Prevalence of exotic and native plant food in the gut contents of *Melanoplus femurrubrum* grasshoppers: molecular confirmation of diet

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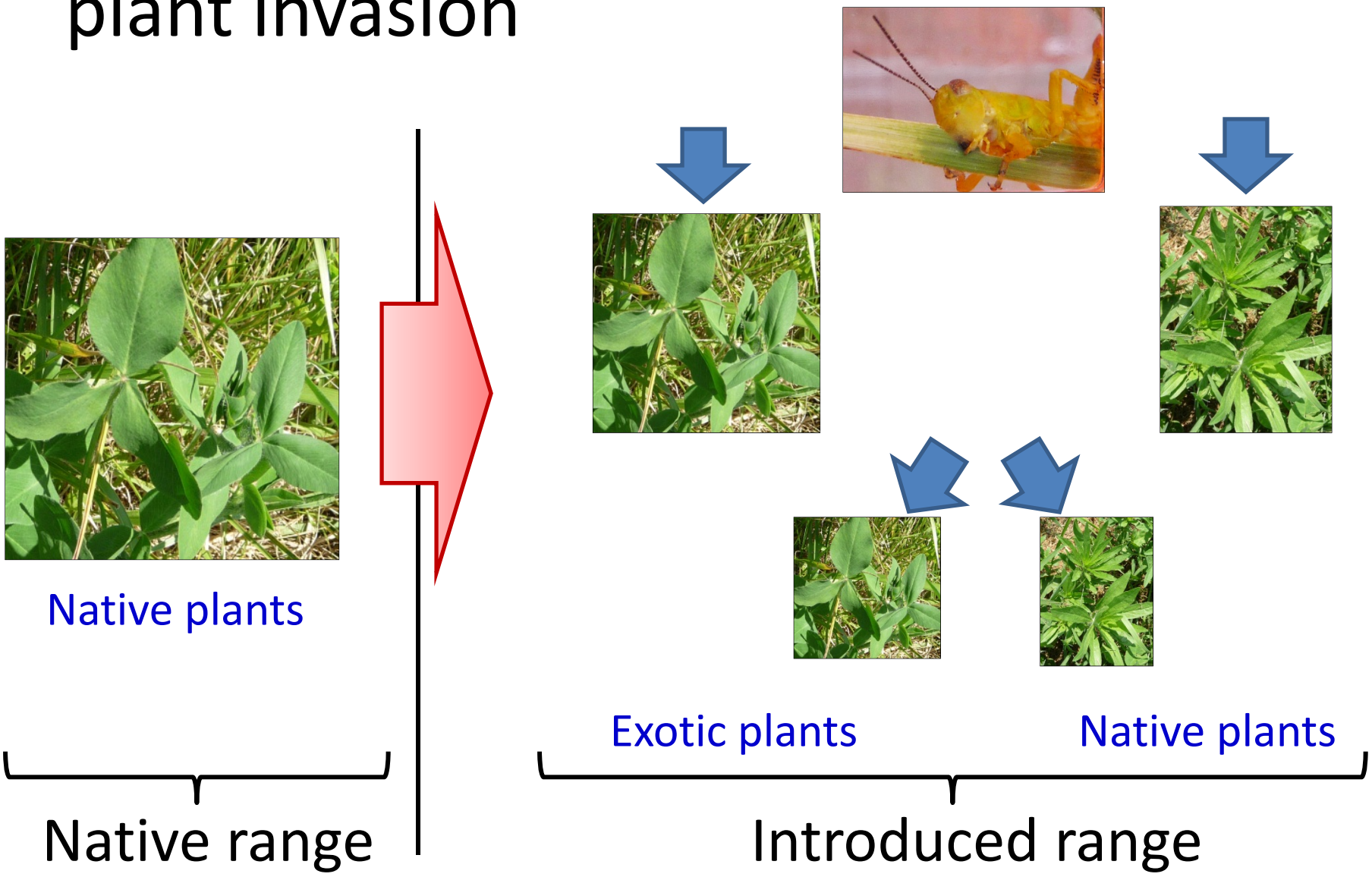
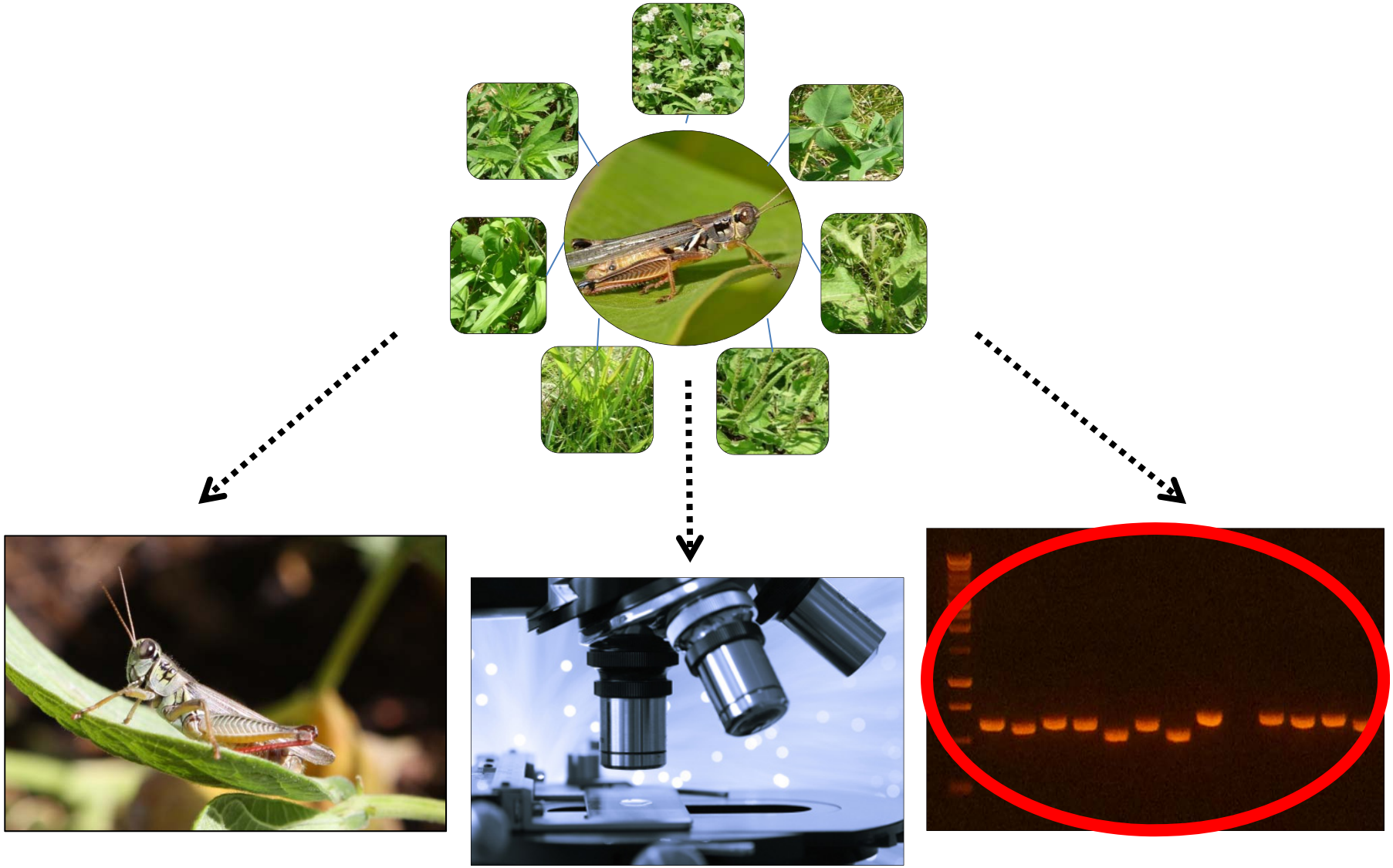
MGRS 2014

