USA, Canada and Italy. The status of records from northern China is unclear, and at least some of these also appear to refer to a related species *Popillia quadriguttata*.

Host Plants

Adult Japanese beetles are highly polyphagous, with over 300 hosts in 79 plant families reported in the USA. While they are best known as defoliators, adults will also feed on fruit. Only a few of the recorded hosts are listed below, selected on the basis of those favoured by the beetle, and of importance to the UK. Tree hosts include *Acer* (maples), *Betula* (birch), *Fagus* (beech), *Larix decidua* (larch), *Malus* (apples), *Populus* (poplars), *Prunus* (stone fruit), *Quercus* (oak), *Tilia* (limes) and *Ulmus* (elms). Shrubs and bushes commonly attacked include *Althaea rosea* (hollyhock), *Rhododendron*, *Rosa* (roses), *Rubus idaeus* (raspberry), *Vaccinium* (blueberry), *Viburnum* and *Vitis* (grapevine). Other hosts of economic importance to the UK include *Asparagus officinalis, Fragaria* (strawberry), *Trifolium* (clover) and *Zea mays* (maize).

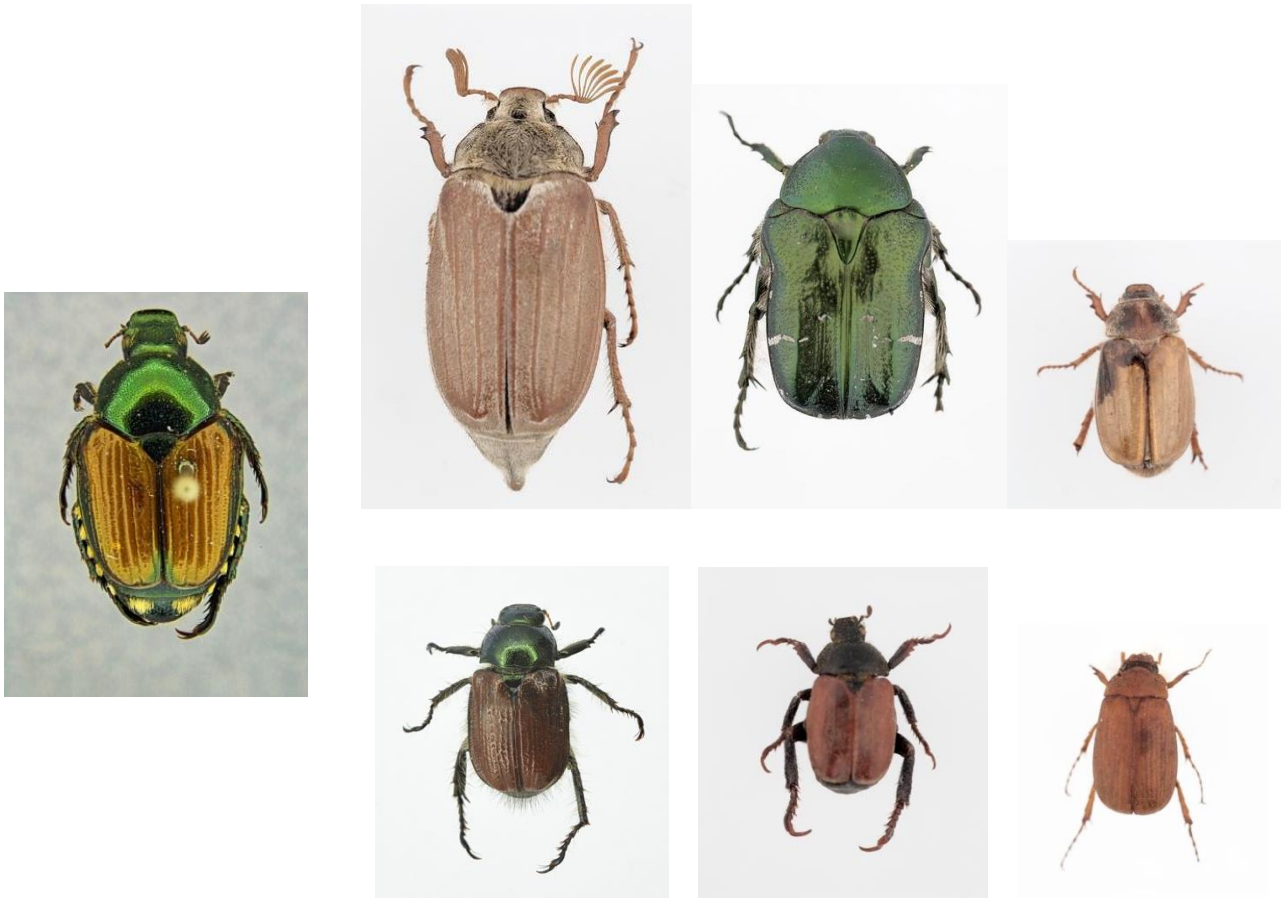

Figure 8. Chafer beetles that may be confused with Japanese beetle in Britain. Japanese beetle (left), Cock chafer, rose chafer, summer chafer, garden chafer, Welsh chafer and brown chafer adults © Crown copyright

Larval food plants are less well documented, mainly because the larvae live and develop underground, feeding on roots, and are thus more difficult to study. The larvae have limited mobility and their food source is mostly determined by where the female beetle oviposited. Females usually lay eggs near the plant upon which they are feeding, though beetles feeding on trees and shrubs usually lay eggs in nearby grass. Larval damage is usually associated with turf and pasture.

Description

Japanese beetle adults are brightly coloured with a metallic green thorax and head and coppery bronze wing cases (elytra), oval in shape, and vary from 8 to 11 mm in length, and 5 to 7 mm in width (Figs 1 & 2). The female is typically larger than the male. Along each lateral side of the wing cases are five tufts of white setae present and two dorsal spots of white setae on the last abdominal segment (pygidium). In Britain, there are several chafers which superficially resemble Japanese beetle (Fig. 8), such as brown chafer (*Serica brunnea*), cock chafer (*Melolontha melolontha*), garden chafer (*Phyllopertha horticola*), summer chafer (*Amphimallon