

# ANOPLOPHORA IN EUROPE: INFESTATIONS AND MANAGEMENT RESPONSES

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## Abstract

### *Anoplophora glabripennis* (ALB)

At the end of 2004 four sites of infestation by ALB have been detected in three countries of Europe: Austria in 2001, at Braunau am Inn (Upper Austria); France in 2003, at Gien (Loiret), and in 2004 at Sainte-Anne-sur-Brivet (Loire Atlantique); and Germany in 2004, at Neukirchen am Inn (Bavaria). So far, all infestations are located in urban environments.

### Circumstances of the ALB discoveries

At Braunau (Austria), symptoms of unidentified attacks were first observed in November 2000 by employees of the municipal gardening office on trees near a site where wood packing material, which was used for the importation of stones and cast-iron from China, was stored. In July 2001, ALB adults were collected on the damaged trees. The Austrian Federal Office and Research Centre for Forests in Vienna identified the insects, started monitoring the pest at Braunau, and sent alerts in Austria to the regional plant protection services. As Braunau is right next to the Austrian-German border, alerts were also sent in Germany to the Bavarian plant protection service.

At Neukirchen (Germany), symptoms of decline were observed on branches of maple trees around a cemetery opposite a building belonging to a company storing granite stones imported from China. Since 2001 in this area, all companies importing goods from Eastern Asia were alerted to the risks of introduction of exotic pests. The Bavarian plant protection service sampled larvae from the damaged trees and passed them to the Austrian Federal Office and Research Centre for Forests in Vienna for DNA analyzes. Results showed that the

larval specimens could be assigned to the species *A. glabripennis*. The Bavarian plant protection service started monitoring the pest in Neukirchen.

In 2002, at Gien (France), during a barbecue party that took place at the end of the school year, three longhorned beetles were disturbed by smoke and fell down on a table placed under the crown of a maple tree. The unknown specimens were placed by a student in a container for later identification. As the specimens did not belong to a species from the French fauna, in March 2003, they were passed to an entomologist in the Museum of Natural History in Dijon. The person, realizing that the insect may belong to a dangerous exotic pest, passed the specimens to the National Laboratory of the French plant protection service (LNPV) in Montpellier where they were identified as ALB. In April 2003, the regional plant protection service in Orléans was alerted, and a monitoring of the pest was begun at Gien. Larvae were sampled and submitted for DNA analyzes to EBCL, Montpellier. The ongoing infestation by ALB in several trees in Gien was confirmed.

At Sainte-Anne-sur-Brivet (France), in July 2004, an adult beetle was collected on a willow in a private yard near a square recently paved with granite stones imported from China. The person brought the beetle to the city hall which then sent it on July 15, 2004, to the LNPV in Montpellier where it was identified as ALB. In early August 2004 the alerted regional plant protection service in Nantes started monitoring the pest on susceptible trees in, and around the village. Oaks were also monitored because an ALB adult was observed roaming about on an oak adjacent to ALB-infested maples; moreover, a few big

**Table 1.—Results of monitoring of the *Anoplophora* spp. infestations in Europe**

| Pest | Site                                 | 2001    | 2002   | 2003   | 2004     | TOTAL    |
|------|--------------------------------------|---------|--------|--------|----------|----------|
| ALB  | Braunau Am Inn<br>(Austria)          | 38 (89) | 22 (0) | 8 (25) | 27 (4)   | 95 (118) |
| ALB  | Neukirchen Am Inn<br>(Germany)       |         |        |        | 16 (13)  | 16 (13)  |
|      | Gien<br>(France)                     |         |        | 30 (0) | 12 (12)  | 42 (12)  |
| ALB  | Sainte-Anne<br>-Sur -Brivet (France) |         |        |        | 55 (?)   | 55 (?)   |
| CLB  | Soyons<br>(France)                   |         |        | 2 (3)  | 0 (0)    | 2 (3)    |
| CLB  | Parabiago<br>(Italy)                 | ? (?)   | 18 (?) | 27 (?) | 741* (?) | 786 (?)  |

Values are numbers of *Anoplophora* spp.-infested trees (values in parentheses are numbers of adult beetles collected).

\*Out of 741 infested trees, only 30 trees were fully destroyed at Parabiago.

exit holes of an unknown (at that time) insect were seen on some *Quercus pedunculata* and *Quercus americana* near the ALB-infested maples.

#### **History of the ALB discoveries and management responses**

In 2002, the commission of the European communities issued the directive 2002/36/EC notifying the member states of the necessity to take measures to protect the community against *A. glabripennis*.

