IMPROVING HOT WATER TREATMENT IN GRAPEVINE NURSERIES BY ADDING FUNGICIDES TO PREVENT INFECTION OF PETRI DISEASE PATHOGENS

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10ITGS - 29 November 2023

GRAPEVINE TRUNK DISEASES (GTD's)

Commonly found GTD's in the nursery and accompanying pathogens in South Africa.

Petri disease

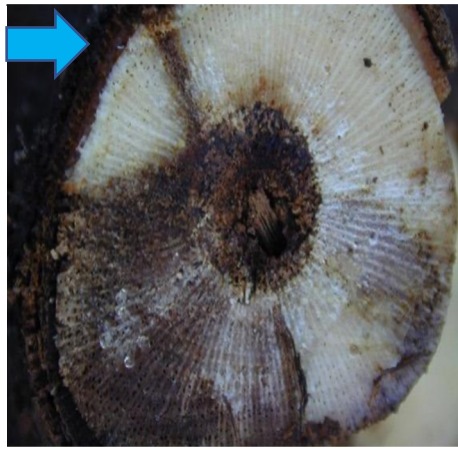
- *Phaeomoniella chlamydospora*
- *Phaeoacremonium minimum*
- *Phaeoacremonium parasiticum*
- *Cadophora luteo-olivacea*
- *Pleurostoma richardsiae*

Botryosphaeria dieback

- *Neofusicoccum australe*
- *Neofusicoccum parvum*

Black-foot disease

- *Ilyonectria liriodendri*
- *Ilyonectria destructans*
- *Dactylonectria macrodidyma*
- *Campylocarpon fasciculare*
- *Campylocarpon pseudofasciculare*



- Phomopsis dieback
  - *Diaporthe* spp.
  - *Diaporthe ampelina*

Hofstetter *et al.*, 2012 Fungal Diversity 54: 51–67.; Halleen *et al.,* 2003 Australasian Plant Pathology 32: 47–52.

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HOT WATER TREATMENT (HWT)

- Cost-effective method to reduce pests and pathogens
- Grapevine cuttings submerged in hot water bath: 50°C for 30 min
- Eradicate Aster yellows: 50°C for 45 min
- Petri disease was not eliminated at 50°C for 45 min:
  - *-Phaeomoniella chlamydospora*
  - *-Cadophora luteo-olivacea*
  - *-Phaeoacremonium minimum*
  - *-Phaeoacremonium parasiticum*
  - *-Pleurostoma richardsiae*
- *Pleurostoma richardsiae* was not eradicated at 60°C for 45 min

Industrial hot water treatment bath

Fourie and Halleen, 2004 Plant Disease 88: 1241–1245.; Webber, 2021 MScAgric thesis, University of Stellenbosch, Stellenbosch, South Africa.

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AIMS AND OBJECTIVES

Improve hot water treatment at 50°C for 30 min with fungicides to reduce Petri disease pathogens in the nursery process with a focus on *Pleurostoma richardsiae*

1

Identify fungicides and confirm the efficacy ***in vitro***

2

Test the efficacy of fungicides **in detached rootstock assays**

3

Test the efficacy of fungicides + HWT in **commercial grapevine nurseries with grafting material**

