

Controlling invasive tree pests in the urban forest using tree microinjection (TMI)



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Introduction

Invasive tree pests are posing problems globally. We have leveraged global corporate knowledge to develop specific formulations of emamectin benzoate that can be injected into trees to provide effective control of a wide variety of tree pests.

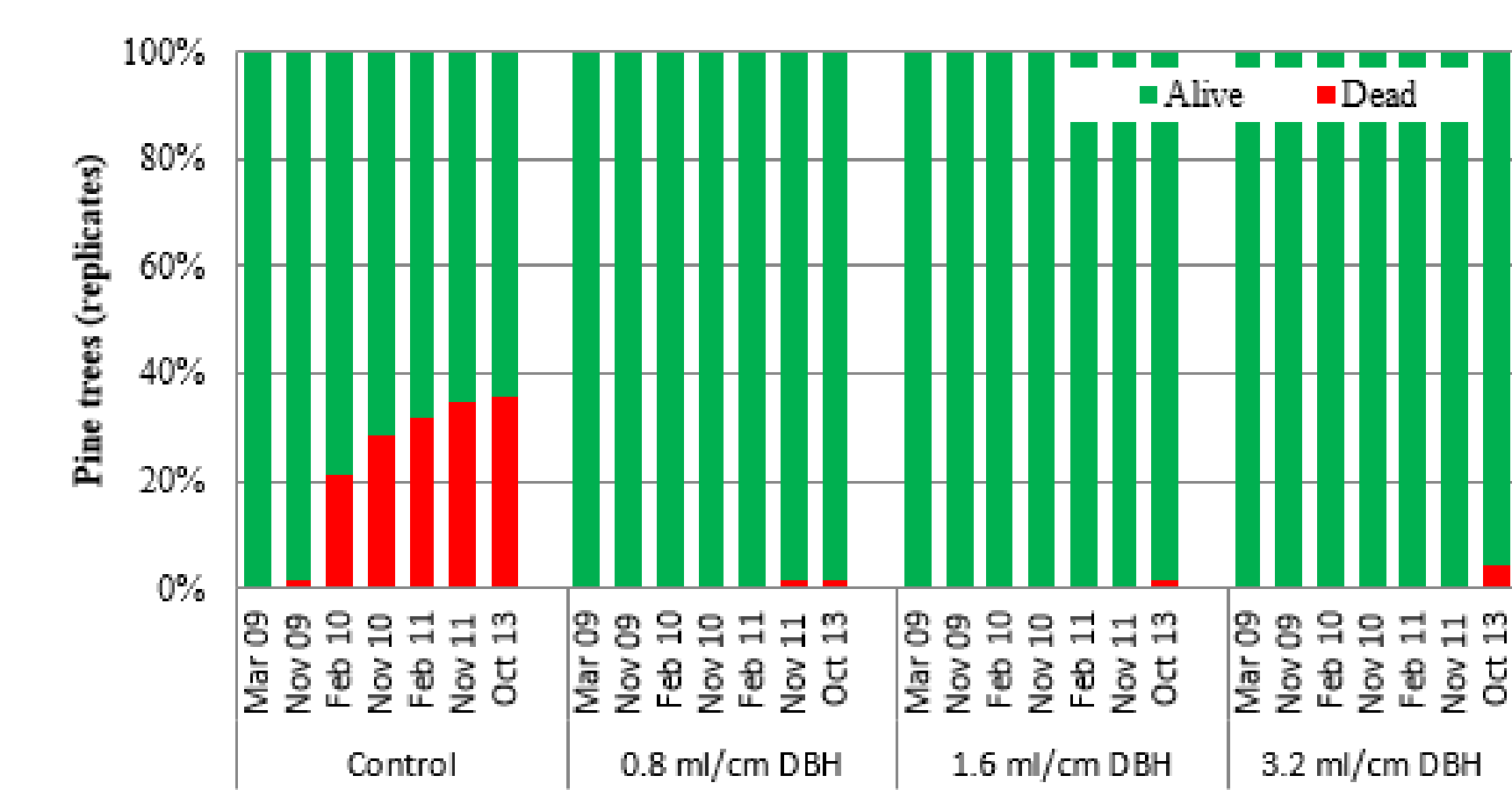
Methods

Trees were injected with emamectin benzoate formulation (4 or 9.5% a.i) using proprietary equipment (below).