solstitiale*), rose chafer (*Cetonia aurata*) and Welsh chafer (*Hoplia philanthus*). Japanese beetle may be distinguished from all other chafers present in Britain (and Europe) by the presence of the white setal spots along the sides of the abdomen and on the pygidium (indicated by the white arrows in Fig. 2), which are absent on the other species. Garden chafer is most similar in appearance to Japanese beetle as it may have a metallic green thorax and whitish hairs along the sides of the abdomen but they do not form distinct setal spots and are absent from the pygidium.

Newly deposited eggs are variable in size and shape: they may be round, elliptical or nearly cylindrical, with a length of about 1.5 mm. Colour may range from translucent to creamy white and the external surface is marked with hexagonal areas. The larvae are usually easily recognised by their C-shape form and well developed legs and head capsule (Fig. 3). The soft body is curved downwards so that the dorsal surface forms outside of the curve. The spiracles (breathing holes) are surrounded by a sclerotised C-shaped or kidney-shaped ring. The pupae are 14 mm in length and 7 mm wide, and resemble the adult, but wings, legs and antennae are held close to the body and are functionless. The colour changes from a cream colour to tan and eventually the metallic green observed in the adult.

Biology

In southern parts of the USA Japanese beetles have one generation per year and grubs spend about 10 months under the soil surface. However, in more northerly or mountainous locations, where temperatures are lower, the life cycle can take two years to complete. Adults emerge from turf grass in late June and immediately begin to feed on low-lying plants such as roses and shrubs. Adults eventually move up on tree foliage to feed and mate. Mated females move back to turf grass to lay egg masses in soil cavities. Females prefer to lay eggs in healthy, vigorous turf grass and will avoid stressed lawns. Most eggs are laid between mid-July and early September. The eggs hatch into small grubs that feed

on roots underground until late September when the temperature cools. The almost fully-grown grubs burrow 4–8 inches down in the soil and remain inactive all winter. In the early spring, grubs become active again and feed until turning into resting pupae. The pupae hatch into adults and emerge from the soil. In cooler climates the life cycle is extended over two years.