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Objective 1

Identify fungicides and confirm efficacy ***in vitro***

		Mycelial inhibition			Spore germination inhibition		
Active ingredient (a.i.)	**A.i registered dose (ppm = mg/L)**	**Conc. Range (mg a.i. /L)**	**EC_{50} (mg a.i./L)**	**SD**	**Conc. Range (mg a.i./L)**	**EC_{50} (mg a.i./L)**	**SD**
Didecyldimethylammoinium chloride (DDAC)	60	1-50	10.40	1.04	0.5-100	1.01	0.23
Tebuconazole	75	0.05-5	1.52	0.27	0.5-100	0.38	0.08
Pyraclostrobin	100	0.5-50	0.58	0.11	0.05-5	0.03	0.01
Metrafenone	125	1-10000	nc	nc	nc	nc	nc
Cyprodinil	150	1-500	1.42	1.39	1-100	0.15	0.06
Azoxystrobin	200	1-500	nc	nc	0.1-10	1.53	0.91
Carbendazim	250	0.1-10	0.25	0.02	1-50	16.43	4.95
Spiroxamine	300	0.5-100	4.56	0.79	nc	nc	nc
Boscalid	400	1000-10000	nc	nc	nc	nc	nc
Pyrimethanil	480	0.05-50	4.94	2.68	0.1-100	0.31	0.11
Iprodione	500	1-5000	911.43	287.33	1-100	10.69	6.71
Procymidone	500	100-10000	3089.12	377.65	5-500	281.24	83.96
Fludioxanil	598	0.5-5000	703.28	278.19	0.1-0.5	0.12	0.03
Thiophanate-methyl	700	1-10	2.31	0.2	50-1000	123.23	27.33
Captab	1000	1-500	287.26	33.06	0.05-5	0.94	0.5
Thiabendazole	2000	0.05-5	0.99	0.04	0.5-100	25.74	10.07
Prochloraz	2250	0.05-5	0.19	0.07	1-100	0.18	0.096
8-Hydroxyqiunoline sulphate	5000	0.5-100	10.89	0.14	0.5-100	10.37	2.26

Objective 1

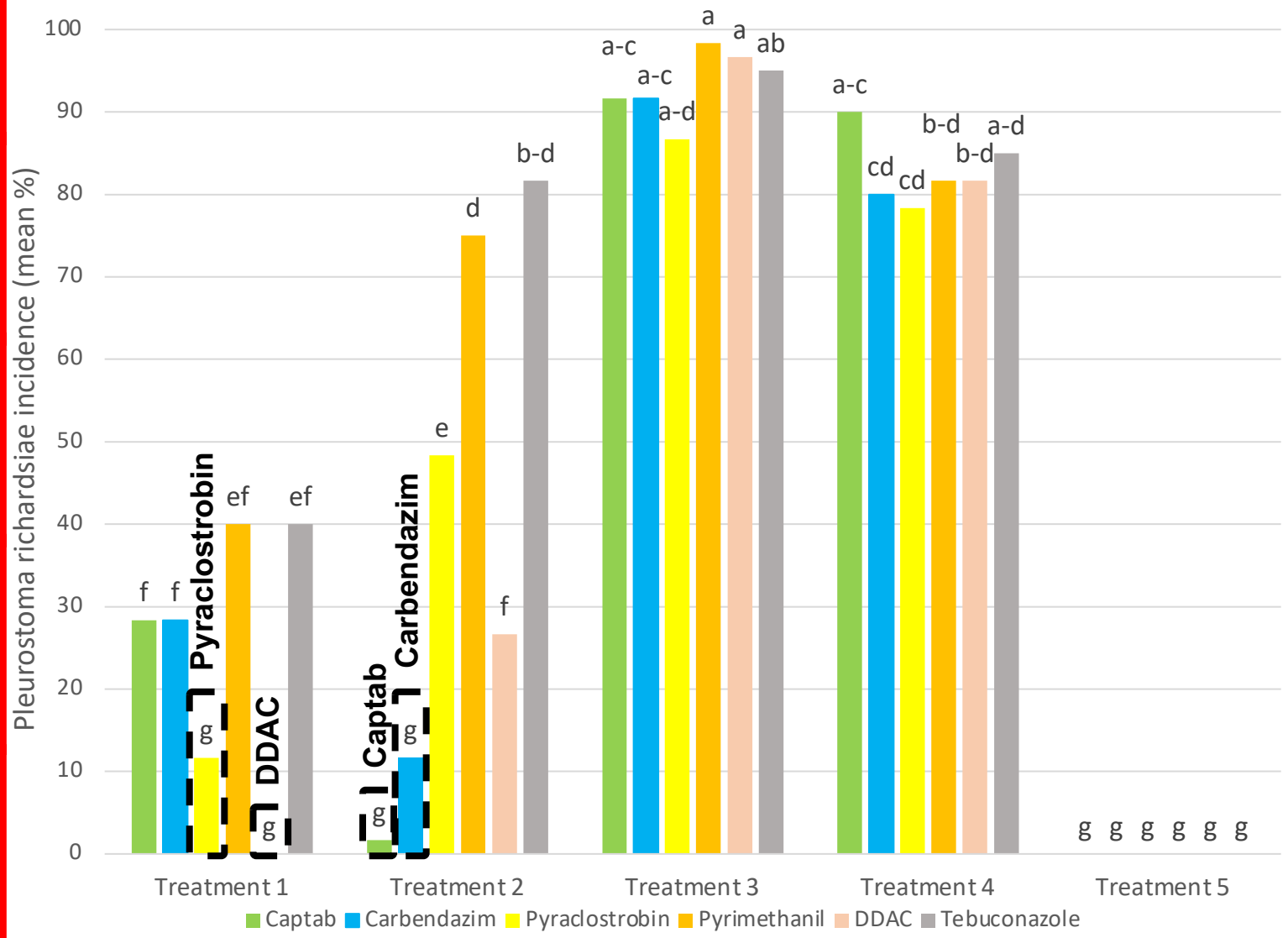
Fungicides ranked according to the EC_{50} percentage of the registered dose.