In the 4 ALB-infested sites, given the number of pest damages and exit holes on some particular trees, it is thought that the initial infestation occurred at least 5 years before the pest discovery. In Austria and Germany, a decree on the ALB control was issued immediately after the pest discovery, and eradication started without delay. At Gien, because of the particular circumstances of the pest discovery, a year elapsed before a decree on its control was issued and eradication started. At Sainte-Anne-sur-Brivet, 2 months elapsed before eradication started, but in the meantime the infested trees were sprayed twice with a contact insecticide (bifenthrin) to kill the ALB adults emerging during summer 2004. In the 4 sites, ALB was introduced as larvae and/or pupae in tunnels in fresh untreated wood packing material imported from China. In the four sites, special efforts were made to increase public awareness. In France,

information about the ALB problem was also spread through the association of the mayors of France. In the four sites, the monitoring of the ALB infestations was made by visual examination of susceptible trees, using binoculars, ladders, bucket trucks, and tree climbers. Depending on the site, 2 to 10 people working 1 to 3 days a week were involved in the monitoring. In each site, a 1-km radius around each infested tree was examined. A 1 or 2 km- width buffer zone was delimited around each infested area. Near Braunau, the buffer zone was extended to the whole political district. In Austria, France and Germany, the monitoring concerned the public area, and the private yards as well. It was extended outside the infested areas, around some importers of goods from eastern Asia, and in Austria, around some importers of goods from the USA. The infested areas were quarantined by banning any movement of living susceptible plants, or firewood. In each of the four infested sites several local partners were involved in the monitoring and in the eradication of the pest. Funding to cover the cost of monitoring and eradication was primarily supplied by the regional administrations.

#### **Fate of the ALB infestations in Europe**

The results of the monitoring in the four ALB-infested sites are shown in Table 1. Each year, in all sites, fairly low numbers of infested trees were found. In Braunau

**Table 2—Host plants of *Anoplophora glabripennis* in Europe, at the end of 2004**

| Species       |                                                | Braunau Am Inn<br>(Austria) | Neukirchen Am Inn<br>(Germany) | Gien<br>(France) | Sainte-Anne-<br>Sur-Brivet<br>(France) |
|---------------|------------------------------------------------|-----------------------------|--------------------------------|------------------|----------------------------------------|
| Maple trees   | <i>Acer</i> spp.                               |                             | ✓ (5)                          | ✓ (31)           | ✓ (23)                                 |
| Boxelder      | <i>Acer negundo</i>                            |                             |                                | ✓                | ✓                                      |
| Silver maple  | <i>Acer saccharinum</i>                        | ✓                           |                                | ✓                | ✓                                      |
| Norway maple  | <i>Acer platanoides</i>                        | ✓                           |                                | ✓                | ✓                                      |
| Sycamore      | <i>Acer pseudoplatanus</i>                     | ✓                           |                                |                  |                                        |
| Plane tree    | <i>Platanus</i> sp.                            | ✓                           |                                |                  |                                        |
| Beech         | <i>Fagus sylvatica</i> “ <i>atropunicea</i> ”  | ✓                           |                                |                  |                                        |
| Beech         | <i>Fagus sylvatica</i> “ <i>asplenifolia</i> ” | ✓                           |                                |                  |                                        |
| Birch         | <i>Betula</i> sp.                              | ✓                           | ✓ (2)                          | ✓ (8)            | ✓ (23)                                 |
| Horse chesnut | <i>Aesculus hippocastanum</i>                  | ✓                           | ✓ (4)                          | ✓ (1)            | ✓ (3)                                  |
| Poplar        | <i>Populus</i> sp.                             |                             | ✓ (1)                          |                  | ✓ (1)                                  |
| Willow        | <i>Salix</i> sp.                               |                             | ✓ (4)                          | ✓ (2)            | ✓ (4)                                  |
| Plum tree     | <i>Prunus</i> sp.                              |                             |                                |                  | ✓ (1)                                  |
| Total         |                                                | 95                          | 16                             | 42               | 55                                     |

Values are numbers of infested trees in each species

where the first infestation was discovered 4 years ago, the number of infested trees newly detected during 2004 was not much lower than in 2001; however, no ALB infested tree was found outside the city. The infested trees were distributed at Braunau in a 0.5 km radius, at Neukirchen in a 0.2 km radius, at Gien in a 0.5 km radius, and at Sainte-Anne-sur-Brivet in a 0.2 km radius. In the four sites all the infested trees were cut, the stumps were uprooted, and all plant material was incinerated. At Braunau and at Neukirchen, the infested plant material was first chipped then burnt. The host plants of ALB in Europe at the end of 2004 are listed in Table 2. Maple trees were the preferred host plants in most sites. At Sainte-Anne-sur-Brivet, birches were also much affected. In this site, 17 *Quercus rubra* and five *Quercus robur*, which were located near ALB-infested maples bore exit holes of an unknown wood borer and were also destroyed. Dissection of infested logs of the oaks showed that *Cerambyx cerdo*, the Great capricorn beetle, native to Europe, was one of the pests present in the oaks. DNA analyzes of samples of cerambycid larvae from the oaks by M.-C. Bon, EBCL, Montpellier, showed two different non-ALB profiles.

