Ophiostomatoid Fungal Infection and Insect Diversity in a Loblolly Pine Stand

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Forestry in the Southeastern US

- From cotton to pine
- Large areas of monocultured pine species
- Pest insects typically respond to stressed trees
  - Poor soil, flooding, compaction, drought, mechanical damage
- Insects feed on tissues and vector pathogens

Insects in Forestry

- Nonnative pests are a large part
  - Economic damage
  - Alter ecosystems
    - Emerald ash borer, beech scale
- Native *Dendroctonus*
- Root feeding beetles of special concern
  - Belowground damage
  - Vector blue staining fungi that occlude xylem

Insects as Beneficial


6legs2many.wordpress.com

- Water quality
  - Mayflies, stoneflies, caddisflies
- Not all are pests
  - Pollinators, predators of pests, food for wildlife, biocontrol of weeds, human food source
- Ecosystem health
  - Decomposition
- Stand health


realmonstrosities.com


reddit.com

Objective

To obtain data on annual insect population dynamics for a study investigating the impact of a beetle vectored fungus, *Leptographium terebrantis* on tree physiology

Experimental Design

- 1 field site in Eufaula, AL
- 15 plots
  - 3 pitfall traps per plot (45 total)
  - 6 panel traps throughout the study area
- Insects were collected bimonthly for 4 years
  - Stored in the cooler until processed
  - Identified to family, sorted by morphospecies

Experimental Design

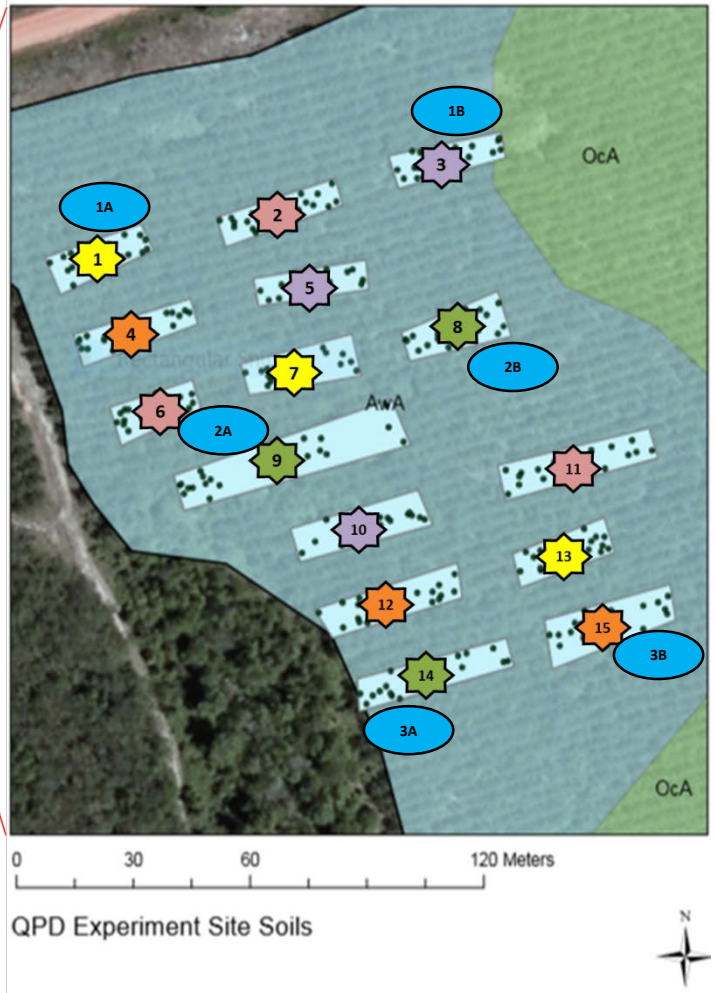


Figure 1: The location of the Eufaula, AL study site on an Alabama map and the layout of the 15 study plots and panel trap locations. Stars correspond to plots while ovals are panel traps.