❖ Generalist herbivores might affect plant invasion

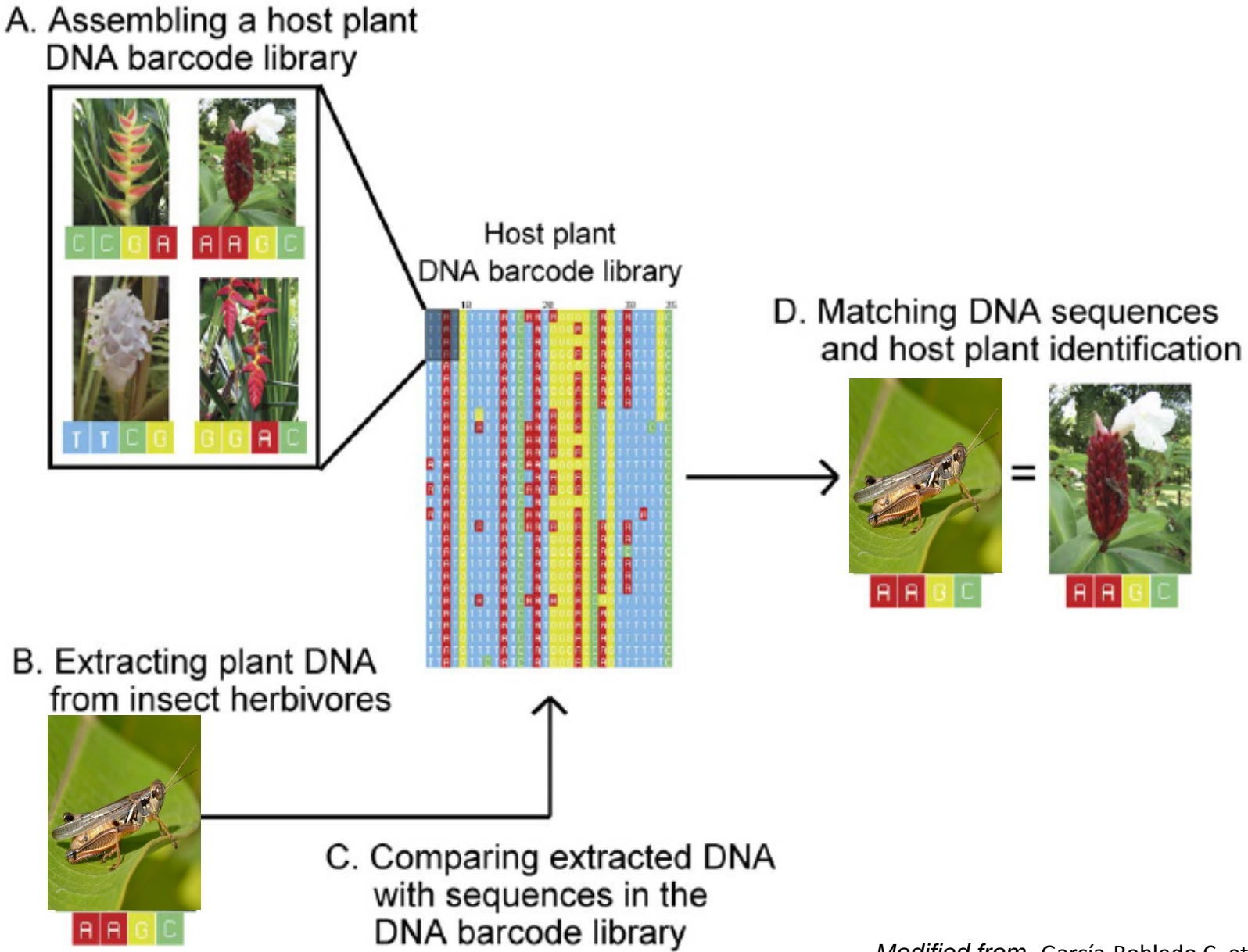


Modified from Keane & Crawley (2002)

