ODA Nursery 2017 Final Report

Insect Damage to Nursery Irrigation

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Problem: A large nursery was concerned about damaged drip tube irrigation in Aug 2016. The manufacturer that they first contacted proposed it might be insect damage. We met with the grower in Spring 2017 to discuss what they have seen, and some basic observational studies.

Obj. 1) Identify possible insects that could be causing this damage to tube irrigation.

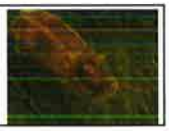
Carabid beetle *Bradycellus congener* near damaged tubes Aug. 1, 2017
This is a common small native species, identified by J. LaBonte.
Diet: omnivore, seeds, small invertebrates
Habitat: open habitats with moisture
Culprit? We think not, its preference for moisture may explain why it has been found by the grower, and in our pitfall traps.

Mormon Cricket, *Anabrus simplex* in July 2017
Diet: more than 400 plants, preferring succulent forbs, voracious feeder
Habitat: Forage plants and cultivated crops, migrate when populations get very large, common in sagebrush and forb landscapes, prefer warm climate.
Culprit? Probably not, the large mouthparts on this insect would suggest a larger pattern of damage. Information on the Mormon Cricket (Wyoming Agricultural Experiment Station Bulletin 912) suggest it thrives in different habitats than where the nursery was.

Soil samples. Twenty samples were taken from two affected fields on Aug. 9, 2017. Ten cores were taken per field, ~5 inches down. Soil samples were placed over Burlese funnels for 6 days. No insects were recovered ☹.

Pitfall traps. Five traps were set up per affected field on Aug. 9, and collected Aug. 17, 23, and 29, 2017. In total, 525 arthropods were identified. The most common ones are listed below

Arthropod	**#caught**	Comments
Ants	351	A culprit in tropical areas, Florida and Hawaii, among the emitters
Big-eyed bugs	41	Predator of small insects, has piercing chewing sucking part, and can drink plant juice
Leafhoppers	26	Very thin piercing-sucking mouthpart
Wireworms	12	A culprit in other studies, makes a round hole similar to what was seen in the damaged tape samples given to us
Lygus bugs	10	Pest, has piercing-sucking mouthpart
Grasshopper	9	Good chewer
Carabids	13	Omnivore or predator, strong chewing mandibles

Anthicid beetle	7	Scavengers or opportunistic predators of small arthropods, flimsy mandible, likely not capable of penetrating irrigation tubes	

Obj. 2) Did certain arthropods damage drip tube in the lab?
No, out of 48 trials, none of the tested insects damaged irrigation tubes when confined with them from September to December 2017. All died by the end of the trial except for the mealworms. *Despite a past published lab study, any future approaches to study irrigation damage may best be done in the field.*

Methods:

These were tested based on pitfall samples and availability for testing.

Arthropod	**Notes**	**Source**
Large carabid beetles	In pitfall traps, use large ones to see what chewing damage might look like	Field trapped
Crickets	Crickets in early soil samples, grasshoppers in pitfall, crickets used to see what chewing damage looks like	Pet store
Large wireworms	Smaller wireworms found in pitfall traps, noted in other studies. Use larger one to see what damage looks like	Pet store
Lygus bugs	Found in pitfalls. Test to see what piercing-sucking damage might look like	Rearing
Ants	Found in pitfalls, noted in other studies	Field trapped
Mormon cricket	Suggested because casings may have been in affected fields. Crickets were dying and fed minimally on a shrub.	Field collected in Arlington, OR

Extra-large petri dishes (14 cm diameter), with ventilating mesh lids were used to create a small observable chamber to hold soil and insects. Tubing was placed through the chamber and pinched closed on both ends by closing the lid tightly with rubber band. The tubing was filled with the diet relevant to each insect to stimulate chewing. The design was based on work with irrigation damage by white-fringed weevils (Nicholas, 2010). Insects would only be able to access the food by chewing through the plastic; the tubing placed in the dish were prepared so as not to have an emitter hole.

10-20 insects were placed in each chamber and 12 replications for each insect type. 4 different brands of drip tape were tested, with 3 replications of each drip tape for each insect. The drip tape brands used were PL-Ultra, Jain, John Deer, and Toro.

Schedule: Tubing was taken out and checked for each replication after no more living insects were found in the dish. Arthropods were kept alive by spraying the soil with water and adding a new water wick with a 5% sugar solution each week. However, arthropods were kept without a full diet to stimulate them to chew on the tubing.

Motivation: Each insect was chosen based on the frequency that they were found in pitfall traps located in fields that have experienced damage, and if previous damage had been reported in literature or reports. We tried to stimulate chewing by putting food sources inside of the tubing. The food sources for each insect are as follows:

a) Wire worms - Wire worms (click beetle larvae) had carrots stuffed into the tubing. This was chosen based on a standard diet of potato tubers, roots and stem of canola and corn, and other roots such as carrot and rutabaga (Ota, 2016). Wire worms were found in association with damage sites in their adult stage, and also created damage with similar circular and felt like appearances to those observed in the field samples of drip tape (Stansly and Pitts, 1990).
b) Carabid Beetles – Dog food was used because of their predatory life strategy.
c) Crickets – Dog food was used because of their predatory life strategy.
d) Lygus Bug - Green beans

Literature Cited:

Nicholas, A.H., 2010. Whitefringed weevils Naupactus leucoloma (Boheman), (Coleoptera: Curculionidae) damage sub-surface drip irrigation tape. Irrigation science, 28(4), pp.353-357.

Stansly, P.A. and Pitts, D.J., 1990. Pest damage to micro-irrigation tubing: Causes and prevention. Phytopathology, 53(4), pp.412-415.

Obj. 3) Document damage to drip tube irrigation from nursery. *This describes which type of damage is prevalent.*

Frayed damage was most prevalent, mostly originating from the outside, and observed similarly on the center of the tube as on the crease of the tube (see Table below). Frayed damage were typically < 1 mm, whereas mechanical damage was larger in size 3.7 mm.

Culprit? Most literature describes insects causing fray damage. Wireworm damage is typically round as opposed to asymmetrical. Observed samples were mostly round.

	All samples (n=449)	**Frayed damage (n=355)**	**Mechanical damage (n=51)**
Origin of damage			
Both	10%	9%	16%
Emitter	1 sample	1 sample	
Inside	6%	6%	4%
Outside	84%	84%	80%
Part of tube			
Both	<1%		4%
Center	54%	47%	72%
Edge (crease)	45%	53%	24%
Damage type			
Chew	7%	Size 0.9 mm	Size 3.7 mm
Frayed	79%		
Mechanical	11%		
Puncture	3%		