= plot

= panel trap

Methods

30 each

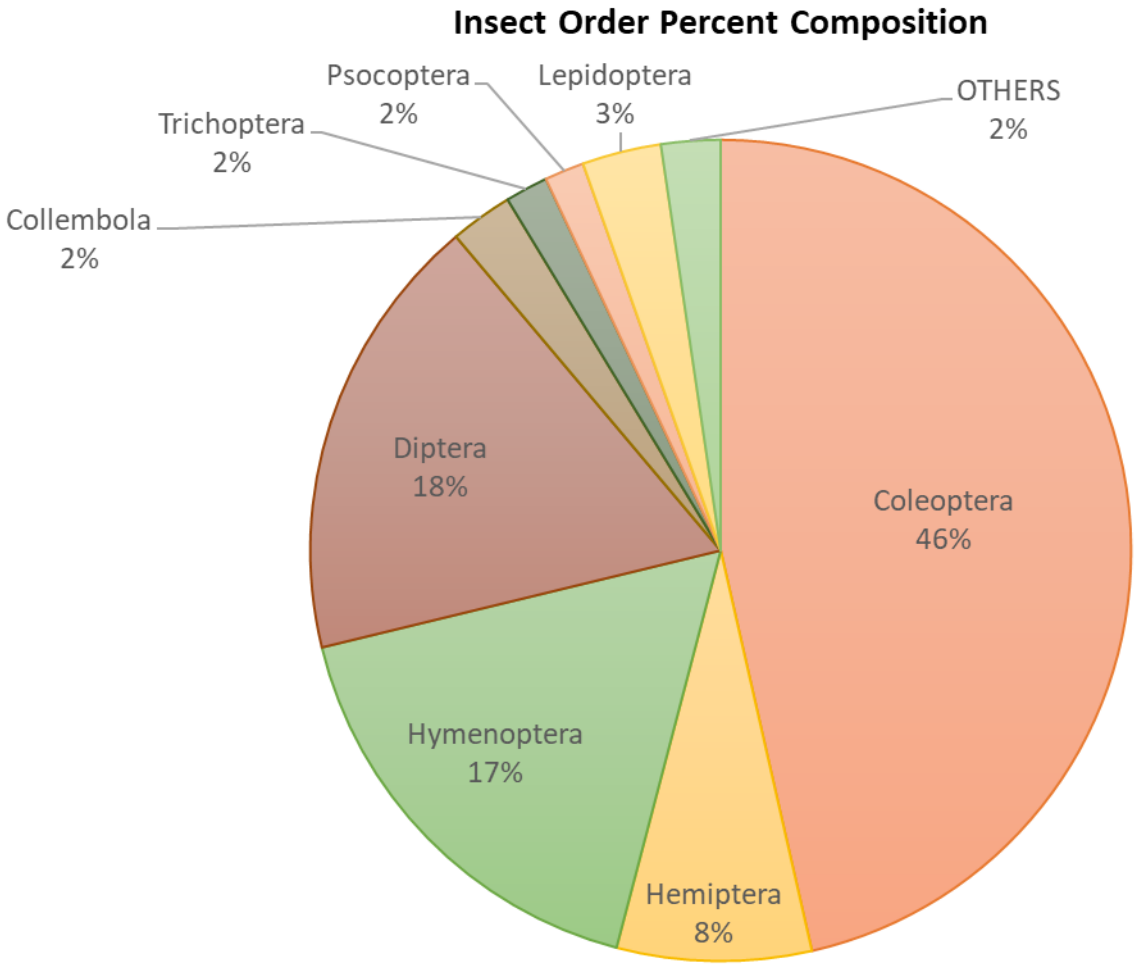
6 each

15 each

Methods

- Number of species (morphospecies) and common diversity indices used to defined diversity
  - Shannon's index
  - Simpson's index
- Analyzed pitfall traps according to treatment, year, and plot
- Analyzed panel traps according to year

Results



771 species

OTHERS: composed of the orders Orthoptera, Neuroptera, Blattodea, Microcoryphia, Mecoptera, Phasmatodea, Mantodea, Thysanoptera, and unknowns (≤5 species).

