

# Turning the tables all over again: The impact of a specialist herbivore on a carnivorous plant

Rachel N. Carmickle and John D. Horner  
Department of Biology, Texas Christian University, Fort Worth, Texas 76129

Carnivorous plants inhabit nutrient-poor environments and supplement nutrient uptake by trapping and digesting prey, usually insects. However, carnivorous plants are also subject to herbivory, but herbivory in carnivorous plants has not been well studied. Herbivory by the specialist herbivore *Exyra semicrocea* on *Sarracenia alata* results in loss of nutrients and photosynthetic tissue (direct losses) and decreases prey capture (indirect losses).

Hypotheses: Herbivory by *E. semicrocea* has a negative effect on fitness as estimated by plant growth. We further hypothesized that the combined effect of direct and indirect losses is greater than the effects of either direct or indirect losses alone.

## Study Species



Fig. 1. Larva of *Exyra semicrocea* (Noctuidae)

In addition to direct damage caused by feeding, larvae girdle pitchers and spin webs across pitcher openings, resulting in indirect losses due to reduced prey capture.



Fig. 2. *Sarracenia alata* in field site in Leon county, Texas. *S. alata* utilizes passive pitfall traps.

## Methods



Fig. 3. Pitcher opened lengthwise showing evidence of larval feeding (direct losses). Larvae feed from inside the pitcher to the outer cuticle, leaving a 'window' (see also image at uppermost right).

### Experimental cross-classified design

		Herbivory	
		+	-
Supplemental Feeding	+	Direct losses	No losses
	-	Direct & Indirect losses	Indirect losses

To determine the impact of herbivory, total season pitcher growth was used as an estimate for plant fitness



Fig. 4. Manipulation setup in the field. Plastic ring and cotton 'plugs' in pitcher openings exclude *Exyra semicrocea*.

## Results (cont.)

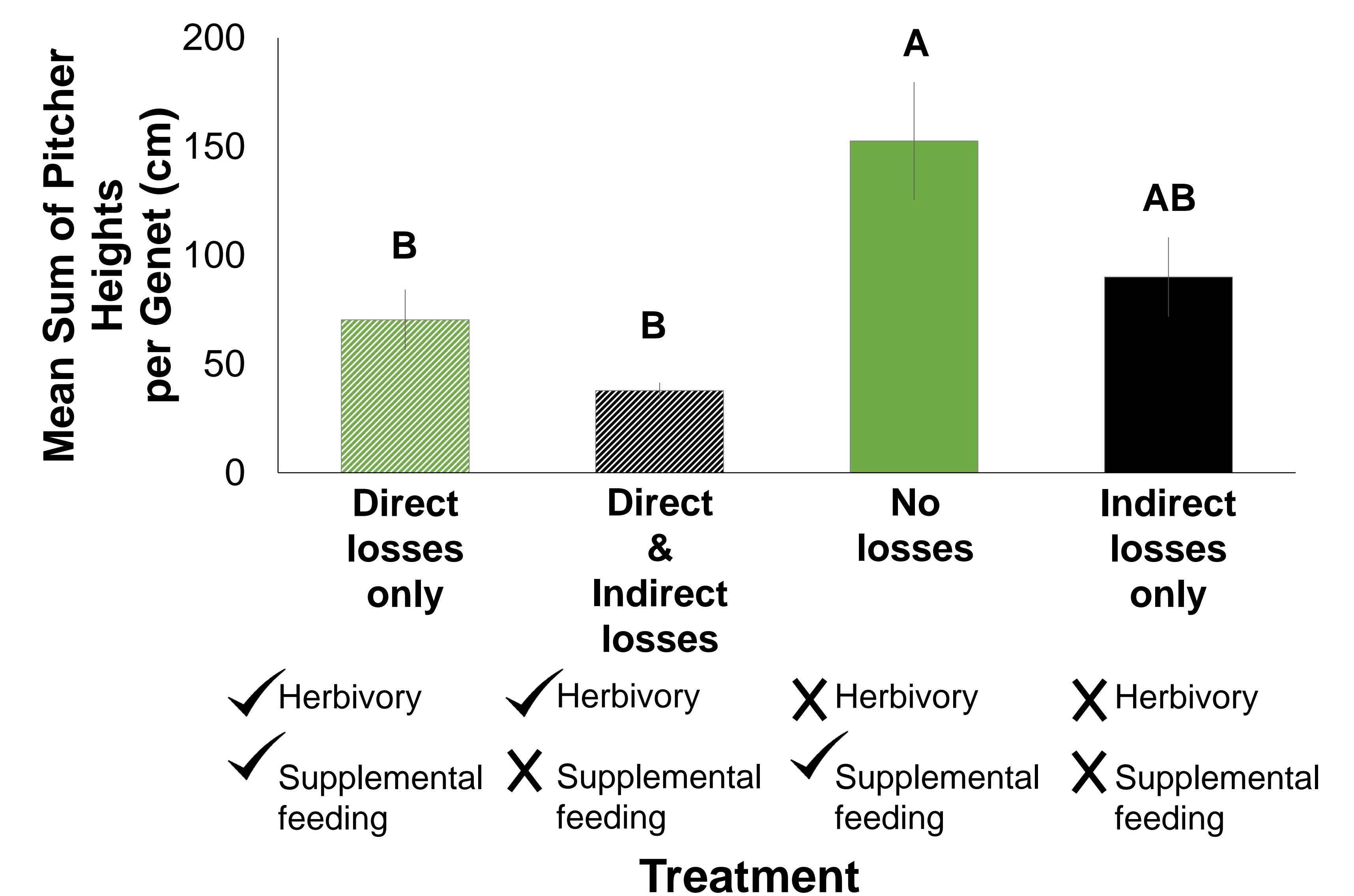


Fig. 5. Effect of *Exyra semicrocea* on pitcher growth (first two pitchers omitted). Columns with different letters are significantly different ( $p < 0.05$ ). Error bars are  $\pm 1SE$ . Herbivory:  $F_{1,45} = 9.44$ ,  $p = 0.004$ ; Feeding:  $F_{1,45} = 4.72$ ,  $p = 0.04$ ; Interaction: ns.

## Results

- Five transects of ten quadrats each showed  $86.2\% \pm 2.86$  (mean  $\pm SE$ ) of pitchers in the study population were attacked by *E. semicrocea*
- Scans of attacked pitchers showed that on average  $16.4\% \pm 1.35$  of the total area of each attacked pitcher was consumed ( $n = 68$ )
- Total N lost, per pitcher =  $1.17 \text{ mg} \pm 0.079$ ,  $n = 30$
- Total P lost, per pitcher =  $0.0433 \text{ mg} \pm 0.0029$ ,  $n = 30$

**Conclusion:** The combination of direct and indirect losses have a significant negative effect on plant growth ("fitness") in *S. alata*.

**Acknowledgements:** We thank Wes Nowlin of the Aquatic Ecology Lab at Texas State University for nutrient analysis, and Zane Winer for help in the field. This research was supported by the TCU Research and Creative Activities Fund and the Adkins Fund.