- Accurate confirmation of plant food digestion is critical



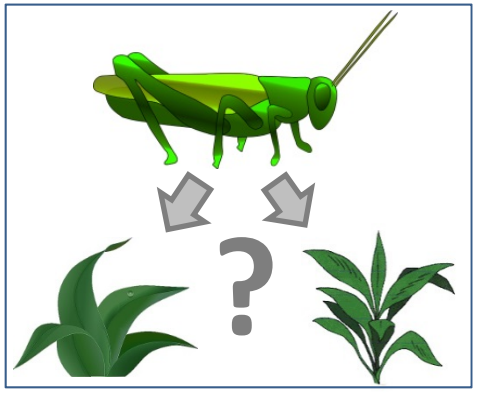
❖ Molecular confirmation of insect diet



Modified from García-Robledo C. et al. (2013)

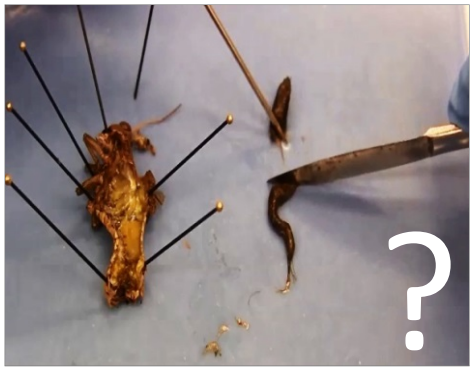
❖ Information about grasshopper gut contents is limited

- Grasshopper feeding preferences on native and exotic plants – results from studies are mixed



- Most of the studies have been done using field enclosures or greenhouse – herbivory under natural conditions?

- Studies on molecular confirmation of diet have been done for a limited number of insect species – grasshoppers?



Research questions/hypotheses

RQ 1. Do *M. femurrubrum* grasshoppers incorporate exotic plants in their diet?

Hypothesis 1. *M. femurrubrum* grasshoppers do not avoid exotic plants and their gut contents contain ingested exotic plants

RQ 2. If yes, do they prefer to feed more on exotic than on native grasses?

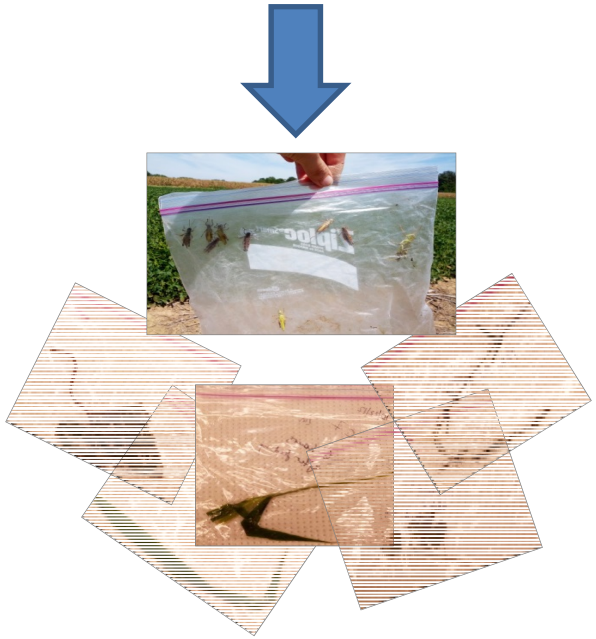
Hypothesis 2. Gut contents of *M. femurrubrum* grasshoppers contain a similar proportion of exotic plants and native plants.

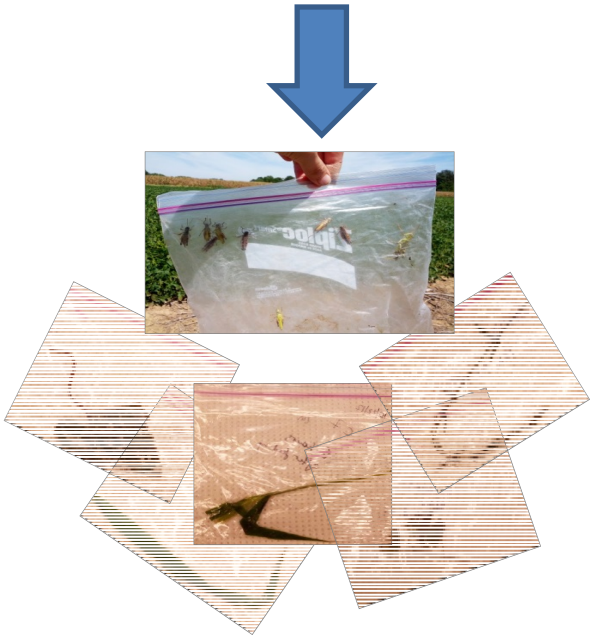
Hypothesis 3. Gut contents of *M. femurrubrum* grasshoppers contain a greater proportion of exotic plants compared to native plants.

