**Title:**

**Abstract**

**Introduction**

Traits such as SLA, reproduction, growth, and plasticity have been identified to unite plants that successfully invade (Pysek et al 2013). Performance attributes such as these may be influenced by environmental factors such as light availability and resident herbivores once established in the invasive range. Although release from enemies is often attributed to invasion success (Keane and Crawley 2003), invasive species necessarily encounter resident herbivores, pathogens, predators, and parasites in the recipient range, and these have the capacity to limit the spread of invasions. In addition, a growing body of literature shows that invasive species can accumulate enemies over time (Flory and Clay 2013), which can further mediate the effects of invasions (Stricker et al. in press, Stricker and Stiling 2012, Flory et al. Ecosphere).

Over time, invasive species adapt to conditions in the new range. Indeed, many cases have been documented in which invasive species exhibit local adaptation (Novy citation). One way to identify whether adaptation has occurred is by investigating patterns over latitudinal gradients. Latitudinal differences in responses to stress can indicate that local adaptation has occurred. In addition, many ecological processes vary in predictable ways as one moves away from the Equator. One well-known ecological phenomenon is the latitudinal gradient in biodiversity, in which biological communities become more species-rich closer to the Equator. As a result, plants are thought to be better defended against a more diverse enemy assemblage at lower latitudes. In addition, plants at southern latitudes experience longer growing seasons and experience light availability differently than plants growing in the north.

Phenotypic plasticity plays an important role in species invasions and is also impacted by latitude.

Understanding how invasive plants respond to extraneous factors is useful in predicting the long-term impacts of invasions and can help direct effective management strategies. This information is also useful in helping to understand what habitat types are most vulnerable to invasion.

**Materials and Methods**

An herbivory treatment was implemented by…Caterpillar herbivory reduced overhead leaf area by 13.1% on average before FAW pupation. Because we were interested in a much more significant level of herbivory, we supplemented damage by FAW by removing most of the remaining leaf biomass by hand, resulting in a total reduction of 45.5% overhead leaf area. These estimates of leaf area loss are likely to be conservative because they do not account for the loss of biomass under the topmost level of vegetation.

Although we originally intended to quantify total reproductive effort per pot, it was not feasible to do so as a result of the vast number of seed heads produced as well as the cryptic cleistogamous seeds produced in leaf sheaths. Previous studies have shown that Microstegium biomass and total reproductive effort are tightly correlated at XX, so we assume here that biomass and reproduction are equivalent.

**Results**

We detected negative relationships for all attributes with latitude, indicating that Microstegium performance decreases with increasing latitude. The exception to this pattern was in terms of the number of seeds per seed head under unshaded and herbivore-damaged conditions, where the relationship was positive. This latter result suggests that herbivory increases the number of seeds per seed head at more northern latitudes, although the number of seeds per seed head was still higher under ambient light when the plants were not attacked by herbivores.

**Discussion**

We further show that herbivory reduces biomass by X% and tiller length by X%. Furthermore, shaded plants produce X% less biomass and X% shorter tillers. Because biomass and total reproduction are highly correlated, this suggests that high levels of defoliation by generalist herbivores can negatively impact Microstegium reproduction. However, Warren et al. showed that Microstegium invasions are highly density-dependent, and this reduction is likely not sufficient to mitigate invasions. On the other hand, populations growing under shaded conditions may be less problematic from a management perspective than those growing in full sun as a result of the substantial decrease in biomass caused by shade.

Interactions with herbivory only occurred in reproductive traits, indicating that Microstegium may exhibit latitudinally dependent plasticity in reproductive traits such as seed mass and number of seed per seed head. [It is not clear how this relates to seed number, as there is a tight correlation between seed production and biomass.] There was also a marginal interaction for senescence.

Overall, there was a lack of plasticity in non-reproductive traits, including SLA, biomass, tiller length, and flowering date.

This experiment showed obvious effects of light and herbivory on Microstegium, although the reduction in light seemed to have a more substantial effect than herbivory.

Increases in seed mass are correlated with increased chances of successful seedling establishment.