Results

Pine Wood Nematode



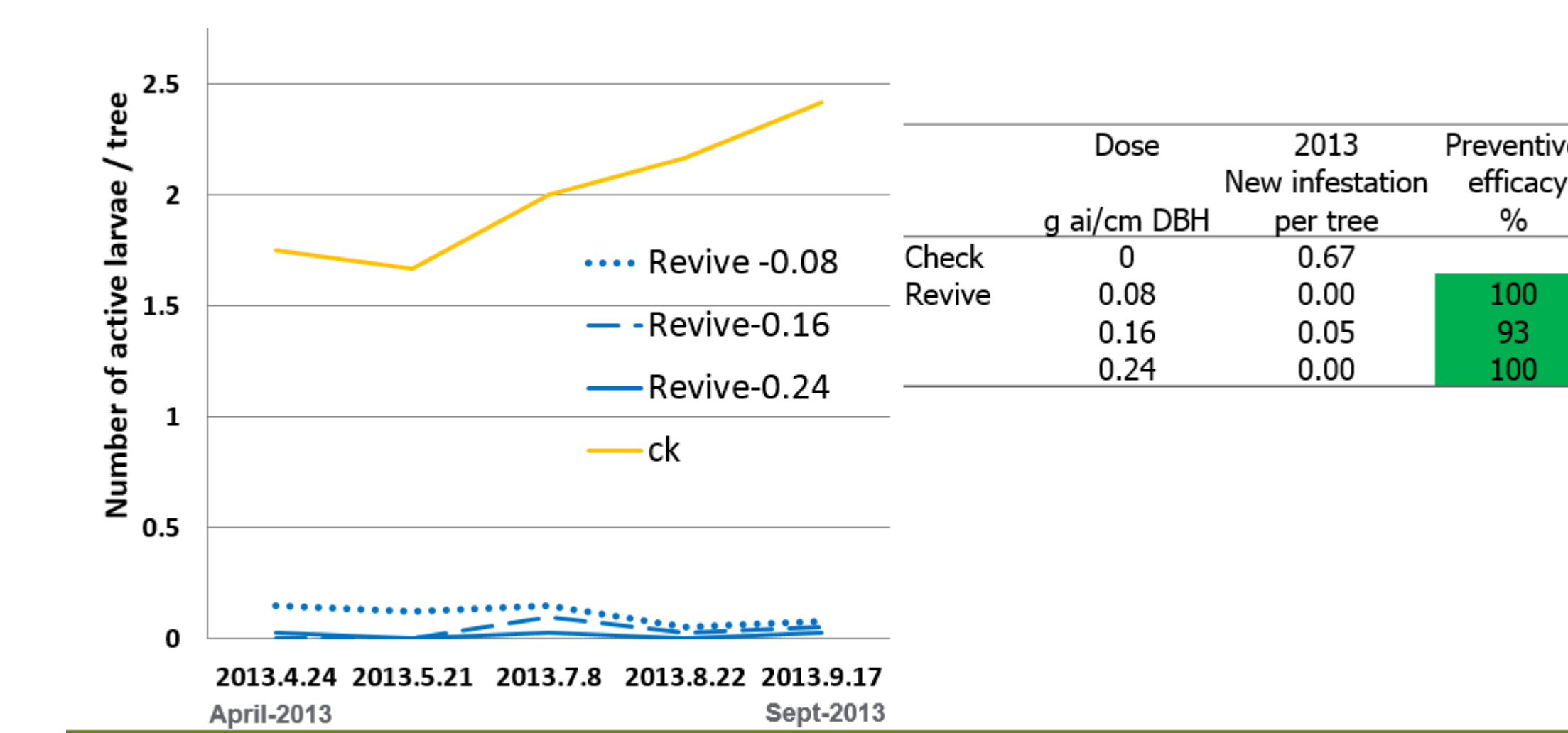
TMI against pine wood nematodes (PWN) on maritime pine trees. Application: March 2009, 3 dose rates (ml Product/cm DBH Diameter at breast height), along with an untreated control plot (n=75 trees). Injected pines were assigned at random and homogeneously distributed through the four plots, which also included several non-treated trees. Assessment of tree mortality caused by PWN

Pine Processionary Moth

TMI of european black pine against pine processionary moth at 14 November 2012. Assessment of natural infestation 3 months after treatment (MAT) and of artificial infestation 126 MAT (3 and 2 months after infestation (MAI) respectively). %Efficacy: Mortality of larvae. Control mortality was below 11%

Revive [®] Dose	28.02.2012 3 MAT	10.01.2013 3 MAI	06.01.2014 26 MAT
1 ml/cm DBH	0	100	87
2	49	100	81
4	42	100	85

Asian Longhorn beetle



Oak Processionary Moth

TMI trial against oak processionary moth on english oak trees at London (UK). Trees (4 replicates) were treated at 25 April 2012 at 4 dose rates (0.5, 1, 2 and 4 ml Product/cm DBH). Assessment: 1st year natural infestation; 2nd year artificial infestation in April by transfer of nests.

