

## 短報 (Note)

### Note on the dieback of *Cornus florida* caused by *Xylosandrus compactus*

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#### Abstract

The dieback of *Cornus florida* caused by *Xylosandrus compactus* was observed in Tsukuba, Ibaraki, Japan. Trees were heavily attacked by this beetle between June and August. This beetle also attacked 22 tree species belonging to 11 genera in this area. Several fungi were isolated from the body surface of the insect, whereas *Ambrosiella xylebori* was more frequently detected from the mycangia. The damage to the host was mainly due to mechanical boring by the insects; however, fungal invasion to phloem and xylem also caused damage. Based on the fact that *X. compactus* is distributed mainly in tropical and subtropical regions and has a wide host range, I predicted that in the future, this beetle has a high potential for outbreak in Japan when global warming has progressed.

**Key words :** *Xylosandrus compactus*, *Ambrosiella xylebori*, *Cornus florida*, dieback, ambrosia beetle, ambrosia fungi.

#### Introduction

*Xylosandrus compactus* (Eichhoff) is one of the economically important ambrosia beetles and distributed in West Africa, Hawaii, South-East Asia, and Japan (Bright 1968; Ngoan et al. 1976; Wood and Bright 1992). This beetle invaded the United States and Cuba in the mid-1900s and rapidly has spread there. It attacks the twigs of healthy coffee, tea and fruit trees, and causes their dieback leading to extensive economic loss (e. g. Ngoan et al. 1976). More than 224 plant species, including tree species commonly distributed or planted in Japan, are reported to be its hosts (Ngoan et al. 1976; Wood and Bright 1992). In Japan, this beetle has caused the dieback of the twigs of tea trees. Thus, its biology, including its symbiotic fungus, has been examined (Kaneko et al., 1965; Takagi and Kaneko, 1965; Kaneko, 1965). However there are few reports of damage from other trees and areas in Japan. Further, critical isolation of the fungi from this beetle have never been conducted.

In 2003–2004, the dieback of *Cornus florida* L. was widely observed in Tsukuba, Ibaraki, Japan. Examination of the dead twigs revealed that they were infested with *X. compactus*. *Cornus florida* was extensively attacked by this beetles and in part declined. Several kind of trees also are attacked by this beetle. In this note, I report the damage caused by this insect to *C. florida* and other trees in the defined region. In addition, I provide the list of species of its associated fungi. This case study is useful for management of this beetle in the area. I also discuss the potential risk of this beetle spreading in Japan.

#### Materials and Methods

The study area was at the premises of Forestry & Forest Products Research Institute, located in Tsukuba, Ibaraki, Japan. The investigation was conducted in every two weeks between June and September in each 2004 and 2005. I confirmed the dieback of twigs of all trees planted in the area and checked the species name of those trees that were the breeding habitat of *X. compactus*. With respect to *C. florida*, 10 trees (DBH (average  $\pm$  SD)=15.2  $\pm$ 3.04 cm) were selected and the number of beetle attacks per tree was observed. Fifty twigs attacked by *X. compactus* were randomly collected in 28 June 2004 and brought to the laboratory, sterilized by 70%EtOH, and dissected longitudinally by using flame-sterilized scalpel. Cross-sections of dissected twigs were observed with binocular. Preoviposition adult beetles in the twigs were collected and used for the isolation of the fungi; a total of 30 beetles were used for this purpose. The beetles were allowed to crawl on 1% malt extract agar (MA) for half a day; subsequently, they were rinsed with 70% EtOH at 30 s and sodium chlorite (1% available chlorite) at 1 min and rinsed with distilled water at 1 min. The mycangia of the rinsed beetles were exposed using flame-sterilized tweezers and tungsten needles, and the fungal mass in their mycangia was transferred to plates containing 1% MA. These plates were incubated at 20°C in the dark. After two weeks, the mycelia grown on the plate were transferred to plates containing 2% MA. The pure cultures obtained were examined using a light microscope and identified.

