

Data sheets on quarantine pests¹
Fiches informatives sur les organismes de quarantaine

Agrilus planipennis

Identity

Name: *Agrilus planipennis* Fairmaire

Taxonomic position: Insecta: Coleoptera: Buprestidae

Synonyms: *Agrilus feretrius* Obenberger, *Agrilus marcopoli* Obenberger

Common names: emerald ash borer (English), agrile du frêne (French)

EPPO code: AGRLPL

Phytosanitary categorization: EPPO A2 action list no. 322

Hosts

Native hosts of *A. planipennis* include the Asian species *Fraxinus chinensis*, *Fraxinus japonica*, *Fraxinus lanuginosa*, *Fraxinus mandshurica*, *Fraxinus rhynchophylla*, *Juglans mandshurica*, *Pterocarya rhoifolia*, *Ulmus davidiana* and *Ulmus propinqua*. In North America, *Fraxinus americana*, *Fraxinus nigra* and *Fraxinus pensylvanica* have been attacked. There is no information on the susceptibility of the native European ash species (e.g. *Fraxinus excelsior*, *Fraxinus angustifolia*).

Geographical distribution

EPPO region: Russia (Far East) (Haack *et al.*, 2002)

Asia: north-eastern China (Hebei, Heilongjiang, Jilin, Liaoning, Neimenggu and Shandong Provinces), Japan, Korea Republic, Mongolia, Russia (Far East) and Taiwan (Jendek, 1994; Haack *et al.*, 2002)

EU: Absent

North America: Canada (Ontario: Essex county), USA (Michigan: Livingston, Macomb, Oakland, Monroe, Washtenaw and Wayne counties; Maryland: Prince George county; Ohio: Lucas county; Virginia: Fairfax county)

A. planipennis has become established in portions of Michigan and Ohio (US) (Mecteau & Marchant, 2003) and Ontario (CA). It was first discovered in south-eastern Michigan in 2002 (NAPPO, 2002). In September 2002, 6 south-eastern Michigan counties and one adjoining county in Ontario had known

infestations. These infestations are believed to have been established for at least five years prior to their discovery. In February 2003, an infestation in Lucas County, Ohio was confirmed (Ohio Department of Agriculture, 2003). It is suspected that *A. planipennis* entered the USA at Detroit, in dunnage from cargo ships.

Biology

Agrilus is a large genus of flat-headed woodborers with species found in Asia, Australia, Europe and North America (Browne, 1968). The larvae typically feed in the cambium of trees or in the stems of vines and small woody plants. The adults are attractive insects with striking metallic colours and are often referred to as jewel beetles. Several species are of economic importance in forestry, arboriculture and agriculture. About 100 species are native to North America and at least 11 in Europe. No North American species of *Agrilus* are known to attack ash (Drooz, 1985; Furniss & Carolin, 1977), nor does Schwenke (1974) mention any species on ash in Europe.

In China, *A. planipennis* typically has one generation per year although some individuals may require two years to complete a generation. Adults are active between mid-May and July. After emergence, they walk to the crown of their host tree and feed on the foliage. After 3–4 h of feeding, they may begin to fly. They continue to feed on foliage throughout their lives, being active from 6–17 h, especially on warm, sunny days. On cloudy or rainy days, adults rest in bark cracks or on foliage. They remain on the foliage at night. Eggs are laid individually on the bark surface, inside bark cracks and crevasses. Each female can lay 68–90 eggs. Adult males typically live for 2 weeks and females for 3 weeks. Eggs hatch in about one week. First-instar larvae tunnel through the bark to the cambium, where they feed from mid-June to mid-October. Larvae make long serpentine galleries (up to 26–32 mm long) into the sapwood which enlarge as they grow and which are filled with brownish sawdust and frass (Web Fig. 1). The mature larvae overwinter in pupal cells. Pupation occurs in April and May at the end of a tunnel near the surface. Individual larvae that are not full grown by autumn overwinter in the cambium, resume feeding in April and complete development in late summer. Adults remain under the bark for 1–2 weeks and then emerge through D-shaped exit holes that are about 3–4 mm wide (Haack *et al.*, 2002).

¹The Figures in this data sheet marked 'Web Fig.' are published on the EPPO website www.eppo.org.