Results

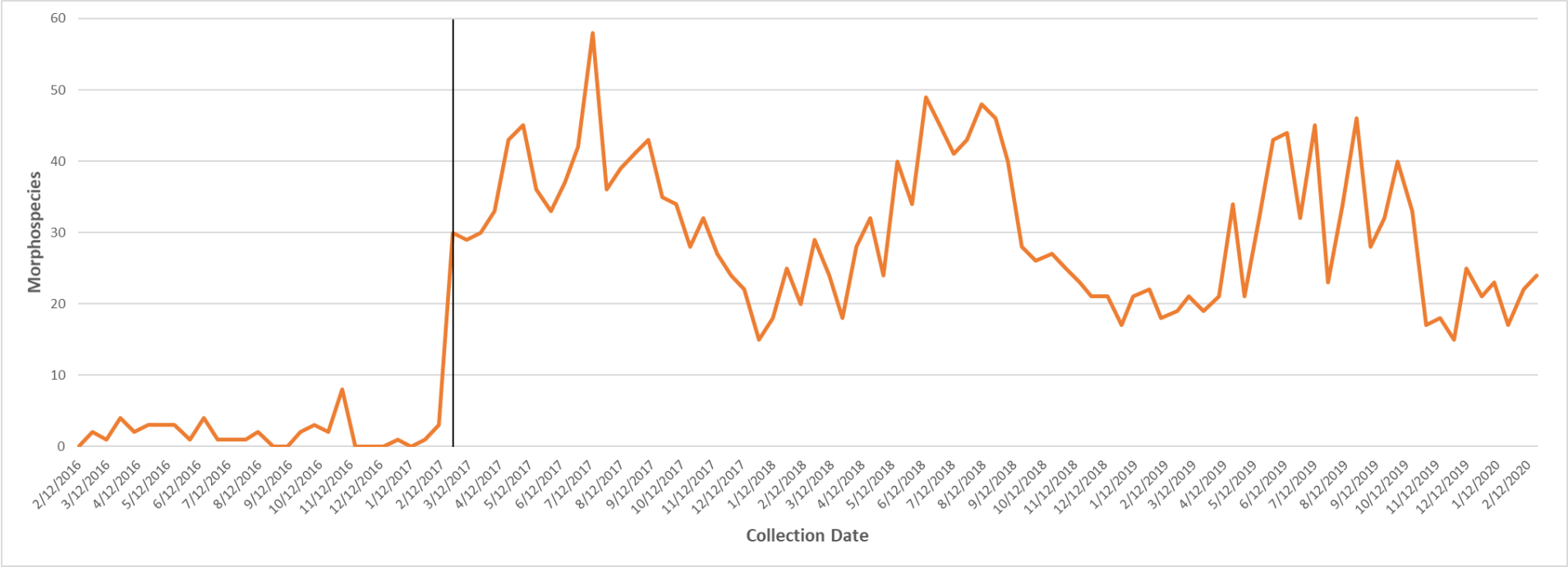


Figure 2. Total morphospecies caught by all pitfall traps, both twig- and antifreeze-based, over 4 years.

Results

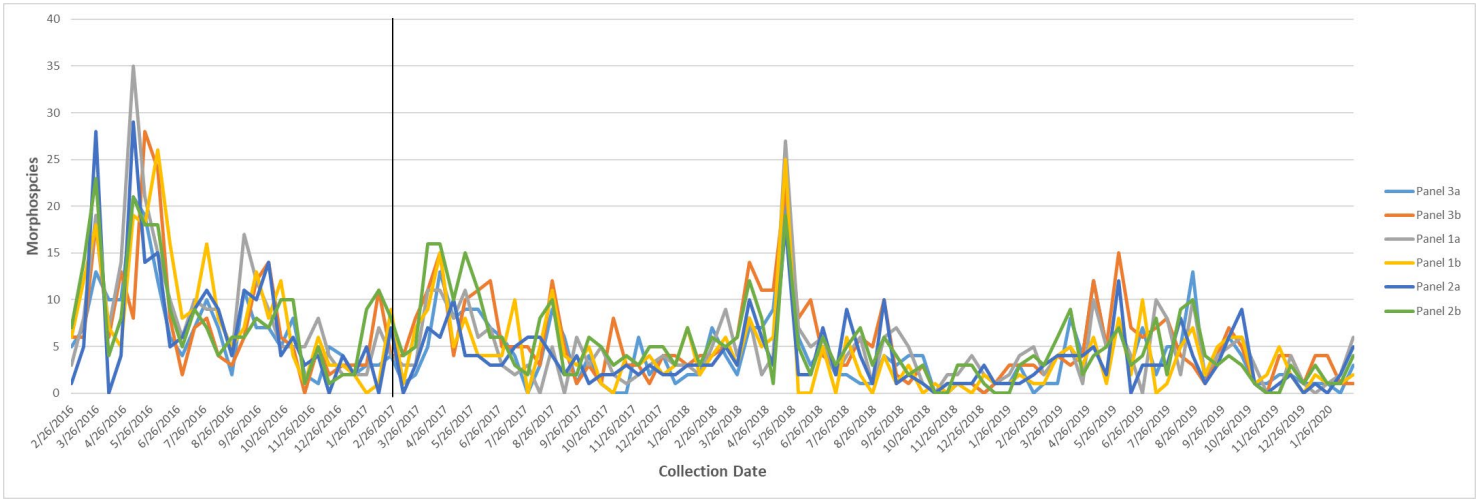


Figure 3. Morphospecies caught by panel trap over 4 years.

