EPPO DATA SHEETS ON QUARANTINE PESTS

Anoplophora glabripennis

IDENTITY

Name: *Anoplophora glabripennis* (Motschulsky)
Common names: Asian long-horn beetle (English)
Basicosta white-spotted longicorn beetle (English)
Starry sky beetle (English)
Taxonomic position: Insecta: Coleoptera: Cerambycidae
Notes on taxonomy and nomenclature: the taxonomy of this genus is in some confusion. *A. glabripennis* is part of the *glabripennis* complex, comprising *A. glabripennis*, *A. freyi*, *A. flavomaculata* and *A. coeruleoantennatus* (the latter being doubtful, taxonomically) (Wu & Jiang, 1998). Wu & Jiang (1998) considered the members of the *glabripennis* complex on a geographical basis within China, possibly pointing to different races of *A. glabripennis* in various parts of the country. For example, there is debate in China whether *A. glabripennis* from northern China and *A. glabripennis* from southern China are actually two separate species (Chen, 1989). There is also potential for *A. malasiaca* and *A. chinensis* (EPPO A1 list) to be confused with *A. glabripennis*.
Bayer computer code: ANOLGL
EPPO A1 list: no. 296
EU: subject to emergency measures under Commission Decision 1999/355.

HOSTS

The major hosts of *A. glabripennis* in China are species and hybrids of section Aegeiros of the genus *Populus*: *P. nigra*, *P. deltoides*, *P.* x *canadensis* and the Chinese hybrid *P. dakhuanensis*. Some poplars of the other sections of the genus (Alba and Tacamahaca) are also attacked, but are only slightly susceptible (Li & Wu, 1993). *Salix* spp. (*S. babylonica*, *S. matsudana*) are also major hosts. Various other woody plants have also been recorded as hosts in China: *Acer, Alnus*, *Malus*, *Morus*, *Platanus*, *Prunus*, *Pyrus*, *Robinia*, *Rosa*, *Sophora* and *Ulmus*. Within the urban outbreak areas in North America, *A. glabripennis* has mainly been found on *Acer* spp. (*A. negundo*, *A. platanoides*, *A. pseudoplatanus*, *A. rubrum*, *A. saccharinum* and *A. saccharum*) and on *Aesculus hippocastanum*. However, it has also been found on a range of other hardwood species: *Betula*, *Fraxinus*, *Liriodendron tulipifera*, *Morus alba*, *Populus*, *Robinia pseudacacia*, *Salix* and *Ulmus*. Although *A. glabripennis* has a sufficiently wide host range to be considered as polyphagous, it has not been recorded on many of the major important forest genera of the EPPO region (conifers, *Fagus*, *Quercus*). It should also be noted that the host range has two elements: the species on which larvae can develop to maturity and the species on which adults do their maturation feeding. As the outbreak areas in North America are recent, and subject to containment and eradication measures, it is not quite clear what is the natural host status of the various trees on which *A. glabripennis* has been recorded, as larvae or adults.

GEOGRAPHICAL DISTRIBUTION

A. glabripennis is indigenous to China. Its prevalence and range has increased as a result of widespread planting of susceptible poplar hybrids (see Economic impact). Yan (1985) provided a map showing the beetle to be most damaging in a zone of eastern China extending from Liaoning to Jiangsu and inland to Shanxi, Henan and Hubei. It was also present, but at lower levels, further west (to Neimenggu, Gansu, Sichuan and Yunnan) and further south (but not in the south-east). Li & Wu (1993) recorded the pest practically throughout the country [absent only from the Central Asian provinces in the west (Qinghai, Xinjiang and Xizang)]. This implies that the pest, in the interval between these publications, was found in Jilin and Heilongjiang in the north, and in Zhejiang, Fujian and Hainan in the south-east.

EPPO region: absent.
Asia: China (Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaonang, Neimenggu, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Yunnan, Zhejiang), Japan (possibly recorded in the past, but not now present), Korea Democratic People's Republic, Korea Republic, Taiwan.
EU: absent.
North America: USA (New York - New York city, discovered in 1996, although probably present for the previous three years; Illinois - Chicago, discovered in 1998-07 although probably present since at least 1993). Measures aimed at eradicating the pest are being implemented (Haack *et al*., 1997; USDA, 1996, 1998).
Distribution map: see CABI/EPPO (1999, no. 590).

BIOLOGY

In China, the number of annual generations varies with climate and latitude. The further north *A. glabripennis* is found, the longer it takes for a generation to develop. In Taiwan, there is one generation per year. In eastern China, a generation may take one or two years to develop, while in northern China (Neimenggu), a single generation takes two years to develop. Thus, there can be one or two overlapping generations per year, depending upon the climate and feeding conditions. Adults emerge between May and October and live for about a month. The most active period for adult activity is late June to early July (Li & Wu, 1993). The adults usually remain on the tree from which they emerged, or fly short distances to nearby trees, and feed there on leaves, petioles and young bark. Egg deposition begins a week after copulation. The eggs, about 32 per female (Wong & Mong, 1986), are laid one by one under the bark, in oviposition slits chewed out by the female. Slits are generally cut on the eastern side of the trunk or of branches greater than 5 cm in diameter (Li & Wu, 1993). Eggs hatch after about two weeks. The larva feeds in the cambial layer of bark in the branches and trunk and later enters the woody tissues. Pupation takes place in chambers in the heartwood, accompanied by presence of characteristic wood "shavings" that are packed into the chamber. Adults emerge from circular holes, 10 mm across, above the sites where the eggs were laid.

Unlike many cerambycid species, *A. glabripennis* can attack healthy trees as well as trees under stress. Several generations can develop within an individual tree, leading eventually to its death.