Detection and identification

Symptoms

Symptoms of attack of *A. planipennis* include frass-filled larval galleries in the cambium, adult exit holes, yellowing and thinning of foliage, dying of branches, dieback and mortality of the tree. Callus tissue produced by the tree in response to larval feeding may cause vertical splits 5–10 cm in length to occur in the bark above a gallery (Canadian Food Inspection Agency, 2002). As no European species of *Agrilus* is known from ash, the occurrence of galleries typical of this genus in ash trees should automatically be suspect.

Morphology

Eggs

Eggs are light yellow in colour, turning to brownish yellow before hatching. They are oval-shaped, 1 × 0.6 mm. The centre of each egg is slightly convex.

Larva

Mature larvae of *A. planipennis* (Web Fig. 2) are 26–32 mm long and creamy white in colour. The body is flat and broad. The head is small and brown and it is retracted into the prothorax, exposing only the mouthparts. The prothorax is enlarged, and the meso- and meta-thorax are slightly narrower. The mesothorax bears spiracles. The abdomen is 10-segmented. Segments 1–8 have one pair of spiracles each and the last segment bears one pair of brownish serrated styles.

Pupa

Pupae of *A. planipennis* are 10–14 mm long and are creamy white in colour. The antennae stretch back to the base of the elytra and the last few segments of the abdomen bend slightly ventrad (Canadian Food Inspection Agency, 2002).

Adult

Adults of *A. planipennis* (Web Fig. 3) are 8.5–14.0 mm long and 3.1–3.4 mm wide. The body is narrow and elongate, cuneiform, and a beautiful metallic blue-green colour. This species is glabrous and characterized by dense but fine sculpture. The head is flat and the vertex is shield-shaped. The compound eyes are kidney-shaped and somewhat bronze-coloured. The prothorax is transversely rectangular and slightly wider than the head, but the same width as the anterior margin of the elytra. The anterior margin of the elytra is raised, forming a transverse ridge, the surface of which is covered with punctures. The posterior margins of the elytra are round and obtuse with small tooth-like knobby projections on the edge.

Pathways for movement

Research in China and Japan indicates that *A. planipennis* adults are strong fliers and typically fly in bursts of 8–12 m.

Long-distance flights of more than 1 km are also possible (Haack *et al.*, 2002). Adults are small and subject to dispersal by air currents. This insect can be transported with plants and wood products (including wood, wood packaging, wood chips, firewood) containing bark, moving in international trade. Between 1985 and 2000, 38 confirmed detections of *Agrilus* spp. were made at points of entry in USA. Twenty-eight of these were on dunnage, 4 on crates, 4 on grapevine leaves, and 1 from a cutting; one was at large in a ship's hold (Haack *et al.*, 2002).

Pest significance

Economic impact

Trees attacked by *A. planipennis* are ultimately killed. In China, *A. planipennis* typically attacks ash trees that grow in open areas or at the edge of closed forests. However, entire stands can be killed during outbreaks. Attack densities are highest in the lower bole of host trees (Yu, 1992). In North America, on the other hand, *A. planipennis* has infested and killed trees in both open settings and closed forests and attacks begin in the upper bole and main branches of host trees. In Michigan, it is estimated that *A. planipennis* has killed millions of trees over the past few years (*F. pensylvanica*, *F. americana* and *F. nigra*, as well as several horticultural varieties of ash). In Ontario, it is estimated that it has killed 9000–10 000 ash trees. *A. planipennis* can kill trees of various size and condition (from small trees, e.g. trunk of 5 cm diameter, to large mature trees). Trees usually die within three years following initial attack, though heavier infestations can kill trees within 1–2 years (Haack *et al.*, 2002).

Attacks by *A. planipennis* can cause direct loss of the attractive and high-quality wood of *Fraxinus* spp., which is used for a variety of products including furniture, tool handles and sports equipment. Possible use of plant protection products for eradication or containment could have undesirable side-effects (Haack *et al.*, 2002). The insect also causes extensive mortality of ornamental and shade trees in infested areas in USA, in city streets and in gardens. Loss of ash street trees may result in reduced values of urban homes. Moreover, homeowners in infested areas have fewer viable choices of suitable ornamental and shade trees (Haack *et al.*, 2002). Finally, various species of *Fraxinus* are important components of broadleaf forest communities, which may suffer altered tree species composition and reduced biodiversity as a result of attacks by *A. planipennis*.

