Detection of the pinewood nematode and its insect vector in the tsunami-damaged trees of *Pinus thunbergii* and *P. densiflora*

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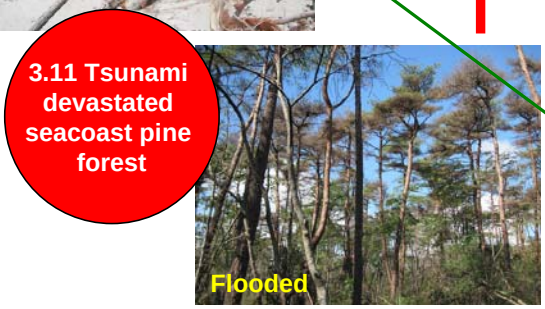
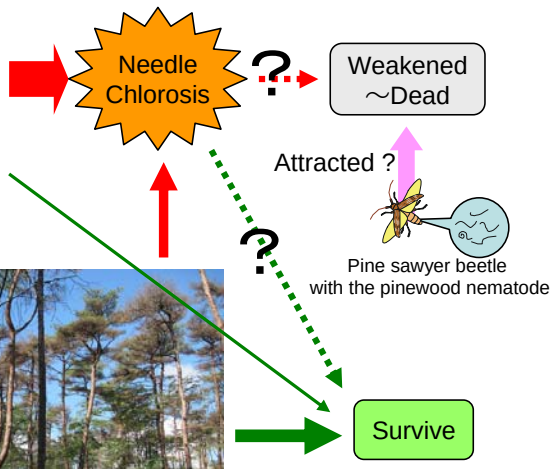


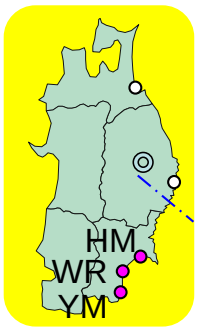


✓The tsunami (tidal wave) following the Great East Japan Earthquake on March 11, 2011, **devastated vast areas of seacoast forest**, mainly composed of the Japanese black pine, ***Pinus thunbergii***, and red pine, ***P. densiflora***.

✓**Needle chlorosis** occurred not only severely damaged trees but also the trees without conspicuous external damage. If those trees were dying, they could be attract and harbor the pine sawyer beetle, ***Monochamus alternatus***, as the major vector of the pinewood nematode, ***Bursaphelenchus xylophilus***, then lead to **an outbreak of pine wilt disease (PWD)**.

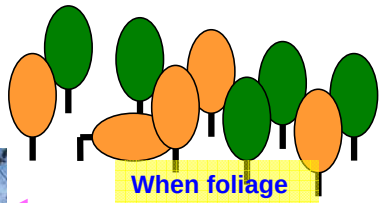
✓THUS, we investigated the presence/absence of the pinewood nematode and its vector in pine trees with discolored foliage in the tsunami-damaged seacoast forests.

✓Investigation was taken place at 6 locations in Miyagi Prefecture; 3 in Higashi-Matsushima City (HM), 2 in Watari Town (WR) and 1 in Yamamoto Town (YM), all included in the PWD affected area.



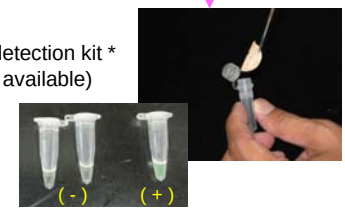
✓**Inhabitation of *M. alternatus*** was checked by searching for oviposition scars on trunk surface and/or frass of the immature insects under the bark.

✓To **detect *B. xylophilus***, we adopted commercial detection kit (Nippon Gene Co. Ltd.).



Try to find the oviposition scar and/or frass of *M. alternatus*

B. xylophilus detection kit * (commercially available)



Number of the trees in which oviposition scars or larval frass of ***M. alternatus* (Ma)** was confirmed among the tsunami damaged-trees with needle chlorosis.

Pd: *P. densiflora* / Pt: *P. thunbergii*

Site	Tree species	Felled/bent trees			Standing trees		
		# trees	with Ma (%)		# trees	with Ma (%)	
HM #1	Pd	0	-	-	66	12	(18.2%)
#2	Pt	0	-	-	10	7	(70.0%)
#3	Pd	0	-	-	20	18	(90.0%)
WR #1	Pt	26	0	(0.0%)	1	0	(0.0%)
#2	Pt	26	0	(0.0%)	9	0	(0.0%)
YM #1	mixed	13	2	(15.4%)	25	5	(20.0%)

- Low detection except for HM #2 and #3.
- Heavily damaged trees (felled/bent) seemed to have had no or little attractively to *M. alternatus* adult in the summer, 2011.

Number of the trees in which ***B. xylophilus* (Bx)** was detected among the tsunami damaged-trees with needle chlorosis.

Pd: *P. densiflora* / Pt: *P. thunbergii*

Site	Tree species	Felled/bent trees			Standing trees		
		# trees	with Bx (%)		# trees	with Bx (%)	
HM #1	Pd	0	-	-	71	3	(4.2%)
#2	Pt	0	-	-	11	7	(63.6%)
#3	Pd	0	-	-	20	2	(10.0%)
WR #1	Pt	38	0	(0.0%)	1	0	(0.0%)
#2	Pt	28	0	(0.0%)	29	0	(0.0%)
YM #1	mixed	14	0	(0.0%)	28	1	(3.6%)

- Low detection except for HM #2 (and #3).
- Detection of *B. xylophilus* in the tsunami damaged-trees (NOT killed by pine wilt disease) suggests infection pathway of the nematode associated with the vector's oviposition, while the high detection rate in HM #3 may have resulted from the latent infection of *B. xylophilus* in the past.

In the vicinity of HM #2 and #3, there were PWD-damaged trees remained on the hill without flooding from tsunami. *M. altnernatus* adults emerged from those trees could be responsible for the high detection of *M. altnernatus* itself and accompanying nematode.

➔The tsunami damaged-trees pose little risk of being source of infection of PWD, unless there was PWD damaged trees in their vicinity.

➔Transmission of *B. xylophilus* through vector's oviposition scars seemed not very effective even if it was.

*** Kikuchi, T., T. Aikawa, Y. Oeda, N. Karim and N. Kanzaki (2009) A rapid and precise diagnostic method for detecting pinewood nematode *Bursaphelenchus xylophilus* by loop-mediated isothermal amplification. Phytopathology 99: 1365-1369.**