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### Results and Discussion

The dieback of *C. florida* caused by *X. compactus* was observed between June and August in two years. The attacked twigs were died within 14 days and could be clearly distinguished from the healthy twigs (Figs. 4 and 5). On an average, 84 twigs per tree were dead. The entrance tunnels of *X. compactus* were observed on the downward side of living twigs up to 5 mm diameter (Fig. 2). An adult beetle (Fig. 1) existed in each tunnel in June and eclosed adults were observed in the breeding galley from July to August (Fig. 3).

In this study, I found that the dieback caused by *X. compactus* was not restricted to *C. florida*. A total of 22 tree species belonging to 11 genera were attacked by *X. compactus* in the study area (Table 1); these were trees popularly used for af-

forestation in Japan. This beetle is already known to be able to attack many trees including *C. florida* (Ngoan et al. 1976; Wood and Bright 1992), and I confirmed this nature in this study. This may mean that *X. compactus* has the potential to spread easily in other areas in Japan where these host trees are planted.

Several species of fungi were isolated from adult beetles (Table 2). Among them, *Fusarium* spp. were frequently isolated from the body surface without sterilization. On the other hand, *Ambrosiella xylebori* Brader ex v. Arx & Hennebert was more frequently isolated from the mycangia of breeding *X. compactus* adults (Fig. 7). Thus, this fungus appeared to function as an ambrosia fungus. *Ambrosiella xylebori* is known to be associated with *X. compactus* and *Corthylus columbianus* (Batra, 1967). Also, in Japan, Kaneko and Takagi (1966) reported the associated fungus to be *A. xylebori*; however, its identity was uncer-

