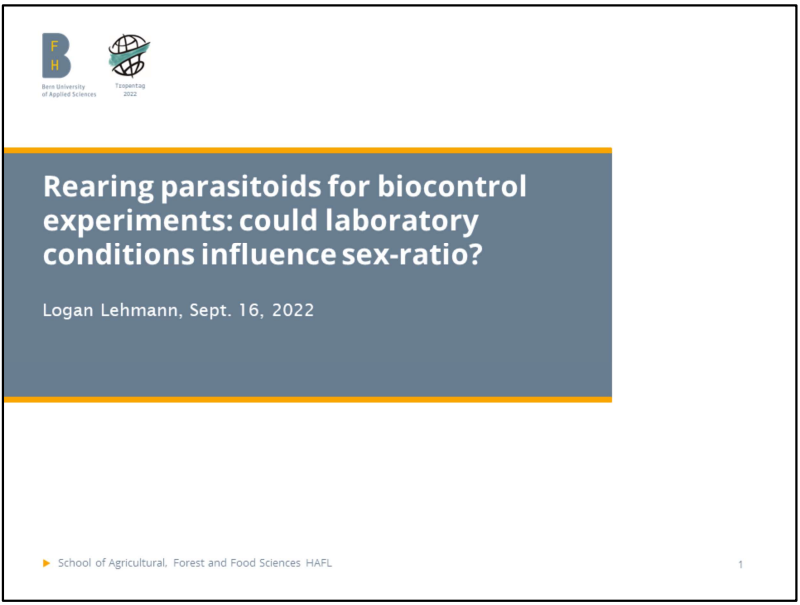
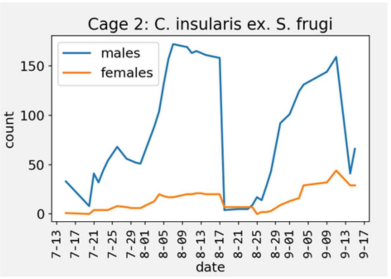


Rearing parasitoids for biocontrol experiments: could laboratory conditions influence sex-ratio ?
This is a question resulting from my thesis internship at CABI Switzerland, where I had to maintain a colony of parasitoid wasps to use in oviposition experiments.

Introduction

- My thesis: *Chelonus insularis* as a potential biocontrol agent against *Spodoptera frugiperda* (FAW)
- During the experiments, **sex-ratio** fluctuated greatly
- **Could it be because of environmental parameters ?**



The wasp was being evaluated as a potential biocontrol agent against the Fall Armyworm.
There were four cages. Here you can see the number of males and females over time in cage n°2.
As the number of individuals increased, the number of males increased much more than the number of females.
Why is this important ?
If the colony runs out of females, it goes extinct.
There are a number of factors that can influence sex-ratio in parasitoid wasp colonies.
Environmental parameters were suspected at one point.
But which ones ?

Methods

- Quantitative text analysis
- 712 abstracts and 201 full-texts
- List of parameters to investigate

  temperature, humidity, pressure, diet, environment structure, host quality, population dynamics
- Each **topic** has a list of keywords, eg:

  structure: patch*, habit*, distan*, locat*...
  dynamics: LMC, compet*, *ism_rate*, life_histor*...

- Analysis based on the number of hits for each topic

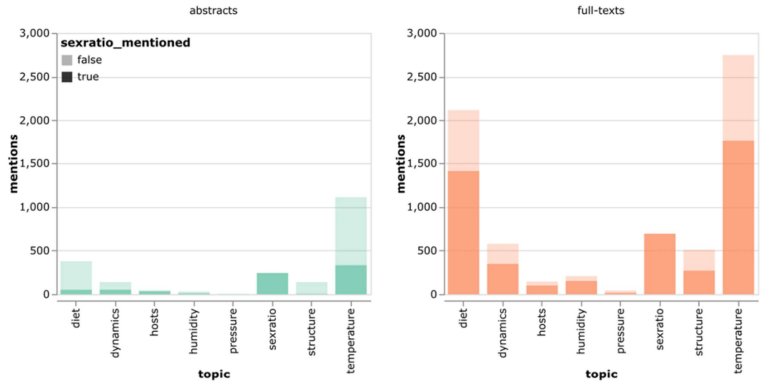
  Prevalence ***R*** (count)

  Presence ***P*** (true/false)

My idea was to perform a search in papers involving parasitoid rearing, and try to see if certain topics are more frequently talked about.
A list of topics was obtained from a book on insect rearing by John C. Schneider.
Each topic is assigned a list of expressions to match, using wildcards.
And then it's a simple word count.

Results: hits for each topic

Times each topic is mentioned in abstracts (n=712) and full-texts (n=201) when sex-ratio is mentioned



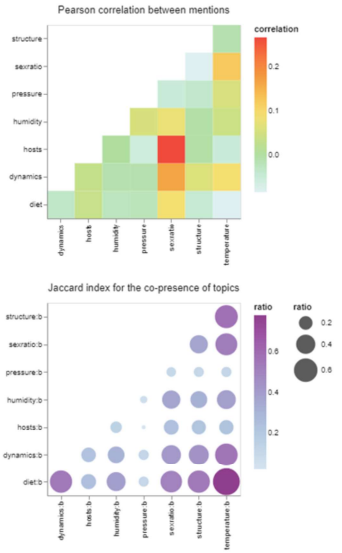
- Same distribution except for diet and humidity.

And here is the number of hits in each corpus.
Abstracts on the left, full texts on the right.
Roughly the same distribution.
Pressure and humidity are very rarely mentioned.
It's common to include temperature in insect studies because of the impact it has on their development.
Temperature and diet are important to include for reproducibility. Beyond the goal an experiment might have, these parameters are typically just part of the experiment description, for reproducibility etc...

Results : relationships

- In **full-texts**
- Highest correlation
  R sex-ratio and ***R*** host quality
  r = 0.27
- Highest co-occurrence
  P temperature and ***P*** diet
  j = 0.78
- Highest effect in regression
  P sex-ratio on ***P*** temperature
  β = 1.41 with p = 0.001

- Only weak relationships detected



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If we look at the number of hits, there is only a weak correlation between sex-ratio and host quality.
It's not surprising, since host quality is the main factor considered by the female wasp when laying eggs.
If we look at the presence of topics, the highest index of co-occurrence is with temperature and diet.
In other words, 3 out of 4 papers mentioning either temperature or diet also mention the other one.
This is bound to happen when the two topics are so prevalent across the corpus.
The Jaccard index does not accommodate the relative importance of each topic.
So regression was tried next, and the only effect that was found was a slight positive effect of the mention of sex-ratio on that of temperature.
Here this simply indicates that sex-ratio is mentioned in the greater proportion of studies mentioning temperature.

We can conclude that the relationship tests were inconclusive !
There is no clear tendency of a topic to appear every time sex-ratio appears.

Conclusion

- Most studies involving parasitoids mention temperature and diet
- Experimenters rarely mention other environmental parameters
- Quantitative text analysis found no strong relationships between sex-ratio and environmental parameters

References

Schneider, J.C. (2009) *Principles and procedures for rearing high quality insects*. Mississippi State MS: Mississippi State University.

In summary, temperature and diet are very often mentioned in studies involving parasitoid rearing, relative to other important parameters.
The prevalence or presence of sex-ratio were not associated with any of the other topics.
The analysis was pretty simple but in retrospect I think it can lead us to a useful conclusion,
which is that causes for sex-ratio fluctuations probably don't lie in environmental parameters.
Thank you for your attention.