Rumble in the Prawns:
A Conflict of Interest Between Behavior Modifying Parasites

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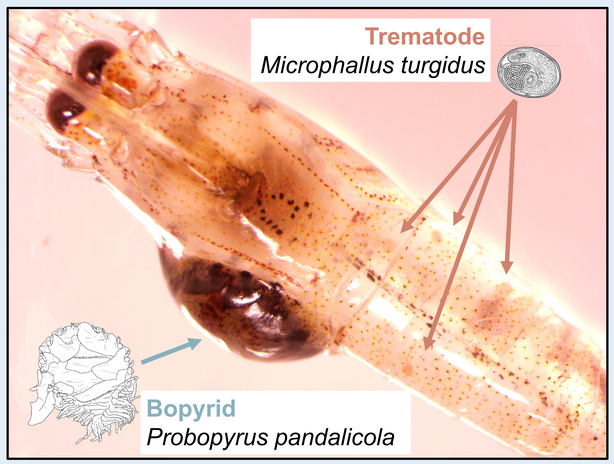
Background

- Host: Grass shrimp (*Palaemonetes pugio)*
- Behavior Modifying parasites:
  - Trematode: trophically transmitted, increases activity around predators, “wants” shrimp to be eaten
  - Bopyrid: castrator, decreases activity around predators, “wants” shrimp to survive
- Conflict of interest: “want” opposing outcomes
- Co-infection does occur, so…
- How do the parasites mitigate the conflict?



Methods

- Field survey
- Site: 4 tidal creeks of the Cape Fear river
- Mallory, Town, Mott, Lilliput
- Collect approx. 200 shrimp per site for 7 months (total of 4130)
- Quantify infection status and length in each shrimp
- Perform chi square and GLMM

Figures

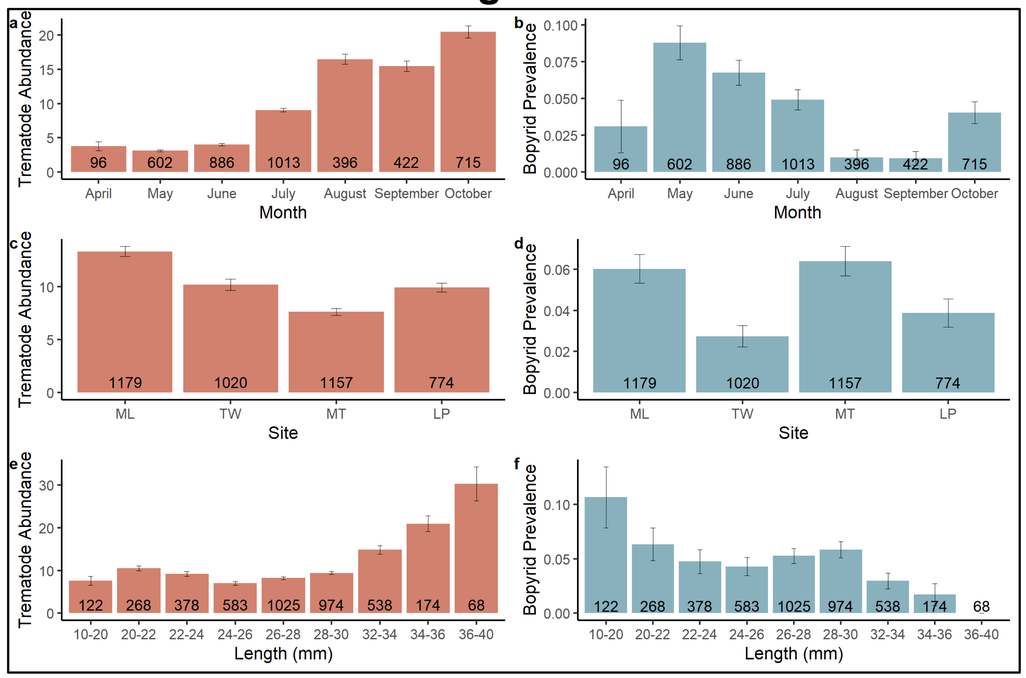


Figure 1. Trematode abundance (mean number of trematodes per all hosts) over month (a), location (c), and length (e) and bopyrid prevalence (mean number of infected hosts per all hosts) over month (b), location (d), and length (f). Months range from April to October 2021. Sites are Cape Fear River tidal creeks: Mallory Creek, Town Creek, Mott Creek, and Lilliput Creek (ordered from north to south).

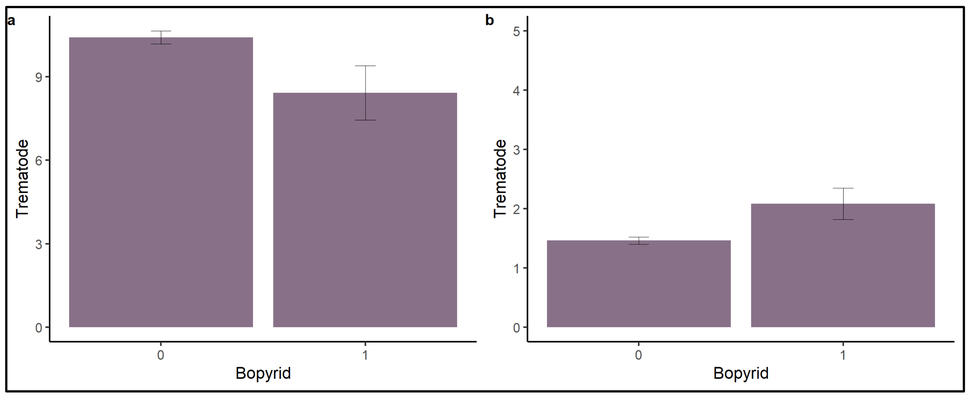


Figure 2. Trematode count plotted against bopyrid infection, using raw data (a) and partial residual with month, site, and length effects removed (b). We see a negative relationship with the raw data (consistent with the chi square test), but a positive relationship when the effects of month, length, and site are removed.

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Results

- Chi square shows negative association: $\chi^2(1,N=4130)=8.44$, p=.003, V = -0.041
- GLMM shows significant relationship for trematode and bopyrid (p < .001, p = .034) and length (p<.001 for both)
- Trematode abundance is greatest in late summer/fall, bopyrid prevalence is greatest in spring/early summer
- No clear trend in sampling locations
- Trematode abundance increases with length, bopyrid prevalence decreases with length

			Trematode Infection		
			Absent	Present	Total
Bopyrid Infection	Absent	Observed	426	3501	3927
		Expected	429.07838	3423.299	3927
	Present	Observed	34	169	203
		Expected	22.180523	176.962	203
Total		Observed	460	3670	4130
		Expected	460	3670	4130

Figure 3. Chi square table showing counts for bopyrid and trematode prevalence

Conclusions

- See fewer co-infected shrimp than would be expected (Figure 2a), but…
- Partial residual shows opposite (Figure 2b)
- Month and length of shrimp are important ways for parasites to mitigate their interaction
- To confirm, currently looking at:
  - Differential mortality: do doubly infected shrimp die more quickly?
  - Sabotage of modification: one parasite “overpowers” the other?
- Future studies should confirm by sampling over a longer time period