Mycelium inhibition	Germination inhibition
1. Prochloraz = 0,009%	1. Prochloraz = 0,008%
2. Thiabendazole = 0,05%	2. Fludioxanil = 0,02%
3. Carbendazim = 0,10%	3. Pyraclostrobin = 0,028%
4. Thiophanate-Methyl = 0,33%	4. Pyrimethanil = 0,06%
5. Pyraclostrobin = 0,58%	5. Captab = 0,09%
6. Cyprodinil = 0,95%	6. Cyprodinil = 0,1%
7. Pyrimethanil = 1,03%	7. Tebuconazole = 0,5%
8. Spiroxamine = 1,52%	8. Thiabendazole = 1,23%
9. Tebuconazole = 2,02%	9. Didecyldimethylammoinium chloride (DDAC) = 0,20%
10. Didecyldimethylammoinium chloride (DDAC) = 17,34%	10. Azoxystrobin = 0,48%
11. Captab = 28,73%	11. Iprodione = 1,07%
12. Fludioxanil = 117,61%	12. Carbendazim = 6,57%
13. Iprodione = 182,29%	13. Thiophanate-Methyl = 17,6%
14. Procymidone = 617,82%	14. Procymidone = 56,25%
15. Metrafenone = 3671,38%	

Objective 2

Hot water treatment detached shoot assay

