別　紙

# 論 文 の 内 容 の 要 旨

生圏システム学　専　攻
平成２０年度博士課程　入学
氏　　名　サングァンスップ　スニサ
指導教員名　　鎌田直人

論文題目　　Ambrosia beetle guild attacking a deciduous oak tree *Quercus serrata* in the Central Japan and species risk assessment in relation to potential invasiveness and aggressiveness based on niche analysis
（中部日本においてコナラに寄生するアンブロシアキクイムシのギルド構造およびニッチ解析による侵入生物と攻撃性のリスクアセスメント）

For decades, secondary ambrosia beetle species have been increasingly observed to attack apparently healthy trees. Some of them cause mortality to living trees. In Japan, *Platypus quercivorus* that is widely distributed in Asia has caused mass mortality of trees belonging to the family Fagaceae by vectoring *Raffaelea quercivora*. Similar disease has been in epidemic in Korea by attacks of *Platypus koryoensis*. On the other hand, unexpected introduction of ambrosia beetles to non-indigenous area has been increasing because of globalization. Some has become major components of ambrosia beetle fauna in the non-indigenous area. The worst example among invasive ambrosia beetles is *Xyleborus glabratus* that causes laurel wilt in US by vectoring *Raffaelea lauricola*. The laurel wilt has caused enormous economic damage to avocado farmers in US. Therefore, ecological information on ambrosia beetles is needed from a view point of biodiversity conservation as well as economic importance. The purpose of this study was to determine ambrosia beetle guild, factors influencing the guild, and niche of each species attacking on an oak tree *Quercus serrata*. Risks of invasion and of vectoring tree-killing disease

were evaluated for each species.

The study was conducted in three locations of the University of Tokyo Forests in the Central Japan. Timing of cutting trees (= TC) was controlled by preparing bolts monthly from March to September in Chichibu. They were covered by metal mesh to protect from insect attacks and left on the forest floor in the three locations: Aichi (LOC-A), Chiba (LOC-B), and Chichibu (LOC-C) (= LOC). The LOC-A had Japanese oak wilt (JOW). However, the LOC-B and the LOC-C had no historical records of JOW. Timing of exposure (= TE) was controlled by removing the metal mesh so that wood oldness (= WO) at the timing of exposure after cutting tree was also experimentally controlled. Bait bolts were exposed to insect attacks for one month in a normal experiment, while they were left until the end of September in a conditioning experiment. Twenty eight regimes, each consisted of four bolts, were set in each of a normal and a conditioning experiment so that the total number of bolts on each location was 224. Ambrosia beetles were collected by dissecting the bolts after the exposure and identified into species. The number of entry holes was used as an indicator for abundance of each species.

In the normal experiment, twenty morphospecies of Scolytinae and six species of Platipodinae were collected. In the conditioning experiment, six Scolytid and two Platypodid species disappeared, whereas one Scolytid species recruited so that fifteen species of Scolytinae and four species of Platypodinae were collected. In total, twenty one morphospecies of Scolytinae and six species of Platipodinae were collected.

Species richness and abundance peaked on bolts prepared in April–May, on bolts exposed in July, and on 2–3-month-old bolts. Eliminating greatest influences of LOC on abundance, results of hierarchical partitioning showed that TC had a strong influence on both species richness and abundance. LOC-A (Aichi), in which Japanese oak wilt disease (JOW) incidence occurred, showed the greatest species richness and the smallest value of Pielou's evenness. Abundance of the most abundant ("the major") species was more than twice that of the second major species, which was a likely cause of the smallest evenness in LOC-A. Trees killed by JOW may have increased the abundance of the major species. On the contrary, in LOC-C (Chichibu), Pielou's evenness and alpha and gamma diversity and the Shannon index were greatest among the three locations although species richness was smallest. High similarity between guilds in LOC-A and LOC-B (Chiba) was probably caused by similarity in vegetation. The LOC had the greatest effect on determining guild structure. Effect of TE was greater than TC. The effect of WO was

negligible. A hierarchical structure among the three factors was a likely cause of their relative importance determining guild structure.

Niche center and niche breadth were estimated for the three niche contexts. Relative competitive ability (RCA) was calculated by subtracting log-transformed abundance after adding 1 in normal experiment from that in the conditioning experiment. The relationship between the RCA and niche center of WO was determined to test the hypothesis that there are trade-offs between these values. No significant relationship between the two values was found for all species. However, significant positive relationship was obtained if thirteen minor species we excluded indicating that poor competitors with negative RCA value tended to attack fresh wood to avoid competition. Species that have been reported as an alien species tended to have broader niche. All Scolytid species collected in my study have a habit of haplodyploidy and sibling mating so that Scolytid have a higher risk of invasion than Platypodid. Platypodid species tended to attack fresh bolts compared to Scolytid so that Platypodid have higher risk to vector tree-killing disease than Scolytinae. Among Platypodinae, *Crossotarsus niponicus* and *Platypus calamus* significantly increased in the conditioning experiment and had great value of the RCA so that these are good competitors and relatively high risk species of invasion. However, they did not show strong preference to fresh bolts compared to other Platypodid species. *Xylosandrus germanus* and *Xylosandrus crassiusculus*, which attack living trees in non-indigenous area, also did not show a strong preference to fresh bolts so that there are no guarantees that *C. niponicus* and *P. calamus* are safe enough in non-indigenous area. Positive RCA values of *X. germanus* and of *X. crassiusculus* supported that they became invasive alien species. *Euwallacea validus* significantly decreased in the conditioning experiment compared to the normal so that this species seemed a poor competitor, whereas this species tended to attack fresh bolts. *Xyleborus ganshoensis* was considered as the highest potential to establish population in non-indigenous area because of its broad niche. *X. ganshoensis* was also likely to attack living trees since many individuals attacked fresh bolts but unlikely an invasive alien species because of its negative RCA value. *Platypus quercivorus*, a vector of the Japanese oak wilt, showed the highest mean abundance on 0-month-old bolts. On the other hand, *Xyleborus seiryorensis* had the smallest value of WO niche center, indicating that this species could be aggressive enough to attack living trees. The method developed in this study would be applicable to similar risk assessment of ambrosia beetles on other host species and in other countries.