Treatment	Year 1; 2 MAT		Year 2; 14 MAT	
	Nests/tree	Larvae mortality %	Nests/tree	Larvae mortality %
Control (no injection)	0.5b	0	6.0	0
Water injected	1.0c	0	6.8	0
0.5 ml Product / cm DBH	0.0a	-	0.0a	-
1 ml Product / cm DBH	0.0a	-	0.0a	-
2 ml Product / cm DBH	0.0a	-	0.0a	-
4 ml Product / cm DBH	0.0a	-	0.0a	-

Horse Chestnut Leafminer

TMI of horse chestnut trees against cameraria leafminer. Treatment of 40-60 years old horse chestnut trees along a street side in June 2007, dose rate 2 ml Product/cm DBH, 4 randomized replicate trees. Assessment: End of August, average infestation % (= % leaf area with mines) of 4 replicate trees (average of 10 leaves per tree); C=control trees, TMI=treated trees

	2007		2008		2009		2010	
	C	TMI	C	TMI	C	TMI	C	TMI
Infestation%	35	23	48	9	44	5	42	11
Efficacy %		93		80		89		74



Left: untreated Right: treated

Red Palm Weevil

Field trials in *P. canariensis* nursery: Stem height 2.5 m; 30 palms treated with Revive 50 ml/4 injection points; 3 treatments over 16 months; Biological assessments over 28 months; 30 control palms.

Date	Treatment	Revive	Control
27.04.2012	Dead palms count	2	2
15.10.2012	Dead palms count	0	6
28.01.2013	Dead palms count	0	6
29.01.2013	Dead palms count	2	4
25.06.2013	Dead palms count	2	4
08.07.2013	Dead palms count	1	4
10.01.2014	Dead palms count	0	0
08.07.2014	Dead palms count	0	0
Total	Dead palms count	5/30	16/30
% Survivors		83%	47%



Conclusions

Emamectin benzoate offers excellent protection from a wide variety of invasive tree pests (see table below). In many instances, multi year protection is possible following a single treatment.

Efficacy summary on multiple tree pests

Target	4%	9.5% A19308A	Dose rates tested (g/cm/dbh)
Pine trees			
Pinaceae Pinus pinaster Pine wood nematode	0.06	0.05-0.13	4 years 0.033; 0.064; 0.128
Pinaceae Pinus nigra Processionary moth	0.04	0.04	3 years 0.04; 0.08; 0.16
Pinaceae Pinus pinaster Processionary moth	0.04	0.04	3 years 0.04; 0.08; 0.16
Pinaceae Ponderosa pine Pine tip moth	0.04	0.04	1 year 0.04; 0.16
Pinaceae Western pine beetle	0.16	0.16	2 years 0.16
Dicot trees			
Salicaceae Willow Asian longhorn beetle	0.08-0.16	0.16-0.24	2 years 0.08; 0.16; 0.24
Salicaceae English oak Oak processionary moth	0.04	0.04	2 years 0.02; 0.04; 0.08; 0.16
Fabaceae Honey locust Gypsy moth	0.04	0.04	1 year 0.04; 0.16
Fabaceae Sophora japonica Cydia trasis	0.04-0.08	0.08-0.16	2 years 0.02; 0.04; 0.08; 0.16
Fabaceae Angsana Leaf miner (moth)	0.023	0.023	1 year 0.023
Platanaceae Sycamore, Plane Lace bug	0.08	0.08	<1 year? 0.014; 0.029; 0.057; 0.114
Myrtaceae Eucalyptus Longhorn beetle	0.08	0.16	2 years 0.04; 0.16
Oleaceae Green Ash Emerald Ash Borer	0.04, 0.16	0.16	2 years 0.04; 0.16
Sapindaceae Horse Chestnut Leafminer	0.02-0.04	0.04-0.08	3 years 0.01-0.08
Rosaceae Cherry Mites		0.16	0.02; 0.04; 0.08; 0.16
Platanaceae Sycamore, Plane Fall webworm		0.16	0.014; 0.029; 0.057; 0.114
Palms			
Areaceae Phoenix canariensis Red palm weevil	2	2-4	6-12 Mts 1; 2; 4 g / palm
Areaceae Phoenix dactylifera Red palm weevil	2	2-4	6-12 Mts 1; 2; 4 g / palm

Further Research

The research phase is nearing its conclusion and the products are being commercialised.

References and cited literature

Micro-injection sur pin, palmier, chene et Marronnier. Bourdrez, P., Delgado, R. & Wyss P. (2014). Phytoma 678 pp21-25.
 Invasive Tree Pest Control Emamectin Benzoate by Tree Micro Injection. Bourdrez P., Delgado, R., & Wyss, P. (2014).
 In AFPP colloque Ravageurs et Insectes Invasives et Emergent.



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