Study Sites

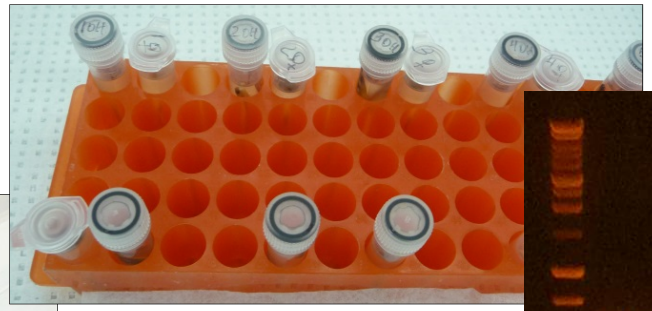
Cincinnati Center
for Field Studies (OH)

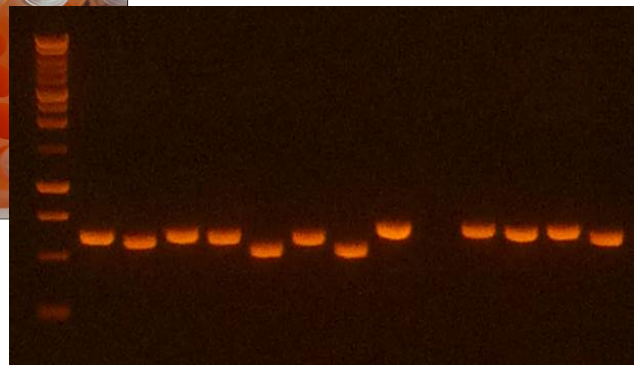
Western Maryland
Research and Education Center (MD)





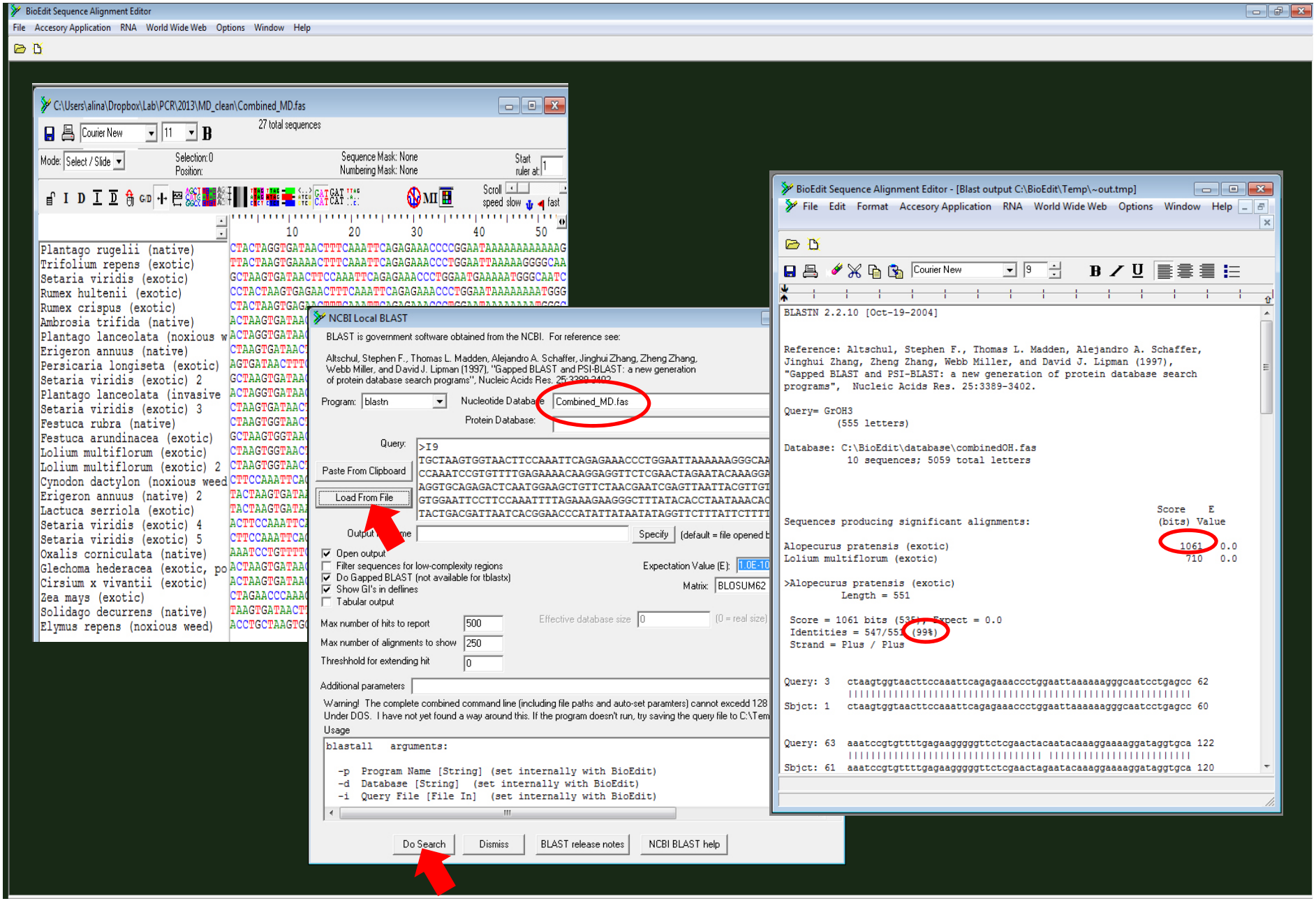
Identification of ingested plants
Step 1. Amplification of *trn*L (UAA) intron