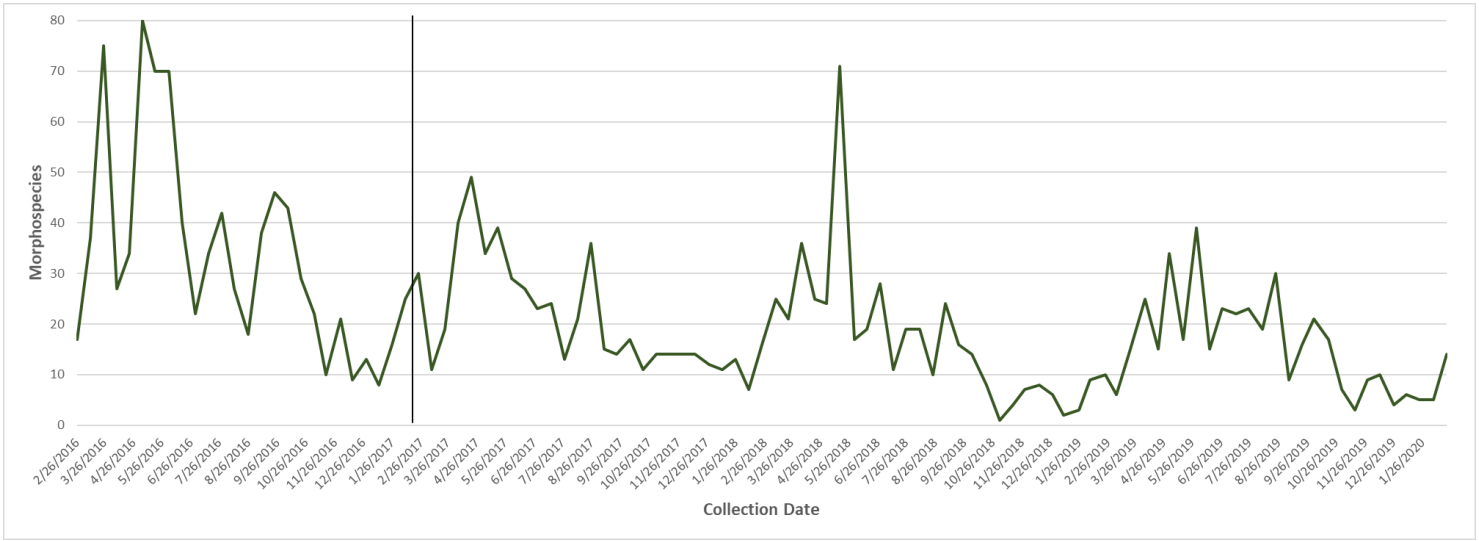


Figure 4. Total morphospecies caught by panel traps over 4 years.

