

Anoplophora glabripennis (Motsch.)

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Distribution

The provinces of Liaoning, Hebei, Beijing, Tianjin, Inner Mongolia, Ningxia, Shaanxi, Gansu, Henan, Shanxi, Shandong, Jiangsu, Anhui, Jiangxi, Hubei, Hunan, Sichuan, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi, Yunnan, and Guizhou in China, Korea, and Japan.

Hosts

Poplars, willows, elm, *Acer truncatum*, and sugar maples

Occurrence and Damage

Anoplophora glabripennis is widely spread in the “Three North” Protection Forest System and the green plain area of northern China (*translator’s note*: The “Three North” Protection Forest System is a gigantic afforestation project established by the Chinese government in 1987 to build a forest system in northwest, north, and northeast China to protect the local environment and economy from sandstorms and soil erosion. It covers an area of 4,069,000 km² in 551 counties of 13 provinces, or 42.4% of the country’s total land area, with a range of 73°20' to 127°50' east longitude and 33°20' to 49°48' north latitude). Poplars are among the most frequently attacked species. Larvae of *A. glabripennis* bore inside the wood, resulting in windbreak of trunks and death of the tree.

Morphology

Adults: Adults are shiny black; each elytron has about 20 blotches of white villi with a smooth base, lacking tubercles. The ventral abdomen, the middle portions of femora, tibia, and the dorsal sides of tarsi are covered with dense blue-gray villi. A spine is present on each side of the prothorax. The head is slightly narrower than the thorax and is divided by a central groove stretching from occiput to vertex and base of labrum; the central groove is most conspicuous on the vertex. Antennae are filiform; the anterior end of the first segment is enlarged; the second segment is the smallest, and the third segment is the longest. The size and length of the subsequent antennal segments gradually decrease distally, and the base of each segment, from the third segment up, is gray-blue. Female antennae are about 1.3 times the body length, with the distal end of the last segment gray-white in color. Male antennae are about 2.5 times the body length, and the distal end of the last segment is black. Females range from 22-35 mm long and 8-12 mm wide, and males range from 20-29 mm long and 7-10 mm wide.

Eggs: Eggs are milky white, turning yellow just before hatch. Eggs are narrow, elongate, elliptical in shape, and slightly curved at both ends; egg length ranges from 5.5 to 7.0 mm.

Larvae: Larvae are milky white with a brown head at hatch; after feeding begins, the head turns reddish. Mature larvae are yellow, about 50 mm long; the head capsule is black-brown, ca. 5 mm in width, and half contracted into the thorax. Antennae are

brownish, three-segmented, and relatively robust. The second segment is equal in length and width. The clypeus is trapezoidal, yellowish brown, and the labrum is semi-rounded, with fine, yellow-brown hairs lining the anterior margin. Larval mandibles are black distally and black-brown proximally; maxillary palpi are brown and three-segmented; maxillary lobes are short, not exceeding the end of the second labial palpi; labial palpi are brown and two-segmented. The prothorax is large and long; posteriorly, the pronotum is convex with dark coloration; both sides of the prosternite lack sclerotized oval patches; the prosternellum is weakly sclerotized. The mesothorax is the shortest of the thoracic segments. An ampulla (a vesiculate projection) is present on the mesosternum, metanotum and metasternum; each ampulla is divided centrally by a transverse groove. Nine abdominal segments are visible dorsally, and the tenth segment is reduced to rumules (nipple-like apophysis). The first seven abdominal segments have a single ampulla on each notum and sternum with one or two grooves, respectively.

Pupae: Pupae range in color from milky white to yellowish white; the appendages are slightly colored. The antennae are curved anteriorly into rings, and rest on the forelegs, the middle legs, and elytra. The pronotum has a spicula on each side and a central dorsal impression. Tips of the elytra reach to the end of the fourth-abdominal segment. A rising spicula is present on the eighth abdominal notum; the eighth sternite is reduced to a structure similar to caudal proleg, with black brown spinules posteriorly. Pupae range in size from 30 to 37 mm long and ca. 11 mm wide.

Biology

Anoplophora glabripennis completes one generation within a year or two. They may overwinter as eggs, neonates inside eggshells, larvae, or pupae. Molted adults stay inside their pupal gallery for about 7 d before chewing an emergence hole above the invasion site. Adult emergence starts in May and peaks in early July. Some adults are still active in early October. Adults are diurnal and most active between 8AM to noon; they tend to rest inside tree crowns or other cool, dark areas when cloudy or temperatures are higher than 33°C. Adults feed on leaves, petioles and barks of small branches of poplars and willows for supplemental nutrition. Mating occurs 2 to 3 d after feeding begins. There are multiple matings and egg depositions throughout adult life. During oviposition, a female chews an elliptical pit in the bark with her mandibles, inserts her ovipositor between the phloem and sapwood, and lays a single egg; the female then seals the egg pit with a sticky secretion. The oviposition of a single egg results in the death of ca. 1 cm² sapwood. Each female deposits an average of 32 eggs in her lifetime. Females oviposit throughout the tree, from exposed roots up to small branches ≤ 3 cm in diameter, however, they prefer the crotches of branches and new shoots. Adults are weak fliers with no phototaxis and are easily captured. Females live 14 to 66 d, and males 3 to 50 d. The egg stage falls between June and July, with an average duration of 11 d. Eggs laid during September and October will not hatch until the next year; some hatched larvae overwinter inside the eggshells. Newly hatched larvae start feeding on the decayed phloem surrounding the egg, excreting brown frass from the egg pit. Second-instar larvae feed on healthy phloem and nearby xylem, and excrete brown frass and sawdust from the egg pit. After consuming ca. 3.8 cm² of phloem under the bark, at late third or early fourth instar, larvae tunnel into the xylem and feed on heartwood, leaving white sawdust behind. Larval galleries are horizontal, slightly curved at first, then turning

vertically up the trunk; galleries increase in size as the larval body grows and average 9.6 cm in length and from 3.5-15 cm in width. Generally, galleries inside the heartwood serve only as nesting areas because larvae actually feed between the sapwood and heartwood. Palm-shaped depressions appear on the bark due to this feeding; frass is excreted from the egg pit. This area of depressed bark ranges from 120-214 mm² and averages 166 mm². Field studies show that one larva is capable of destroying a log of ca. 12×10 cm (length×diameter) or equivalent timber.

Consecutive infestations of *A. glabripennis* cause serious loss to forests. In Hebei province, the overall survival rate of *A. glabripennis* was 17.78%. Densely distributed galleries cause hollow areas in the trunk, resulting in enlarged “insect galls” ranging in length from 30-70 cm. There was a positive correlation between forest damage and the number of “insect galls”. Four years of consecutive attack by *A. glabripennis* may result in 1 to 2 “insect galls” per tree, whereas six years of attack result in 2 to 5 “insect galls”. Longer infestation history left numerous “insect galls”, sparse branches, defoliation, degraded timbers, and poses a serious threat to the local economy and ecology.

Natural Enemies

Spotted woodpeckers and the cylindrical bark beetle, *Dastarcus longulus* (Coleoptera: Colydiidae), were the most common natural enemies, and demonstrated good suppression of *A. glabripennis* prevalence and damage.

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