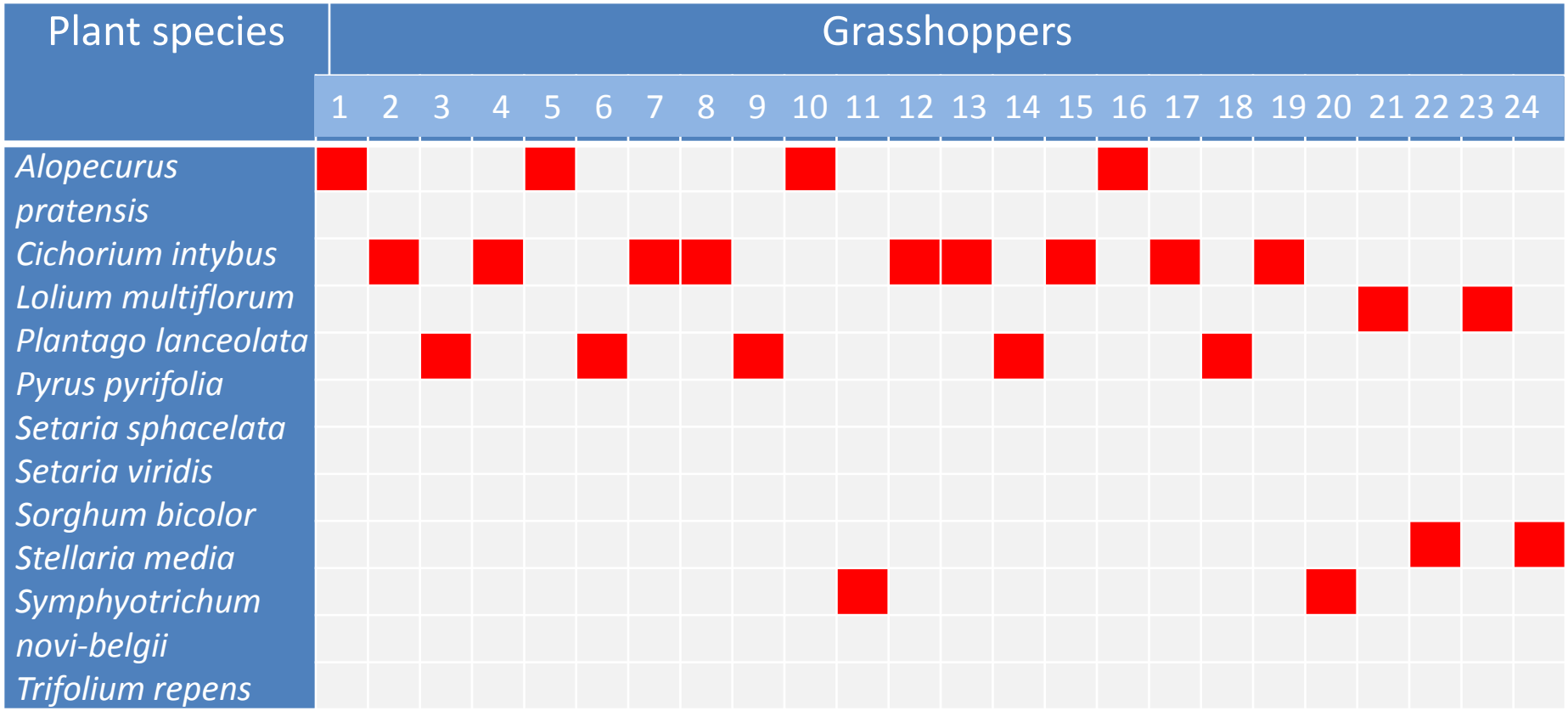


Avanesyan (2014)

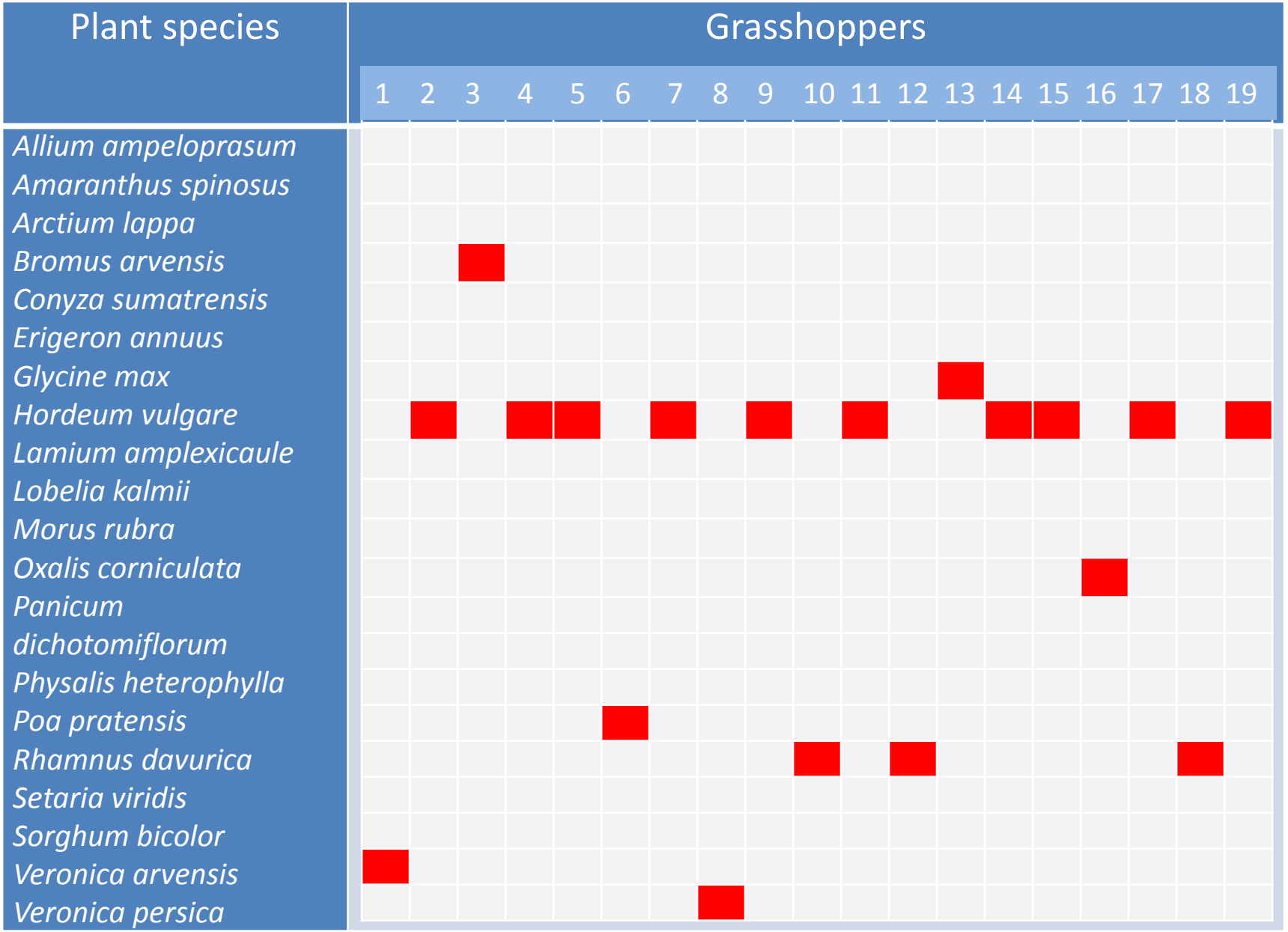
Step 2. Creating a local plant reference database