Results

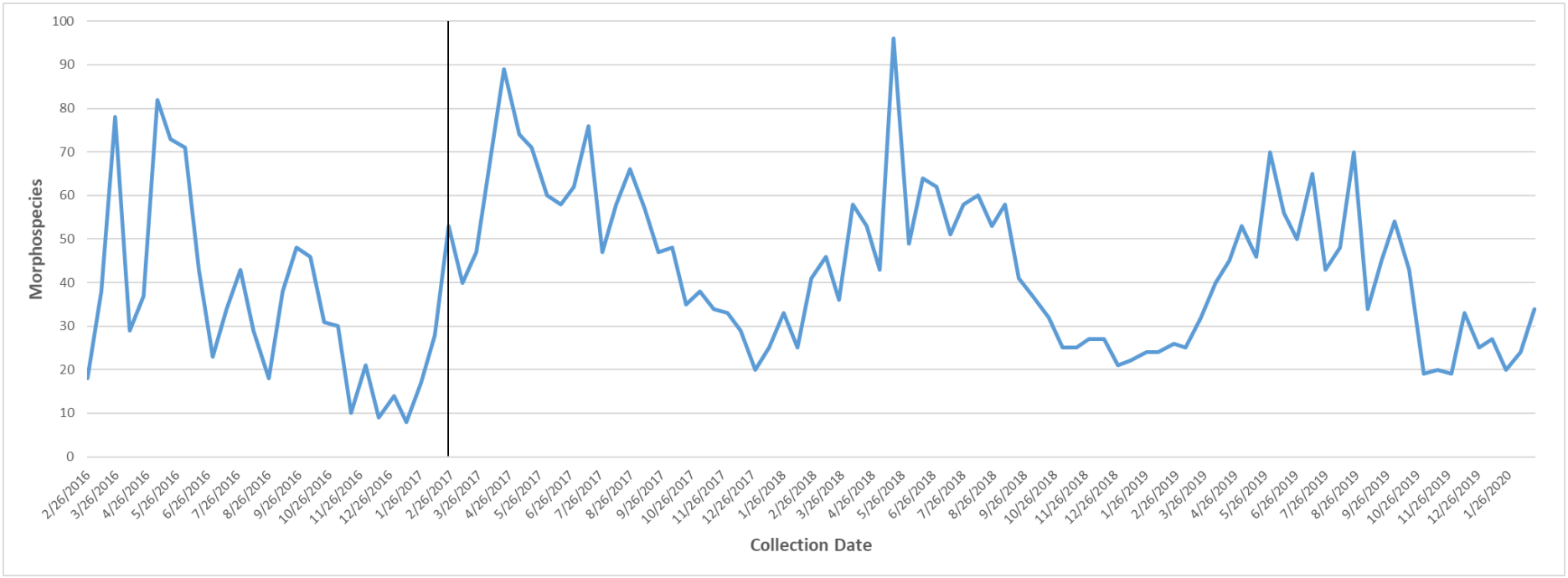


Figure 5. Total morphospecies caught by all traps in Eufaula, AL over 4 years.

Results

Pre-Inoculation (twig-based)

	Winter 1 n = 1		Spring 1 n = 7		Summer 1 n = 6		Fall 1 n = 7		Winter 2 n = 6	
	Shannon	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**
Control	-	-	-	-	-	-	-	-	1.73	4.83
Wound	-	-	-	-	-		-	-	1.27	3.17
Low	-	-	-	-	-		-	-	1.63	4.34
Medium	-	-	-	-	0.04	0.1	-	-	1.56	4.02
High	-	-	0.03	0.09	-	-	-	-	1.88	5.8

Inoculation occurred here

Post-Inoculation (twig and antifreeze-based)

	Spring 2 n = 7		Summer 2 n = 6		Fall 2 n = 7		Winter 3 n = 6	
	Shannon	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**
Control	1.69	4.98	1.75	5.13	1.41	3.76	1.07	2.94
Wound	1.57	4.38	1.66	4.67	1.33	3.81	0.81	2.35
Low	1.26	3.42	1.6	4.48	1.38	4.01	0.99	2.81
Medium	1.14	3.02	1.61	4.32	1.37	3.31	0.95	2.71
High	1.59	4.61	1.71	4.89	1.33	3.69	0.82	2.33

Results

Post-Inoculation (twig and antifreeze-based)

	Spring 3 n = 7		Summer 3 n = 7		Fall 3 n = 6		Winter 4 n = 7	
	Shannon	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**
Control	0.92	2.05	1.17	3.13	0.9	2.25	0.58	1.5
Wound	0.7	2.17	1.43	4.15	0.76	1.74	0.72	1.89
Low	0.92	2.3	1.47	4.15	0.99	2.57	0.8	2.39
Medium	0.68	1.98	1.49	4.2	0.75	1.8	0.29	0.85
High	1.3	4.05	1.76	4.98	0.85	2.03	0.7	1.78

	Spring 4 n = 6		Summer 4 n = 7		Fall 4 n = 6		Winter 5 n = 6	
	Shannon	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**
Control	1.01	2.52	1.62	4.55	0.91	2.37	0.85	2.25
Wound	0.84	2.22	1.5	4.12	0.97	2.58	1.03	2.76
Low	0.85	2.21	1.32	3.69	0.79	2.13	0.83	2.25
Medium	1.08	2.75	1.17	2.97	0.94	2.49	0.86	10.29
High	0.76	1.86	1.24	3.04	0.99	2.73	0.94	2.59

Conclusions

- 771 species in 16 orders, including bark beetles and other insects of concern
- Panel traps caught more morphospecies than pitfall traps
- Pitfall traps caught different species than panel traps
- Species totals varied seasonally
- Treatment did not significantly affect diversity
- Panel traps showed a significant change in diversity by year

Conclusions

- The addition of new traps in year 2 was able to show more stable trends over the following years
- Diversity naturally affected by tree growth, detritus, weather, monocultures

- Ongoing . . .
  - Analyze data by prominent insect orders
  - Dominance by fire ants

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