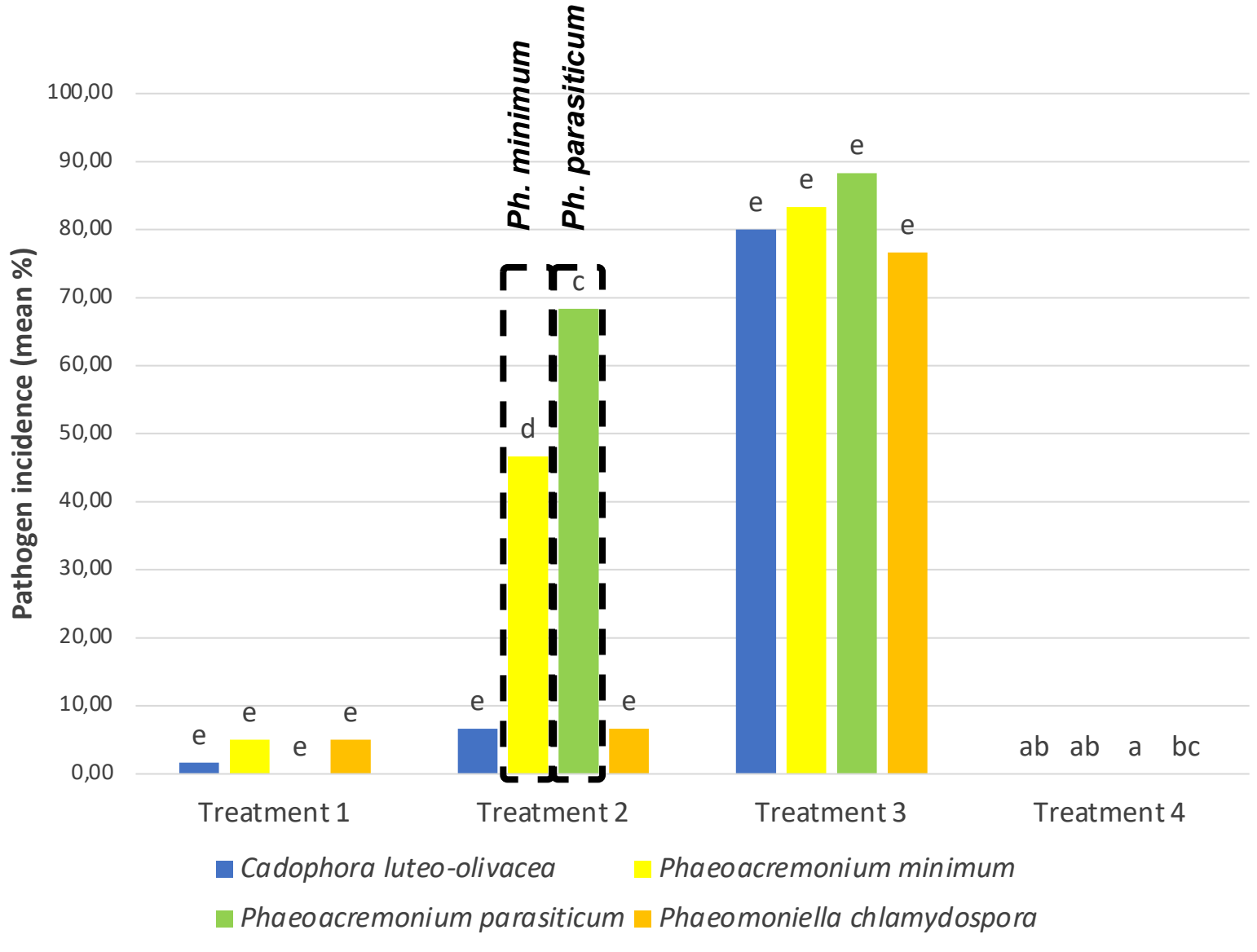
		Hot water bath / cooldown bath	Fungicide	*Pleurostoma richardsiae*
Treatment 1	Hot water bath	✓	✓	✓
	Cooldown bath	✓	✗	
Treatment 2	Hot water bath	✓	✗	✓
	Cooldown bath	✓	✓	
Treatment 3	Hot water bath	✓	✗	✓
	Cooldown bath	✓	✗	
Treatment 4	Hot water bath	✗	✗	✓
	Cooldown bath	✓	✗	
Treatment 5 (Control)	Hot water bath	✗	✗	✗
	Cooldown bath	✗	✗	



Objective 2

Petri disease detached shoot assay

	Pathogen inoculum	Fungicide
Treatment 1	✓	DDAC
Treatment 2	✓	Captab
Treatment 3	✓	✘
Treatment 4	✘	✘



Objective 3

Semi-commercial trial

		Hot water bath / cooldown bath	Fungicide
Treatment 1	Hot water bath	✗	✗
	Cooldown bath	✓	✗
Treatment 2	Hot water bath	✓	✗
	Cooldown bath	✓	✗
Treatment 3	Hot water bath	✓	DDAC
	Cooldown bath	✓	Captab
Treatment 4	Hot water bath	✓	DDAC
	Cooldown bath	✓	DDAC
Treatment 5	Hot water bath	✓	DDAC
	Cooldown bath	✓	✗