### ***Anoplophora chinensis* (CLB)**

*A. chinensis* females lay most of their eggs around the collar of trees. The larvae develop downwards and many

of them tunnel their way in roots. Ninety percent of the CLB population is below ground level. The range of host plants seems even wider in CLB than in ALB. At the end of 2004, two sites of infestation by CLB have been detected in two countries of Europe: Italy in 2000, at Parabiago, and France in 2003, at Soyons.

### **Circumstances of the CLB discoveries**

At Soyons (France), in 2002, an adult beetle emerged from a bonsai, at the client's residence. On June 18, 2003, the dead insect was sent to the LNPV, Montpellier, where it was identified as CLB. On June 18, 2003, the source nursery was visited and five free CLB adults and 11 fresh exit holes were found on two big Norwegian maple trees adjacent to the nursery building. The LNPV confirmed that the collected specimens were all CLBs. At Soyons, the Rhône-Alpes plant protection service started monitoring the pest on susceptible trees around the nursery of bonsais.

At Parabiago (Italy), in 2000, the first discovery of CLB occurred during a survey program carried out by the Institute of Entomology, Agricultural University of Milan (IE-AUM), with financial support of the Lombardy Plant Protection Service (LPPS). The purpose of the monitoring was to check possible new introductions of exotic pests in nurseries and greenhouses near Milan. The

first adult of CLB was collected by a technician in one of the nurseries. CLB was introduced as eggs, larvae and/or pupae in living host plants (bonsais) imported from the Far East. The insect was identified on June 8, 2000, by the IE-AUM, in collaboration with the Museum of Natural History of Milan. Another specimen of the same species was found again among dried insects in a collection box that was made in 1997 at Parabiago. The CLB discovery was reported by Colombo & Limonta (2001). In 2002, a first monitoring program was implemented by the IE-AUM, with the collaboration of the Minoprio Foundation, and financial support from the LPPS.

### **History of the CLB discoveries and management responses**

Because of the repeated interceptions of exotic pests including *Anoplophora* sp. at ports of entry, in 2000, the commission of the European communities issued the directive 2000/29/EC notifying the member states of a list of harmful organisms, including *A. chinensis*, whose introduction into and spread within all member states are banned.

At Soyons, it is thought that the initial CLB infestation occurred at least 5 years before the pest discovery. CLB was introduced as eggs, larvae and/or pupae in living host plants (bonsais) imported from the Far East. Because of the late identification of the first CLB adult found, 1 year elapsed before a decree on CLB control was issued and eradication started. The monitoring was made by visual examination of the base of the susceptible trees. Two people working 1 day a week were involved in the monitoring. A 1-km radius around the infested trees was examined and a 1 km- width buffer zone was delimited around the infested area. The monitoring concerned the public area, and the private yards as well. The infested area was quarantined as for any movement of living susceptible plants, or firewood.

At Parabiago, a collection box of dried insects, made around 1982, and containing CLB specimens was found again recently, which could mean that the very first CLB introduction may have occurred in Italy, about 20 years ago, and not 5 years before Colombo & Limonta's

report (2001). Since this report, 4 years elapsed before a decree on CLB control was issued and eradication started. The decree, published in Bollettino Ufficiale della Regione Lombardia, Serie Ordinaria N. 6 - 2 Febbraio 2004; D.d.g. 26 Gennaio 2004 n°. 731, stipulates that 3 control measures may be used:

1. The CLB infested trees must be cut and the plant parts (including the stump with the roots) removed and destroyed
2. If stump uprooting is difficult, the stump must be killed with herbicides, and covered with wire mesh screen on an area matching the projection on soil of the tree crown
3. On big valuable trees, the LPPS may decide that the trees won't be destroyed if the infestation is low. In this case, a sleeve cage of wire mesh screen is placed around the base of the trunks, and a sheet of wire mesh screen on ground, as well. The wire mesh screens are supposed to contain the CLB populations.

During 2004, special efforts of information were made to increase public awareness. The monitoring was made by visual examination of the base of the susceptible trees. Four to eight people working 1 day a week were involved in the monitoring. A 1-km radius around the infested trees was examined and a 1 km- width buffer zone was delimited around the infested area. At Parabiago, so far, the monitoring concerned the public area, and a very small number of private yards, on request from the owners, only. Outside the CLB-infested area, nurseries importing bonsais are surveyed twice a year. The infested area was quarantined banning any movement of living susceptible plants, or firewood. In both CLB-infested sites several local partners were involved in the monitoring and in the eradication of the pest. Funding to cover the cost of monitoring and eradication was primarily supplied by the regional administrations.