Dispersal and Detection

Adult beetles are active and frequently move within and between plants. They can fly and marked beetles have been found up to 2.75 miles away from their original point of capture; beetles have also been detected on boats over 5 miles out at sea. However, warm temperatures are required for the beetles to take flight with an optimum temperature range of 29–35°C. The adults and larvae can be moved in plant trade and the adults can hitchhike on non-host commodities or vehicles. The larvae are highly cryptic (living in the soil) and could easily be accidently moved with rooted plants.

The adult beetles (Figs 1-2) can be easily detected in the field by visual examination of plant foliage. The adults are often gregarious (Fig. 5). The larvae may be detected by visual examination of roots. Traps containing food-type lures and/or sex attractants have been widely used in the USA to monitor populations and could be useful in warehouses with imported plant material.

The adult beetles skeletonize the leaves by chewing out the tissue between the veins and leaving a vein skeleton (Fig. 4). Leaves may turn brown and fall (Fig. 6). The beetle can cause significant defoliation and may also damage flowers. The larvae simply cause feeding damage to the roots of host plants (Fig. 7), and the symptoms caused are not specific.

Economic Impact

Popillia japonica is a major pest in parts of North America, though impacts in Japan are usually less severe. Crops significantly damaged include maize, soybean and pasture. Adults damage a very wide range of plants, causing defoliation on apple, birch, lime and rose. Impacts on pasture and other grassed areas such as golf courses and lawns are due to larval feeding on the roots. Summer temperatures in the UK are lower than those in many parts of the beetle’s current range, and this would be expected to limit the amount of defoliation caused by the adults. Larvae are expected to have a predominantly 2-year lifecycle in the UK. This would mean the population build-up would be slower and hence damaging numbers may only occur in the warmest years. Due to the wide host range, many crops and fruit trees, turf and ornamental garden species and plants of environmental importance to the UK could potentially be affected, though impacts in North America do seem to be largely social and economic, rather than environmental.

Chafer larvae in Britain often cause significant indirect damage to lawns and turf as they attract badgers and foxes which dig up the grass to find the larvae to eat.

Advisory information

Japanese beetle is an invasive species in North America and some areas of the UK are considered climatically suitable for establishment, although they are likely to have a 2-year life cycle which will limit the numbers and impact.

Early detection is vital for the effective control of this pest and the protection of horticulture, agriculture and the wider environment. Industry should source material carefully, and both commercial growers and gardeners may wish to monitor for its presence. Statutory action will be taken against Japanese beetle if intercepted on imported plant material and against outbreaks on commercial plant production premises in the UK.

Suspected outbreaks of Japanese beetle or any other non-native plant pest should be reported to the relevant authority:

For **England and Wales**, contact your local **APHA Plant Health and Seeds Inspector** or the **PHSI Headquarters**, Sand Hutton, York. Tel: 01904 405138
Email: planthealth.info@apha.gsi.gov.uk

For **Scotland**, contact the **Scottish Government's Horticulture and Marketing Unit:**
Tel: 0131 244 8935 Email: hort.marketing@gov.scot

For **Northern Ireland**, contact the **DAERA Plant Health Inspection Branch:**
Tel: 0300 200 7847 Email: planthealth@daera-ni.gov.uk

For additional information on UK Plant Health please see:
https://secure.fera.defra.gov.uk/phiw/riskRegister/
https://www.gov.uk/plant-health-controls
http://www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases
https://www.daera-ni.gov.uk

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Date: June 2016

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