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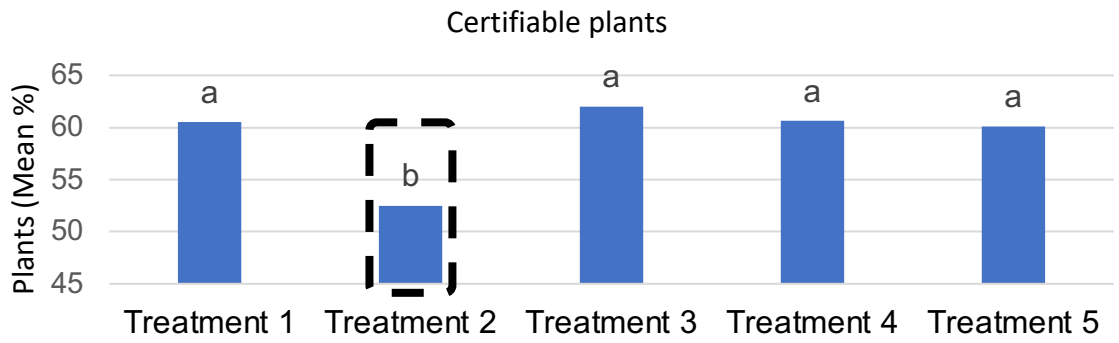
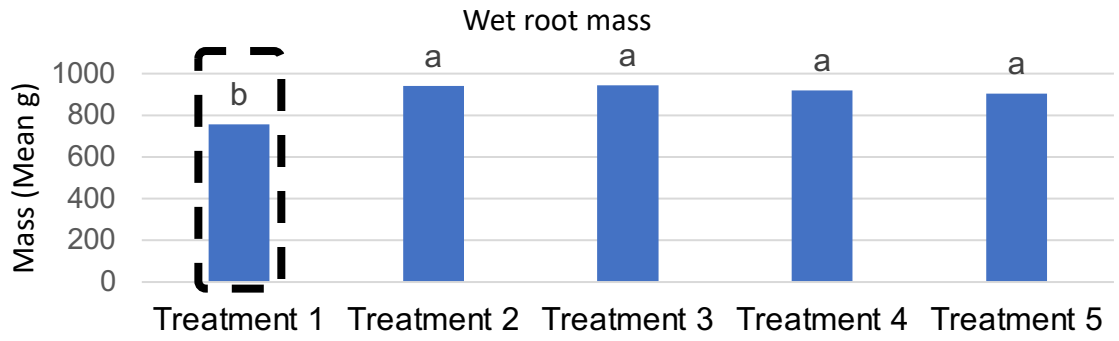
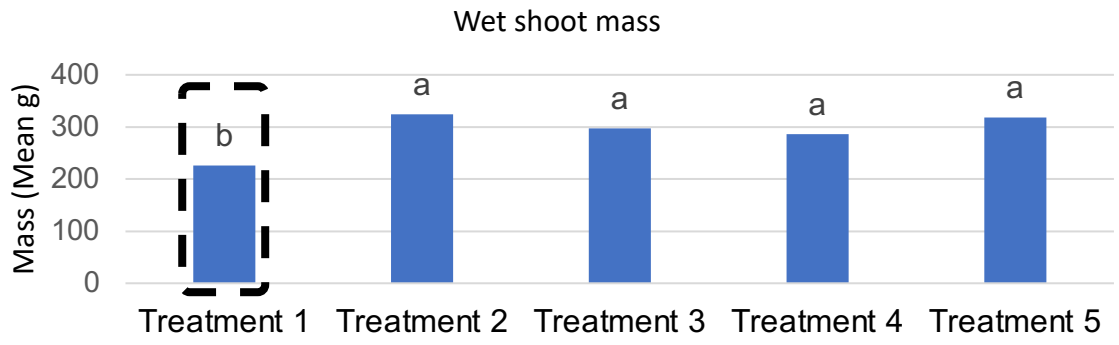
Objective 3

Semi-commercial trial: Growth parameter results

		Hot water bath / cooldown bath	Fungicide
Treatment 1	Hot water bath	✗	✗
	Cooldown bath	✓	✗
Treatment 2	Hot water bath	✓	✗
	Cooldown bath	✓	✗
Treatment 3	Hot water bath	✓	DDAC
	Cooldown bath	✓	Captab
Treatment 4	Hot water bath	✓	DDAC
	Cooldown bath	✓	DDAC
Treatment 5	Hot water bath	✓	DDAC
	Cooldown bath	✓	✗