### **Fate of the CLB infestations in Europe**

The results of the monitoring in both CLB-infested sites are shown in Table 1. At Soyons, 2 infested trees only were detected. They were cut, the stumps were uprooted, and all the plant parts were incinerated. At

**Table 3—Host plants of *Anoplophora chinensis* in Europe, at the end of 2004**

| Species              |                               | Soyons<br>(France) | Parabiago<br>(Italy) |
|----------------------|-------------------------------|--------------------|----------------------|
| Maple                | <i>Acer sp.</i>               |                    | ✓                    |
| Boxelder             | <i>Acer negundo</i>           |                    | ✓                    |
| Silver maple         | <i>Acer saccharinum</i>       |                    | ✓                    |
| Norway maple         | <i>Acer platanoides</i>       | ✓                  | ✓                    |
| Sycamore             | <i>Acer pseudoplatanus</i>    |                    | ✓                    |
| European hornbeam    | <i>Carpinus betulus</i>       |                    | ✓                    |
| Hazel                | <i>Corylus sp.</i>            |                    | ✓                    |
| Plane tree           | <i>Platanus sp.</i>           |                    | ✓                    |
| Beech                | <i>Fagus sylvatica</i>        |                    | ✓                    |
| Crape myrtle         | <i>Lagerstroemia sp.</i>      |                    | ✓                    |
| Apple tree           | <i>Malus sp.</i>              |                    | ✓                    |
| Birch tree           | <i>Betula sp.</i>             |                    | ✓                    |
| Birch tree           | <i>Betula alba</i>            |                    | ✓                    |
| Silver birch         | <i>Betula pendula</i>         |                    | ✓                    |
| Horse chesnut        | <i>Aesculus hippocastanum</i> |                    | ✓                    |
| Poplar               | <i>Populus sp.</i>            |                    | ✓                    |
| Lombardy poplar      | <i>Populus nigra</i>          |                    | ✓                    |
| Cherry laurel        | <i>Prunus laurocerasus</i>    |                    | ✓                    |
| Rose                 | <i>Rosa</i>                   |                    | ✓                    |
| Elm                  | <i>Ulmus sp.</i>              |                    | ✓                    |
| European cotoneaster | <i>Cotoneaster sp.</i>        |                    | ✓                    |
| Common oak           | <i>Quercus robur</i>          |                    | ✓                    |
| Hawthorn             | <i>Crataegus</i>              |                    | ✓                    |
| Total                |                               | 2                  | 786                  |

Parabiago, more CLB-infested trees were found each year at an increasing distance from the nursery of bonsais where the infestation started. In 2003, not only big trees but even shrubs like the Cherry laurels, *Prunus laurocerasus*, which are widely used to make hedges around private yards were attacked by CLB. During 2004, the CLB population exploded. Even old roses in flower beds separating roadways of some large streets were found attacked by CLB. During the summer 2004, an intensified monitoring by the LPPS allowed to detect 741 infested trees spread in 13 municipalities. The infested area covers 57 km<sup>2</sup> inside a 15 km radius. All infested sites are included in a polygon delimited by the four cities Gallarate, Inveruno, Pogliano Milanese, and Saronno. At the present time, out of the 741 infested trees detected, only 30 trees were fully destroyed, 348 trees were cut and the stump treated with herbicides and covered with wire mesh screen, and 363 trees were not cut, but their base of trunk was wrapped in a sleeve cage of wire mesh screen, according to the directions of the

LPPS. The host plants of CLB in Europe at the end of 2004 are listed in Table 3.

### Recent Interceptions

In 2004, at Mönchengladbach (Germany) one ALB adult was intercepted on *Acer palmatum* in a private yard. Despite of a very intensive monitoring, no infested tree and no other ALB adult was found. No possible source of infestation was identified. In 2004, at Gdynia (Poland) one free adult of ALB (or CLB - unclear, yet) was found at a florist's shop on *Acer palmatum*. This would be the first report of ALB from a bonsai, outside its native area.

### Discussion

In all sites except at Parabiago, the infestations seem to have been detected before the numbers of infested trees is high, and before the pests leave the urban habitats. Proper monitoring and eradication measures were applied, and the *Anoplophora* are in course of eradication in most sites. In contrast, the presence of CLB in Italy may be

irreversible, already. The monitoring efforts should take into account the private properties, systematically; so far, only the voluntary requests from private owners were considered. Even though the eradication of CLB seems difficult, a much more aggressive campaign of destruction of the infested trees should be conducted very quickly to limit the spread of the pest.

## References

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