DETECTION AND IDENTIFICATION

Symptoms

Resin bleeds from oviposition holes and larval tunnels in the bark. Larval activity is recognized by the presence of galleries under the bark and, later, tunnels in the wood. Masses of wood shavings extruding from round exit holes are also signs that adults have emerged from infested wood. Piles of wood shavings also collect at the base of infested trees.

Morphology

Egg

About 5-7 mm, off-white, oblong. The ends of the eggs are slightly concave (Peng & Liu, 1992). Just before hatching eggs turn yellowish-brown.

Larva

The larva is a legless grub up to 50 mm long when fully grown. It is creamy white in colour, with a chitinized brown mark on the prothorax.

Adult

Typically cerambycid in shape, 25 mm (male) to 35 mm (female) long. Antennae 2.5 times body length in males; 1.3 times body length in females. The beetle is black with about 20 irregular white spots on the elytra. The antennae have 11 segments, each with a whitish blue base.

MEANS OF MOVEMENT AND DISPERSAL

Without transport of infested material by man, infestations spread slowly, e.g. rates of 300 m $year^{-1}$ in poplar groves in Beijing (CN) have been quoted by Their (USDA Forest Service, pers. comm., 1997). Alhough it is reported that adults can fly weakly 30-225 m in a single flight on a clear day (Wang, pers. comm., 1996), short-distance flight is typical of many cerambycids.

In international trade, *A. glabripennis* is most likely to move as eggs, larvae or pupae in packing material or dunnage made of the wood of host species. Individual larvae and adults have been intercepted in the UK, emerging from wooden packaging material (Malumphy, pers. comm.).

PEST SIGNIFICANCE

Economic impact

Over the last 30-40 years, there has been a policy in China to plant hybrid poplars in plantations, along roads, around farm buildings, etc. This started in Henan and Shandong provinces, but was eventually applied in most of the country. Initially, rather few hybrids were used, on a vast scale. Some of these hybrids were imported from other continents, while others were bred in China. Certain of them, but not all, proved to be very susceptible to *A. glabripennis* and suffered serious damage. *A. glabripennis* has proliferated on these susceptible hosts, becoming a common pest in many parts of China, also attacking a range of other hardwood hosts, especially *Salix* spp. These hosts appear to be mainly fruit, ornamental and amenity trees. Since the 1980s, hybrids resistant to the pest have been used for new plantations of poplar, and there has been a corresponding decline in the importance of *A. glabripennis*. There is no indication that *A. glabripennis* is a pest of natural forests in China.

Poplar wood damaged by *A. glabripennis* larvae can be downgraded and lose value by up to 46% (Gao *et al*., 1993). Severe damage is caused between 21^{o} and 43^{o} N and 100^{o} and 127^{o} E in China (Yan, 1985). The boring larvae damage the phloem and xylem vessels, resulting in heavy sap flow from wounds which are then liable to attack by secondary

pests and infection. Infested trees lose turgor pressure, and leaves become yellow and droop. Structural weakening by the larvae of trees in urban regions poses a danger to pedestrians and vehicles from falling branches. The adults can also cause damage by feeding on leaves, petioles and bark. Damage to the fruiting shoots of fruit trees results in particular economic loss.

In the USA, suppressing a 1996 infestation in New York State cost more than 4 million USD (USDA, 1998).

Control

In China, control measures include the direct application of insecticides (Chen *et al*., 1990; Liang *et al*., 1997), trap trees combined with insecticide treatments (Sun *et al*., 1990) or the use of insect-pathogenic nematodes (providing up to 94% mortality; Liu *et al*., 1992). As certain poplar hybrids are relatively resistant (Qin *et al*., 1996), the planting of such hybrids is now preferred, and the use of very susceptible hybrids is avoided.

In the USA, control measures aim to contain and eradicate the outbreaks in urban areas. However, the cryptic life style and tendency of the beetle to lay small numbers of eggs on several trees combine to make it difficult to define the limits of the outbreak and thus eradicate the beetle without destroying large numbers of trees. In most situations, wholesale felling of infested trees is unlikely to be a viable option, unless the infestation is very localised.

Phytosanitary risk

Attention was drawn to this pest by its introduction into the USA, where a major eradication programme is under way, and strong measures have been taken to reduce the risk of further introduction with wooden packing materials from China. As international trade from China to the EPPO region increases, there is a clear risk that *A. glabripennis* will enter the region by the same pathway. From its wide distribution in China, it may be supposed that *A. glabripennis* could establish in many European countries, particularly in the south. Hybrid poplars are widely planted in many countries, and it is probable that many of these hybrids would be susceptible to the pest. The North American experience with *A. glabripennis* in urban areas could also be repeated in and around European cities, whose trees are a valuable environmental resource. *A. glabripennis* thus presents a considerable risk to the EPPO region, and was added to the EPPO A1 list in 1999.

It should also be noted that there are currently few or no active measures to manage cerambycid beetles in broad-leaved trees in the EPPO region. This favours establishment and increases the risk of serious losses, at least until suitable management practices can be put in place.

Finally, many countries in other continents have become concerned about this pest and are establishing phytosanitary restrictions for wooden packing materials from infested countries. As wooden packing materials may accompany a great diversity of traded commodities, any such restrictions could have considerable economic consequences for exporting countries into which *A. glabripennis* was introduced, independently of the extent of spread or the amount of damage.

PHYTOSANITARY MEASURES

In the USA, strong measures have been taken for wooden packing material from China. This includes packing cases and dunnage. Such material must be accompanied by a phytosanitary certificate declaring that it has been treated with preservatives, heat-treated or fumigated before leaving China. Commercial shipments from China that do not contain any dunnage must include an exporter statement indicating that the shipment contains no such material. A similar approach, based on appropriate treatment of packing materials of hardwoods likely to carry *A. glabripennis*, could be adopted in the EPPO region.

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