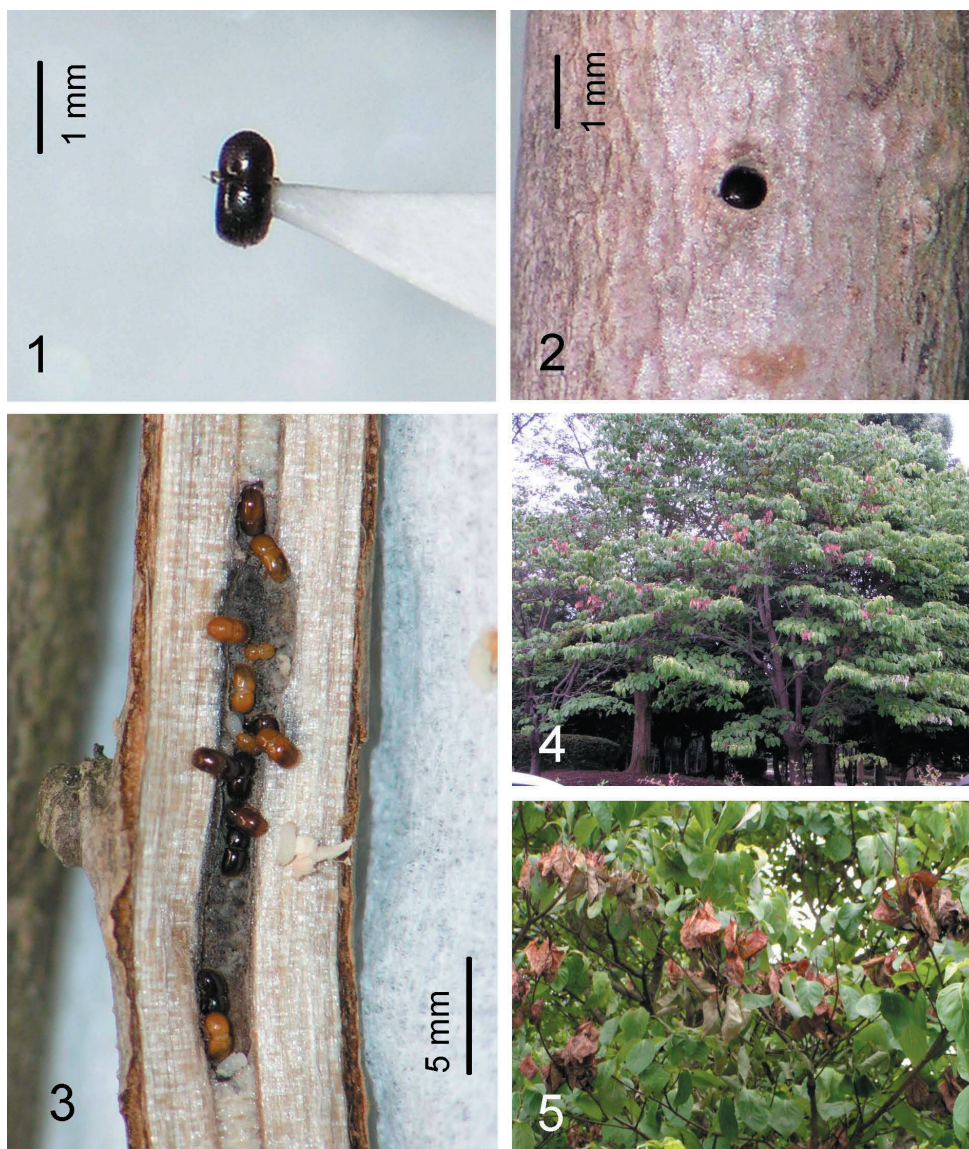


Fig. 1. Female *Xylosandrus compactus*, Fig. 2. Opening of Entrance tunnel of *X. compactus*, Fig. 3. Breeding habitat of *X. compactus*, Fig. 4. Dieback of *Cornus florida* caused by *X. compactus*, Fig. 5. Dieback of *C. florida* caused by *X. compactus* (magnified).

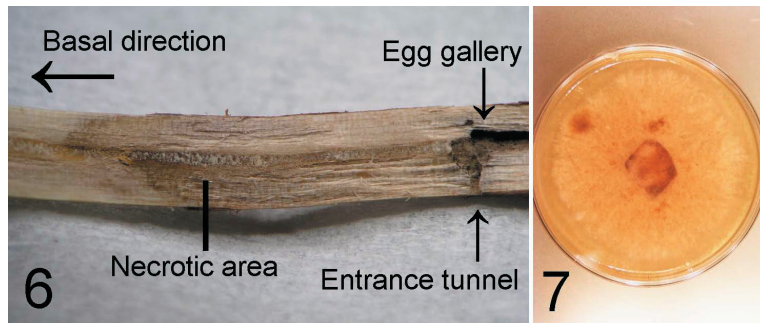


Fig. 6. Longitudinal section of a twig attacked by *X. compactus*, and Fig. 7. Colony appearance of *Ambrosiella xylebori*.

tain because of the lack of a detailed description. Thus more detailed studies of the Japanese *A. xylebori*, including molecular analysis, is required; however I have used this name tentatively in this study.

Ngoan et al. (1976) reported that the ambrosia fungus of *X. compactus* was not *A. xylebori* but *Fusarium solani* (Mart.) Sacc. This discrepancy may be explained by followings: 1) misidentification of the fungus, 2) the contamination of *Fusarium*

to the mycangia, or 3) the difference of beetle population. *Fusarium solani* is morphologically quite different from *A. xylebori*, and it is unlikely to misidentify each other. *Fusarium* species were often detected from the surface of the beetle in this study and may contaminate to mycangia easily. However it did not dominate in mycangia and seems not to be a mycangial fungus. To prove the third hypothesis, more detailed isolation studies from different localities are required.

Table 1. Tree species attacked by *Xylosandrus compactus* in arboretums of Forestry and Forest Products Research Institute.