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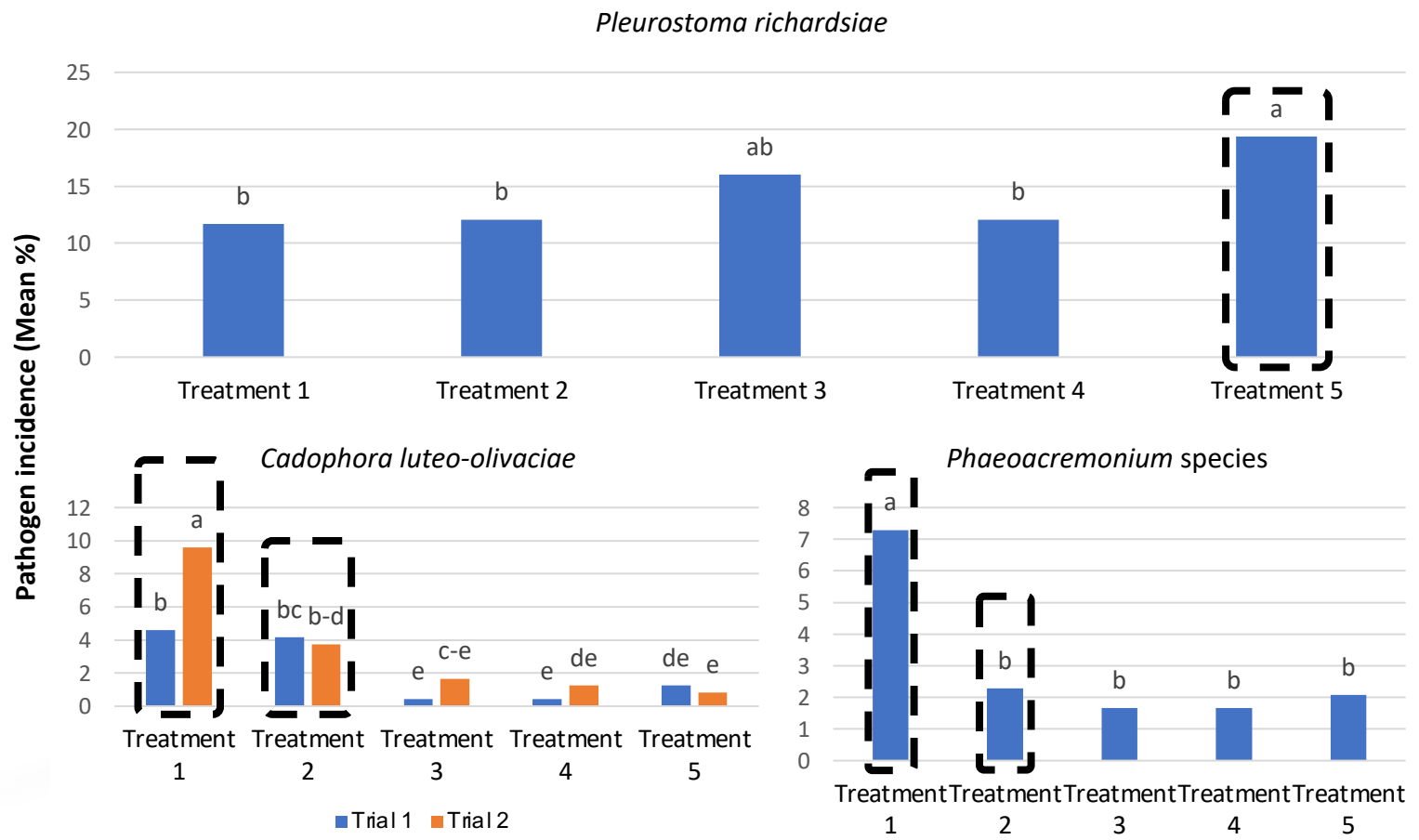
Objective 3

Semi-commercial trial: Pathogen incidence

		Hot water bath / cooldown bath	Fungicide
Treatment 1	Hot water bath	✗	✗
	Cooldown bath	✓	✗
Treatment 2	Hot water bath	✓	✗
	Cooldown bath	✓	✗
Treatment 3	Hot water bath	✓	DDAC
	Cooldown bath	✓	Captab
Treatment 4	Hot water bath	✓	DDAC
	Cooldown bath	✓	DDAC
Treatment 5	Hot water bath	✓	DDAC
	Cooldown bath	✓	✗



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Conclusion

It is recommended to use HWT as part of an integrated management strategy in the nursery process.

DDAC (50 mL/100 L) in the HWT bath and DDAC or Captab in the cooldown bath does not negatively effect growth parameters.

The addition of the chemicals to the HWT process only reduced *C. luteo-olivacea*. Efficacy of DDAC could be increased in the HWT bath with higher concentrations.

Future research could add pyraclostrobin to the HWT bath.

HWT bath water quality after 3 days of consecutive use.

Acknowledgements

Background: www.four-magazine.com