Step 3. Host plants identification (UCCFS, OH)



Host plants identification (WMREC, MD)



Step 4. Determining plant origin

Plant species	Origin	Grasshopper feeding choices	
		Number	%
Alopecurus pratensis	Exotic	4	16.67
Cichorium intybus	Exotic	9	37.50
Lolium multiflorum	Exotic	2	8.33
Plantago lanceolata	Exotic	5	20.83
Pyrus pyrifolia	Exotic	-	-
Setaria sphacelata	Exotic	-	-
Setaria viridis	Exotic	-	-
Sorghum bicolor	Exotic	-	-
Stellaria media (L.) Vill.	Exotic	2	8.33
Symphyotrichum novi-belgii	Native	2	8.33
Trifolium repens	Exotic	-	-

OH

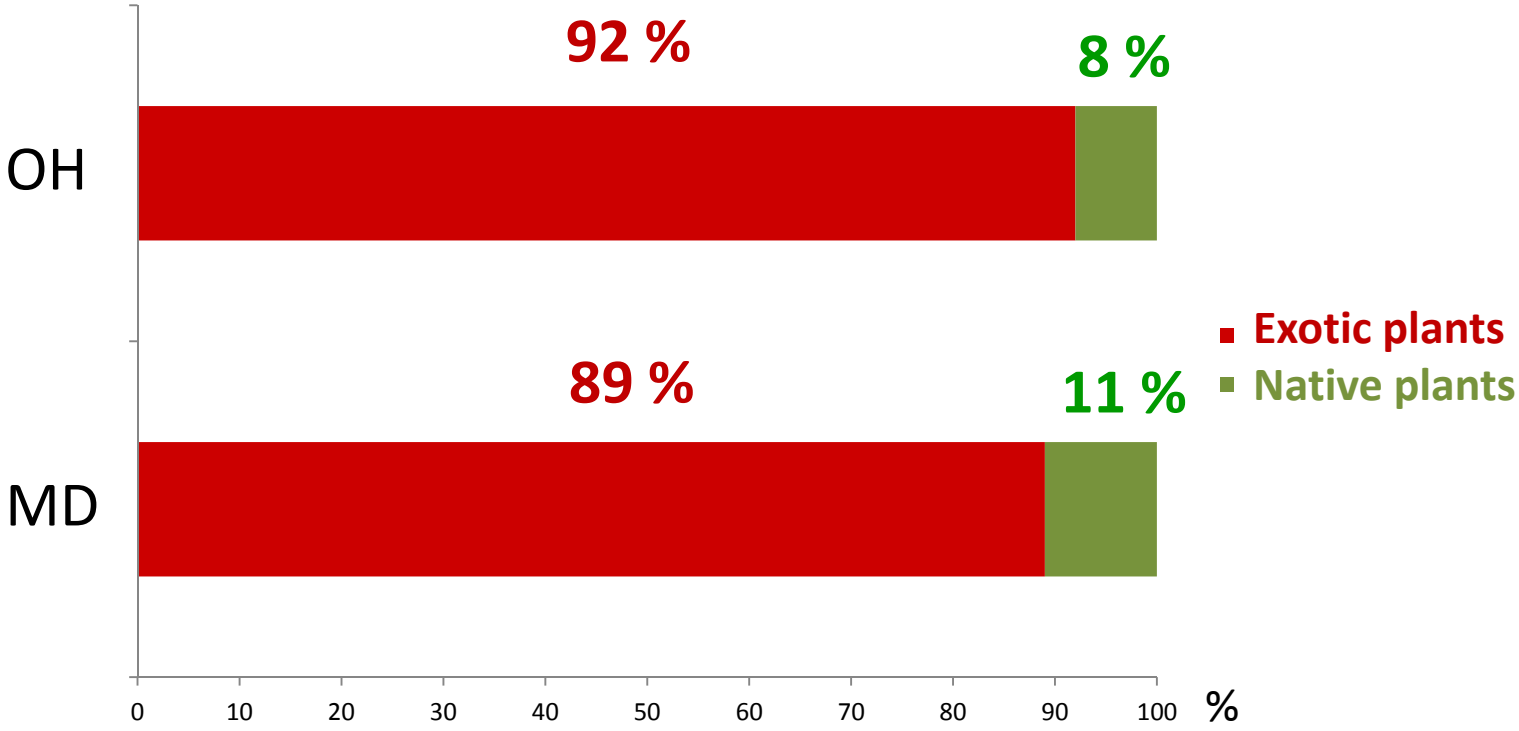
Plant species	Origin	Grasshopper feeding choices	
		Number	%
Allium ampeloprasum	Exotic	-	-
Amaranthus spinosus	Native	-	-
Arctium lappa	Exotic	-	-
Bromus arvensis	Exotic	1	5.26
Conyza sumatrensis	Native	-	-
Erigeron annuus	Native	-	-
Glycine max	Exotic	1	5.26
Hordeum vulgare	Exotic	10	52.63
Lamium amplexicaule	Exotic	-	-
Lobelia kalmii	Exotic	-	-
Morus rubra	Native	-	-
Oxalis corniculata	Native	1	5.26
Panicum dichotomiflorum	Exotic	-	-
Physalis heterophylla	Native	-	-
Poa pratensis	Native	1	5.26
Rhamnus davurica	Exotic	3	15.79
Setaria viridis	Exotic	-	-
Sorghum bicolor	Exotic	-	-
Veronica arvensis	Exotic	1	5.26
Veronica persica	Exotic	1	5.26

