

A soil biota comparison between areas of invasive and native plants at Brumbaugh Nature Center, University of Mount Union

Evelyn Isenberg

Biology Dept. of University of Mount Union

Abstract:

- The purpose of this study is to determine invasive plants species potential impact on soil biota.
- Soil samples and leaf litter were collected from three invasive and three native plant areas from the Nature Center of UMU.
- Bacteria sorted by colony morphology and gram staining.
- Soil invertebrates diversity(H') determined by Shannon Wiener Index.
- Bacterial colony were types similar; most gram (+).
- Native areas had higher soil invertebrate diversity (H'=0.82) than invasive areas diversity (H=0.49).
- This study indicates that invasive plants may not have an impact on bacteria, but can negatively impact soil invertebrates' diversity.

Introduction:

- Invasive species can have negative impacts on the ecosystem and economy.
- An invasive species is non-native and causes harm to the ecosystem, economy or human health (USDA).
- Often invasive species are successful because they escape natural predators.
- Example: Golden Apple Snail, *Pomacea canaliculata*, which was introduced to Asia as a new source of protein (Mooney, 2005).The snail infested rice fields leading to economic damage.
- Invasive plants can reduce diversity and abundance of native plant and animal communities (Stefanowicz et al. 2019).Also can impact activity, biomass, and structure of soil microbes community, influencing decomposition and nutrient cycling. They can alter soil properties: soil carbon, nitrogen, salinity, moisture and pH (Batten et al. 2004).

Methods:

- Performed at Brumbaugh Nature Center of the University Mount Union during spring semester of 2020.
- Soil samples and leaf litter obtained from three invasive plant area and three native plant areas.
- Soil invertebrates extracted from leaf litter with the Burslem-Tullgren funnel.
- Soil invertebrates identified to order with *Soil-Diversity Invertebrates* by Meyer JR (1994).
- Diversity (H') of invertebrates determined by Shannon Wiener Index equation $H' = \sum(\pi_i \cdot \log \pi_i)$.
- Soil bacteria was incubated in 37°C and 25°C.
- Colony morphology determined by shape, color and texture.
- Gram staining performed on isolated bacterial colonies to distinguish bacterial colonies with similar morphology. (Leboffe MJ et al., 2008)

Results:

Areas 1-3 are areas with identified native plant species. Area 1 had a mix of native Maple trees and Black Cherry (*Prunus Serotina*). Area 2 had primarily Pawpaw (*Carica papaya*) trees and area 3 had mostly Spice bush (*Lindera benzoin*). Areas 4-6 are areas with known invasive plant species. Area 4 had Oriental Bittersweet (*Celastrus orbiculatus*) and Area 5 had Norway Maple trees (*Acer platanoides*) present. Multiflora rose (*Rosa multiflora*) was located in area 6.

Table 1: Comparison of soil bacteria from native and invasive plant areas

Area	Native						Invasive					
	1		2		3		4		5		6	
Degrees (C°)	25°	37°	25°	37°	25°	37°	25°	37°	25°	37°	25°	37°
Gram (+)	3	2	4	1	4	1	2	3	4	5	4	4
Gram (-)	1	1	1	2	0	1	0	1	0	0	0	0
Chain of bacilli	2	3	1	2	3	2	1	2	4	3	4	4
Cluster of bacilli	2	0	4	0	1	0	1	1	0	2	0	0
Di-bacilli	0	0	0	1	0	0	0	1	0	0	0	0
Colony Types	4	3	5	3	4	2	2	4	4	5	4	4

Table 2: Comparison of diversity (H') in native and invasive areas

Area	Native			Invasive		
	1	2	3	4	5	6
Diversity (H')	0.51	1.4	0.56	0.47	0.5	0.49
Avg. Diversity (H')	0.82			0.49		

Fig 1-3: Invasive plants in areas 4-6



Discussion/ Conclusion:

- When compared, most of the gram staining results shows a majority of gram (+) bacteria. The number of different colony types per area don't show a significant difference. And the majority of both invasive and native soil bacteria are chain of bacilli.
- This indicates that there might not be a big impact on soil bacteria diversity from these invasive plant species.
- The diversity calculated for the avg. native areas (0.82) was higher than the avg. of invasive areas(0.49). The higher number of H' indicates that the diversity of soil invertebrates are higher. The invasive plant areas have a lower diversity value. This means that the native areas have a greater diversity of soil invertebrates when compared to the invasive areas .
- Overall, the result indicate that invasive plant species have an impact on soil invertebrates diversity.
- However, the results show that there isn't a great impact on soil bacteria. This is because the results don't show a significance difference in colony types, nor does gram staining.
- This study determined invasive species impact on soil biota; results indicate that soil invertebrates diversity was negatively impacted, however, did not indicate impact on soil bacteria.

References:

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