

Pine wood nematode, as an example of alien invasive species

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Since the Convention of Kanagawa was concluded between Commodore Perry and Tokugawa shogunate in 1854, some of the Japanese ports had been opened for foreign trade. The Meiji Restoration in 1868 accelerated international trade to develop into a modernized industrial country. By the late 19th and in the early 20th century, Japan fought two wars, Sino-Japanese War (1894–1895), and Russo-Japanese war (1904–1905). The international trade of Japan must be accelerated further against such political background. The number of alien invasive species increased with increase in international trade.

The first discovery of Pine Wilt Disease (PWD) in Japan was reported in 1905 from Nagasaki city, harbor area, in Kyushu-island (southern island). Since then enormous efforts have been dedicated to control this newly-found forest epidemic, and discovered pinewood nematode, *Bursaphelenchus xylophilus* as a causal agent of this disease in 1969.

As is the case of Japan, the first occurrence of pine wilt disease was reported from harbor area in some other countries. For instance, PWD started its spreading from Busan in Korea, from Setúbal Peninsula near Lisbon. Thus, invasion of pine wood nematode seems to be associated with international trade.

There are so various definitions about “invasive species”, but we may define them as those that could establish outside their natural distribution area and may disrupt original biological diversity of the invaded area. From such point of view, we could assume some conditions that enable invasive species to establish in new area. Invasive species appear to have specific traits that allow them to defeat native species.

Anyway, in the case of PWD, the infection chain is very complicated involving many organisms in it; pine species as the host, pine wood nematode as the pathogen, *Monochamus* species as the vector of the nematode, and blue stain fungi as the food source of the nematode. Wide distribution of susceptible pine species and efficient vector beetles allowed the nematode to establish in invaded area and dominate over wide area not only in Japan but also East Asian countries, and then Europe, resulting in serious damage of pine forests and other organisms associated with those forests.

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