MD

Results

Estimation of the prevalence of ingested plants

P<0.0001, Binomial test



The number of grasshoppers = “number of trials”

Presence of exotic plants in grasshopper guts = “number of successes”

Conclusions

RQ 1. Do *M. femurrubrum* grasshoppers incorporate exotic plants in their diet?

Hypothesis 1. *M. femurrubrum* grasshoppers do not avoid exotic plants and their gut contents contain ingested exotic plants

Yes!

RQ 2. If yes, do they prefer to feed more on exotic than on native grasses?

Hypothesis 2. Gut contents of *M. femurrubrum* grasshoppers contain a similar proportion of exotic plants and native plants.

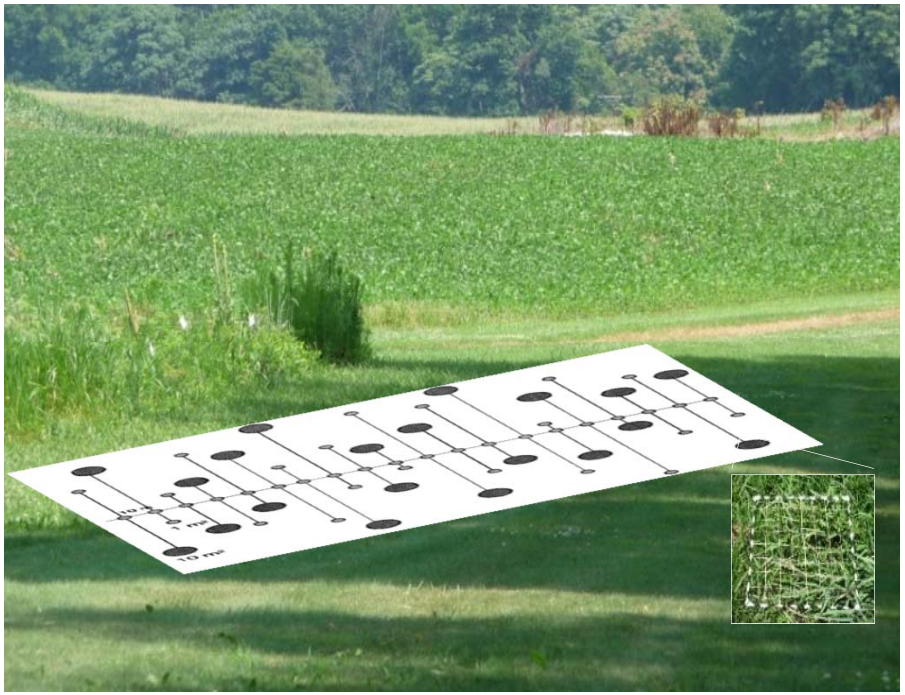
No, the plant proportion was different.

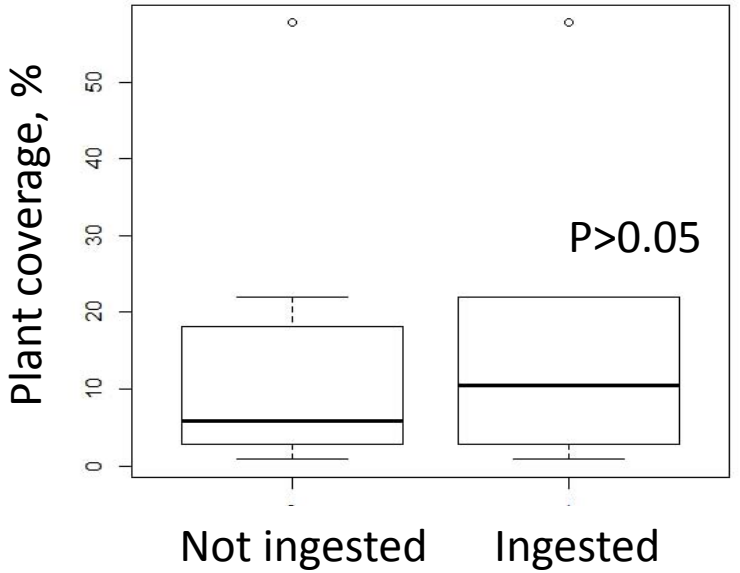
Hypothesis 3. Gut contents of *M. femurrubrum* grasshoppers contain a greater proportion of exotic plants compared to native plants.