Species name	Origin
<i>Magnolia heptapeta</i> Dandy	China
<i>Magnolia quinquepeta</i> Dandy	China
<i>Viburnum awabuki</i> K.Koch.	Japan
<i>Cornus florida</i> L.	North America
<i>Cornus kousa</i> Hance	Japan
<i>Cercidiphyllum japonica</i> Sieb. & Zucc.	Japan
<i>Acer buergerianum</i> Miquel.	China
<i>Acer pictum</i> Thunb. ex Murray	Japan
<i>Acer saccharinum</i> L.	North America
<i>Acer cissifolium</i> (Sieb. & Zucc.) K. Koch.	Japan
<i>Acer amoenum</i> Carr.	Japan
<i>Acer distylum</i> Sieb. & Zucc.	Japan
<i>Acer maximowiczianum</i> Maxim.	Japan
<i>Fagus sylvatica</i> L.	Europe
<i>Fagus crenata</i> Bl. var. <i>multinervis</i> Nakai	Korea
<i>Platanus orientalis</i> L.	North America
<i>Platanus occidentalis</i> L.	North America
<i>Platanus acerifolia</i> (Aiton) Willd.	North America
<i>Prunus laurocerasus</i> L.	Europe to West Asia
<i>Eucommia ulmoides</i> D. Oliver	China
<i>Salix</i> × <i>ericoataphylla</i> Kimura	Japan
<i>Nyssa sylvatica</i> Marsh.	North America

The dieback of twigs appeared to result from the mechanical damage of vessels caused by boring. However, I found that necrosis in the bark and the desiccated zone in the xylem, which extended from the leading edge of galleries toward the basal part of the twigs up to 5 cm in length (Fig. 6). This suggests the invasion of associated fungi in the twig tissue. *Xylosandrus compactus* sometimes attacks twigs 20 mm in diameter and can kill small trees. This may be in part due to the contribution of the associated fungi. *Ceratocystis*, a fungal group related to *Ambrosiella*, and several *Fusarium* species are well known to be pathogenic to plants (Nelson et al., 1981; Wingfield et al., 1993). Additionally, Takahashi et al. (2003) found that *X. compactus* is a vector of *Fusicoccum aesculi* Corda, which is the cause of a well-known plant disease; however, I could not isolate it. Pathogenicity tests of these associated fungi should be conducted.

*Xylosandrus compactus* is mainly distributed in the subtropical region and adapted to a warm environment (Kaneko et al. 1965; Ngoan et al. 1976). This means that global warming can be an important factor leading to the outbreak of this beetle. A recent report hypothesized that global warming is one of the important factors for the outbreak of an ambrosia beetle, *Platypus quercivorus*, which causes mass mortality of the Japanese

Table 2. Frequencies of occurrences (%) of the fungi isolated from *Xylosandrus compactus*.

From body surface		From mycangia	
species	Frequencies (n=30)	species	Frequencies (n=30)
<i>Fusarium</i> sp.1	53	<i>Ambrosiella xylebori</i>	100
<i>Fusarium</i> sp.2	10	<i>Fusarium</i> sp.1	10
<i>Cladosporium</i> spp.	23	<i>Candida</i> sp.	23
<i>Penicillium</i> sp.	10		



oak along the Sea of Japan proper (Kamata et al. 2002). We also need to consider the potential that global warming may induce the spreading tree damage caused by *X. compactus*.

I believe that the incidence of dieback observed in this study would be found in other areas in Japan. Indeed, the dieback of *C. florida* caused by *X. compactus* has been confirmed in Kumamoto, Kyushu, southern Japan (N. Sahashi, personal communication). We need to assess the damage caused by this beetle all over Japan and to take precaution against the spreading of this damage in the future.

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## シイノコキクイムシ (*Xylosandrus compactus*) による ハナミズキの枝枯れについて

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### 要旨

シイノコキクイムシによるハナミズキの枝枯れが茨城県において発生している。時に激しく加害され、いくつかは衰退しているが、加えて11属22種の樹木も加害していることが明らかになった。虫の体表からはいくつかの菌が分離されたが、マイカンギアからは *Ambrosiella xylebori* が高頻度に分離された。宿主の被害は主に機械的損傷によるものと考えられたが、師部や辺材部への菌の侵入も確認された。シイノコキクイムシの分布が主に熱帯や亜熱帯であることや宿主範囲が広いことから、今後温暖化が進むと、大発生する可能性がある。

キーワード：シイノコキクイムシ、*Ambrosiella xylebori*、ハナミズキ、枝枯れ、養菌性キクイムシ、アンブロシア菌

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