

# Japanese Beetle

## *Popillia japonica*

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Figure 1: The Japanese Beetle

**Origin of Species:** In its native lands of far east Russia, northern China and Japan<sup>1</sup>, where it's known as *mamekogane* (マメコガネ), the Japanese beetle is a pest that is merely disliked<sup>2</sup>. This is because there are enough predators and most of the land is not suitable for the development of their larva<sup>2</sup>.

**Invasive History:** The insect was first brought to North America in 1916 on the roots of irises<sup>3</sup>. It started the invasion in south New Jersey and spread throughout the United States from there<sup>4</sup>. In 1939, there was one seen in a car that had crossed over on the ferry that goes from Maine to Yarmouth, Nova Scotia<sup>6</sup>. Now they can be found in most provinces, as well as many US states and a few other countries<sup>4</sup>.

**Current Invaded Ecosites:** Their eggs need to be laid in grassy areas, preferably in locations near their food sources, but could be as far as eight kilometers away, if needed<sup>4</sup>. They tend to seek out urban and rural areas with a lot of grass and near their food supply. They also like being in daylight constantly, so they are likely to go to forest edges, agricultural land, urban gardens, etc. for food<sup>4</sup>.

**Reasons for its Success:** The beetle has a lot of viable land to lay eggs, food is plentiful, predators in North America are not as effective at keeping the populations in check as those in Japan, and the climate is fairly similar to northern Japan<sup>5</sup> or better, and the ever-growing problem of climate change may be helping them<sup>6</sup>.

**Invasive Impacts:** The larva will chew on and eat the roots of grass, which kills that vegetation within the immediate area<sup>4</sup>. Adult beetles will feed on the leaves of various plants, leaving behind nothing but the skeleton of the leaf<sup>4</sup>. This stops the plant from collecting water on its leaves to absorb, thus preventing the plant from having an important water source. They may also eat some types of fruit<sup>7</sup>.



Figure 3: Sassafras leaves destroyed by Japanese Beetles

**Possible Vulnerabilities:** At the larva stage of their life, they are not able to retain water for long and if a drought were to happen, at least some would die before being able to reach adulthood<sup>8</sup>. It would take a few years of droughts to show a significant population decline though<sup>8</sup>. During the adult stage, while they can fly, they tend to be easily picked off of the plants they are sitting on and can be killed by putting them into soapy water. It has also been noted over the years that they are clumsy fliers<sup>9</sup>, which can make them easy to capture mid-air.

**Conventional Eradication and Control Methods:** The beetles are attracted to certain colors such as yellow, white, and green<sup>7</sup>, but according to the recent work done on these species it is found that traps build with solid green colors have proven to be effective in capturing the beetles.

Commonly used traps are funnels containing receptacle with female pheromones and floral volatiles or UV-blocking tunnels for small crops. For management of the beetle population, chemical insecticides were used which led to making people ill and killing birds or pets. Currently, the insecticides used for controlling the population of the Japanese beetles are pyrethroids, organophosphates, carbamates, neonicotinoids, and anthranilic diamides<sup>7</sup>.

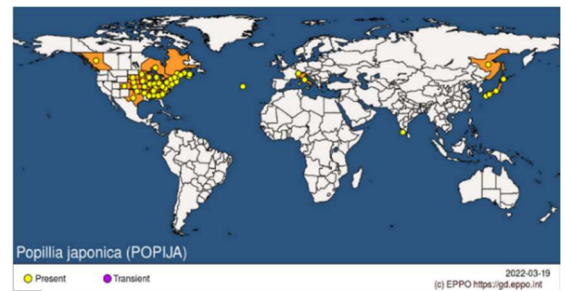


Figure 2: Global Range of the Japanese Beetle<sup>1</sup>

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3 - Mass Audubon. (n.d.). About Japanese Beetles. Retrieved from <https://www.massaudubon.org/learn/nature-wildlife/insects-arachnids/japanese-beetles/about>

4 - Government of Canada. (2017). *Popillia Japonica* (Japanese Beetle) - Fact Sheet. Retrieved from <https://inspection.canada.ca/plant-health/invasive-species/insects/japanese-beetle/fact-sheet/eng/1328165101975/1328165185309>

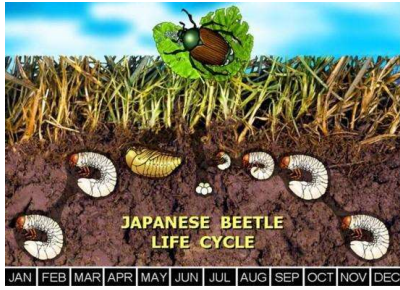


Figure 4: Japanese Beetle Life Cycle<sup>14</sup>

**Modern Biological Control:** Nematode species, such as *Steinernema glaseri* and *Heterorhabditis bacteriophora*, or bacterium species, like the *Bacillus thuringiensis galleriae* (BTG), or Milky Spore. The Government of California has actually used the nematodes and BTG to successfully eradicate the beetle from the state<sup>11</sup>. Domesticated avian species have also been used to lessen the damage done by adult beetles<sup>12</sup>.

**Current Biological Control Status:** There are species native to North America who will eat the beetle in the larva or adult stage. For example, ants, such as the Thief and Labour Day species, will feed on the eggs of the beetles<sup>7</sup>. Some mammals, like skunks and moles, also feed on the Japanese beetle larvae<sup>7</sup>. Various wild avian species have been seen eating the adult beetles as well<sup>7</sup>.

**Candidate Species:** One of the most recommended species for the control of the Japanese beetles are the nematodes such as *Heterorhabditis bacteriophora* and *Steinernema riobrave*<sup>13</sup>. These parasitic nematodes are the most novel and efficient control measure for the beetle species. These are microscopic organisms that feed on Japanese beetle grubs. The eradication of these beetles is still being studied but this biological control method is proven to be highly effective and recommended<sup>13</sup>. Nematodes that belong to the *Heterorhabditis* and *Steinernema* families can be found in a resting form known as infective juveniles, these parasites then infect the hemolymph of the insect with bacteria which then multiplies and produces toxins and antibiotics or biomolecules, that kills the insect within 2-3 days and turning the dead insect into a food source that is suitable for the nematode to reproduce and grow<sup>13</sup>.

**Research Progress:** Most of the research that is carried out, is focused on the larvae or the grubs. There were studies conducted against the adult beetles on some strains of *Steinernematid* and *Heterorhabditid* nematodes. Some of these strains have shown to cause notable mortality rates<sup>13</sup>. The objective of these studies was to understand the range of nematode strains that have the ability to kill the Japanese beetles and aid in controlling their population<sup>13</sup>.

**Results:** Tests run with the nematodes proved successful, but additional research needs to be done<sup>13</sup>. As the results of the article suggests, the nematodes should be paired up with the pheromone traps, for mass effect, where those that are caught can be infected with the parasites, who would go on to kill the host<sup>13</sup>.



Figure 5: Japanese Beetle Grub<sup>15</sup>

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