Yes!

Future directions

- Explore whether the plant coverage (for both native and exotic plants) affects grasshopper feeding choice



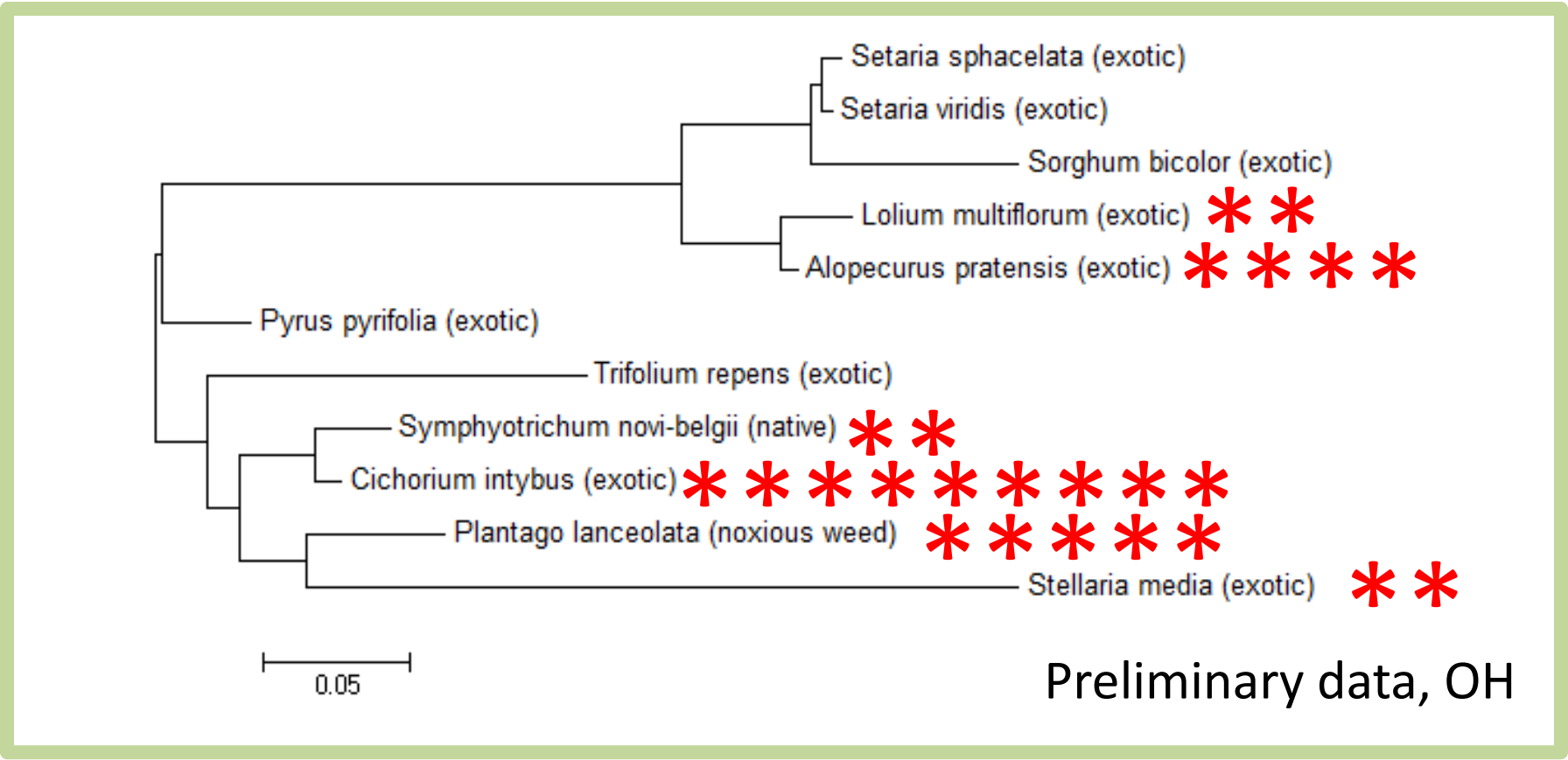


Preliminary data, OH

Native vs. exotic plants?

Future directions

- Explore whether the taxonomic relatedness of plants affects grasshopper feeding choice



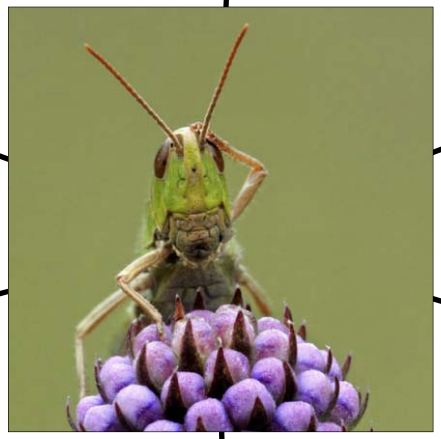
Closely related vs. distantly related plants?

Applications of the study

Plant-insect interaction in the introduced range

Insect feeding behavior

Plant-insect associations



Insect feeding preferences

Control of agricultural pests

Biotic resistance of native communities to plant invasion

Thank you!

University of Cincinnati:
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Angelo Randaci
Roger Ruff
Dr. George Uetz

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Tim Ellis
Dr. William Lamp

Wieman Wendel Benedict Award 2011, 2012, 2013, University of Cincinnati
Entomological Society of America 2013, ESA Eastern Branch 2013