Control

No effective control methods are currently available. However, research is under way to evaluate systemic insecticides, natural enemies, survival rates in cut trees, etc. Infested trees containing larvae and pupae can be cut and chipped. In North America, domestic phytosanitary measures have been imposed to restrict the movement of ash trees, firewood, branches and

logs from infested to non-infested areas (Haack *et al.*, 2002; Ohio Department of Agriculture, 2003).

Phytosanitary risk

Fraxinus spp. are widespread components of mixed deciduous forests in Europe as far as the Caucasus, throughout (*F. excelsior*), in the south (*F. angustifolia*) and in the centre and south-east (*F. ornus*). They are commonly grown for amenity purposes. The American species *F. pensylvanica* is planted for timber and shelter in central and south-eastern Europe. The introduction of *A. planipennis* into North America shows that there are pathways to disseminate this pest outside its area of origin, especially wood packaging. Significant tree mortality has been reported in North America. Control and detection of this type of wood-boring insect is difficult. In view of its area of origin and the area where it has been introduced, it seems highly probable that *A. planipennis* would be able to establish in most of Europe, where *Fraxinus* spp. are common. Though there is at present no information on the behaviour of this pest on European *Fraxinus* spp., it seems very probable that *A. planipennis* would be able to attack and damage them, having an impact on *Fraxinus* spp. in cities and amenity plantations and probably also in woodlands. Planted American species are also at risk.

A. planipennis is native in the Far-Eastern part of Russia, but *Fraxinus* spp. do not occur in Siberia, so there is a large physical barrier to spread within the EPPO region. Other *Fraxinus* spp. occur in Central Asia, and are perhaps also at risk.

Phytosanitary measures

A. planipennis is classed as a quarantine pest in Canada and

USA, and appears on the NAPPO Alert list. It was added in 2002 to the EPPO A2 action list, and EPPO member countries are thus recommended to regulate it as a quarantine pest. Suggested phytosanitary measures for commodities of *Fraxinus* include origin from a pest-free area, or heat treatment (for wood and bark).

References

- Browne FG (1968) *Pests and Diseases of Forest Plantation Trees*. Clarendon Press, Oxford (GB).
- Canadian Food Inspection Agency (2002) *Agrilus planipennis* Fairmaire, Emerald ash borer. Science Branch. <http://www.inspection.gc.ca/english/sci/surv/data/agrplae.shtml>
- Drooz AT (1985) Insects of Eastern Forests. *Miscellaneous Publication USDA Forest Service* no. 1426. USDA, Washington (US).
- Furniss RL & Carolin VM (1977) *Western Forest Insects*. *Miscellaneous Publication USDA Forest Service* no. 273. USDA, Washington (US).
- Haack RA, Jendek E, Houping Liu Marchant KR, Petrice TR, Poland TM & Hui Ye (2002) The emerald ash borer: a new exotic pest in North America. *Newsletter of the Michigan Entomological Society* **47**, 1–5.
- Jendek E (1994) Studies in the East Palaearctic species of the genus *Agrilus*. *Entomological Problems* **25**, 9–25.
- Mecteau M & Marchant K (2003) Emerald ash borer in Essex County, Ontario. *NAPPO Newsletter*, 4–5.
- NAPPO (2002) Pest Alert *Agrilus planipennis* Fairmaire 1888 – Exotic Emerald Ash Borer (EAB). *Agrilus planipennis* reported in Michigan, United States and Ontario, Canada. <http://www.pest.alert.org>
- Ohio Department of Agriculture (2003) Exotic pest confirmed in Ohio ash trees: State task force formed to determine course of action. *Office of Communications*, News Release dated February 28, 2003.
- Schwenke W (1974) *Die Forstschädlinge Europas. 2. Band. Käfer*. Verlag Paul Parey, Hamburg (DE).
- Yu C (1992) *Agrilus marcopoli* Obenberger. In: *Forest Insects of China*, 2nd edn, pp. 400–401. Forestry Publishing House, Beijing (CN).