



Present situation of pine wood nematode *Bursaphelenchus xylophilus* in China

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The pine wood nematode (PWN), *Bursaphelenchus xylophilus*, is the causal agent of pine wilt disease (PWD), and is considered as destructive quarantine pest, producing severe environmental and economic losses worldwide. In China, PWN was first detected in 1982 on *Pinus thunbergii* at the Purple Mountain of Nanjing (Fig. 1). Since the first detection, PWN remains problematic as the temperature condition in most region of China are suitable for PWN survival and epidemic transmission (Fig. 2), which leads to the PWD constantly spreading (Fig. 3).



Fig. 1 Purple Mountain viewed from the NAU campus

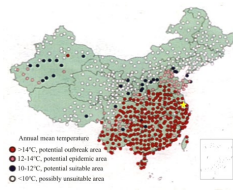


Fig. 2 Prediction of PWN distribution on 1991

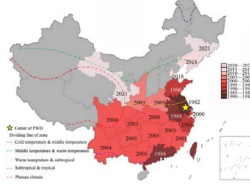


Fig. 3 Spreading of PWD in China

In the past 40 years, the PWD has been spread continuously in China, especially sped up in the last decade (Fig. 4). In 2018, the newly epidemic areas of PWD including 282 districts and counties have been recognized. The symptom of PWD on the mountain region in Zhejiang Province showed the shocking view (Fig. 5), and hundreds of thousands of pine trees have been cut (Fig. 6). In 2020, the Chinese Government reported 726 county-level regions from 18 provinces as the PWD epidemic areas, covering estimated 1.8092 million hm² and 19.4703 million dead pine trees. These data have revealed that PWN damage led to a remarkable ecological crisis in forest areas affected by PWD.

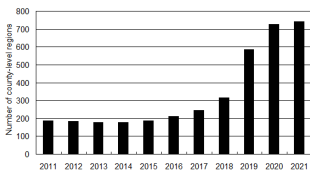


Fig. 4 Number of county-level regions in China occurred PWD during the past decade



Fig. 5 PWD symptom on mountain area in Zhejiang Province in 2018



Fig. 6 Felling pile of pine trees killed by PWD

The plant quarantine remains the basis measure to prevent the introduction of PWN into the country via international trades (Fig. 7). From Jan. 2004 to Dec. 2020, more than 2500 interceptions of PWN have been detected by the Chinese quarantine authorities from different imported materials from more than 70 countries. About 78.9% of PWN detection were on wood-packaging materials, and 18.7% were on wood cargo (Fig. 8). The highest frequency of PWN detection was from materials from the USA, followed by the South Korea, Japan and Germany (Fig. 9). The ports of Nanjing, Ningbo and Shanghai have the higher PWN detection frequency (Fig. 10).



Fig. 7 Regularly inspections for imported logs and wood packaging

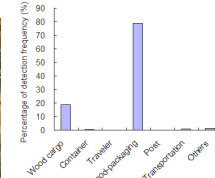


Fig. 8 Percentage of PWN detection in different quarantine business

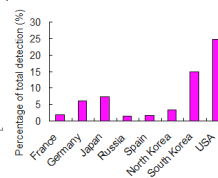


Fig. 9 Percentage of PWN detection from materials from different countries

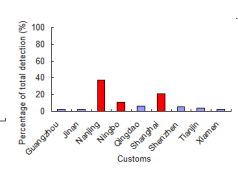


Fig. 10 Percentage of PWN detection by the Chinese Ports

On PWD areas in China, various management programs have been conducted aiming to reduce PWN sources and beetle vectors, including felling, burning or slicing dead trees into small pieces.



Traps with insect attractants, insecticide powder spraying by knapsack sprayer or drones, nematocides injecting into pine trunk, enemy insects such as *Dastarcus helophoroides* releasing into forest by drones, are used to prevent PWN transmitted by beetles.



Felling dead trees were recycled making as wood products under the quarantine surveillance, or as the substrate for culturing *Poria cocos* which is a fungus as medicine and food.



Acknowledgments: Some of photos were taken from public internet news. **References:** 1. Li JS, et al., Forest Pest and Dis., 2021, 40(4): 1-4; 2. Zheng YN, et al., J. Beijing Fores. Univ., 2021, 43(5): 155-160.