Mass multiplication of native soil mesofauna for re-introduction in the degraded agro-ecosystems

KUMAR ,**N.G.**

University of Agricultural Sciences, Bengaluru, KARNATAKA, INDIA

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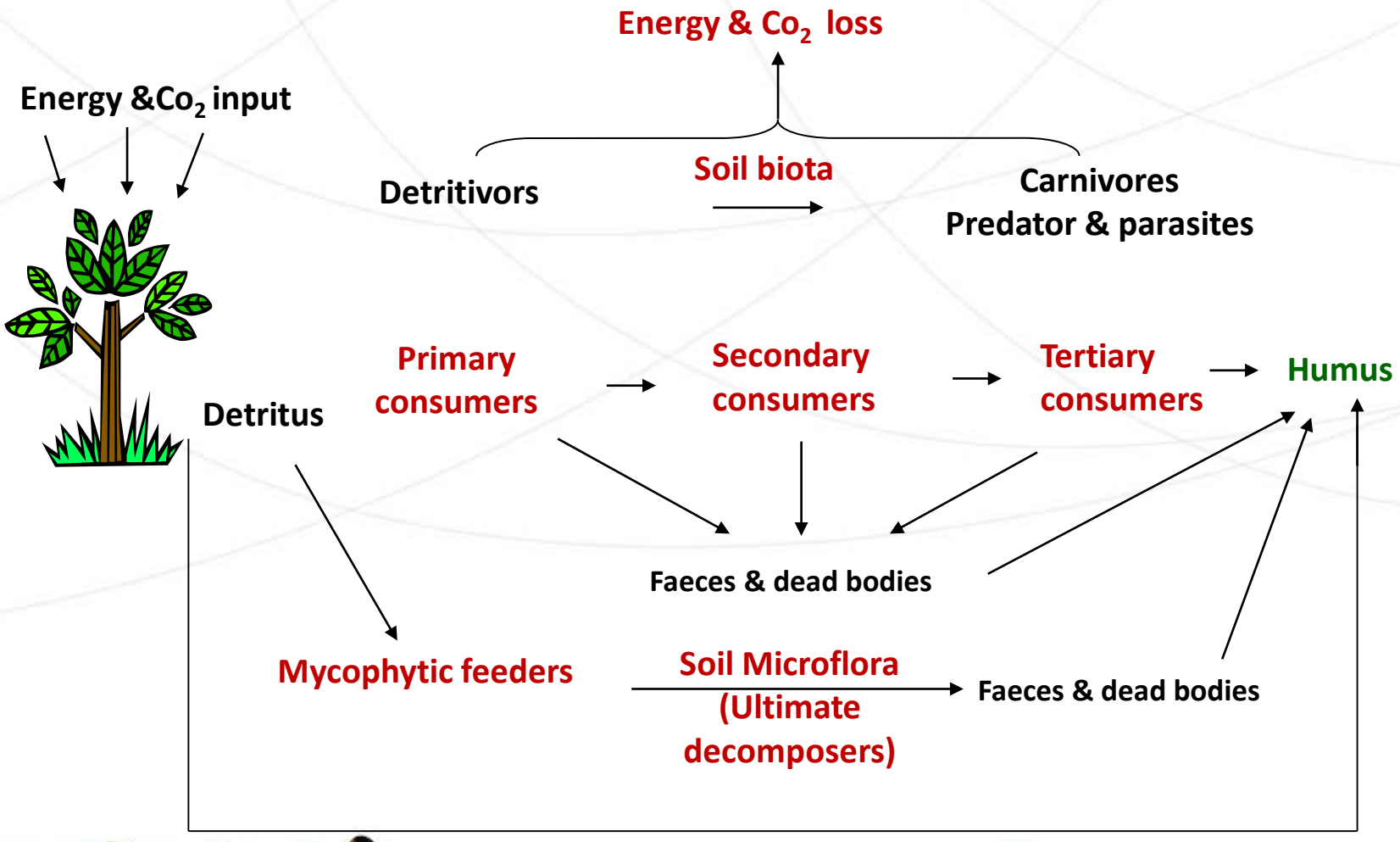
Introduction

Soil organisms are those which participate either in the disintegration and chemical weathering of the parent rock or in the decomposition of dead animals and plants. It excludes certain stages (pupal, hibernation, metamorphosis) or presence by chance or accident (Ramann, 1911).

Role of soil organisms

Biological fertility of the soil is correlated to the interaction between soil, animals, microorganisms and plants. These interactions regulate the pattern and rate of organic matter decomposition, nutrient recycling, nutrient immobilization and nutrient uptake by plants; together with abiotic factors of the soil environment they regulate soil fertility.

General pathway for the breakdown of higher plant tissue



Western ghat –Natural forest

GREEN REVOLUTION

-HYV /HYBRIDS
-Fertilizers
-Insecticides
-Fungicides
-Nematicides
-Herbicides
-Heavy machines
-Monoculture
-Clean cultivation
-Non-application of FYM
-Over exploitation of land & irrigation

Self sufficiency in food production

Stagnation / Lower Crop yields
Loss of soil biological/ mineralogical fertility & sustainability

Organic farming

-Less availability
-Not support soil invertebrates
-Slight increase in existing fauna

- **Fresh heaps of organic matter contain very few or no animals but as the heaps age, there is succession of animals paralleling the chemical changes during decomposition (Muller, 1957).**

- **Typical manure animals are replaced by compost animals, which in-turn are displaced by typical soil fauna (Cernova, 1971).**

- **In leaf compost, mites may initially predominate but are later surpassed by collembolans (Ghilarov, 1965).**

- **Among the collembolans, certain species are shown to be regularly eliminated by aging of the compost (Mrohs, 1961).**

- **Keesing and Wratten (1998) also highlighted the importance of indigenous invertebrate components in ecological restoration in agricultural landscapes for better sustainable function.**

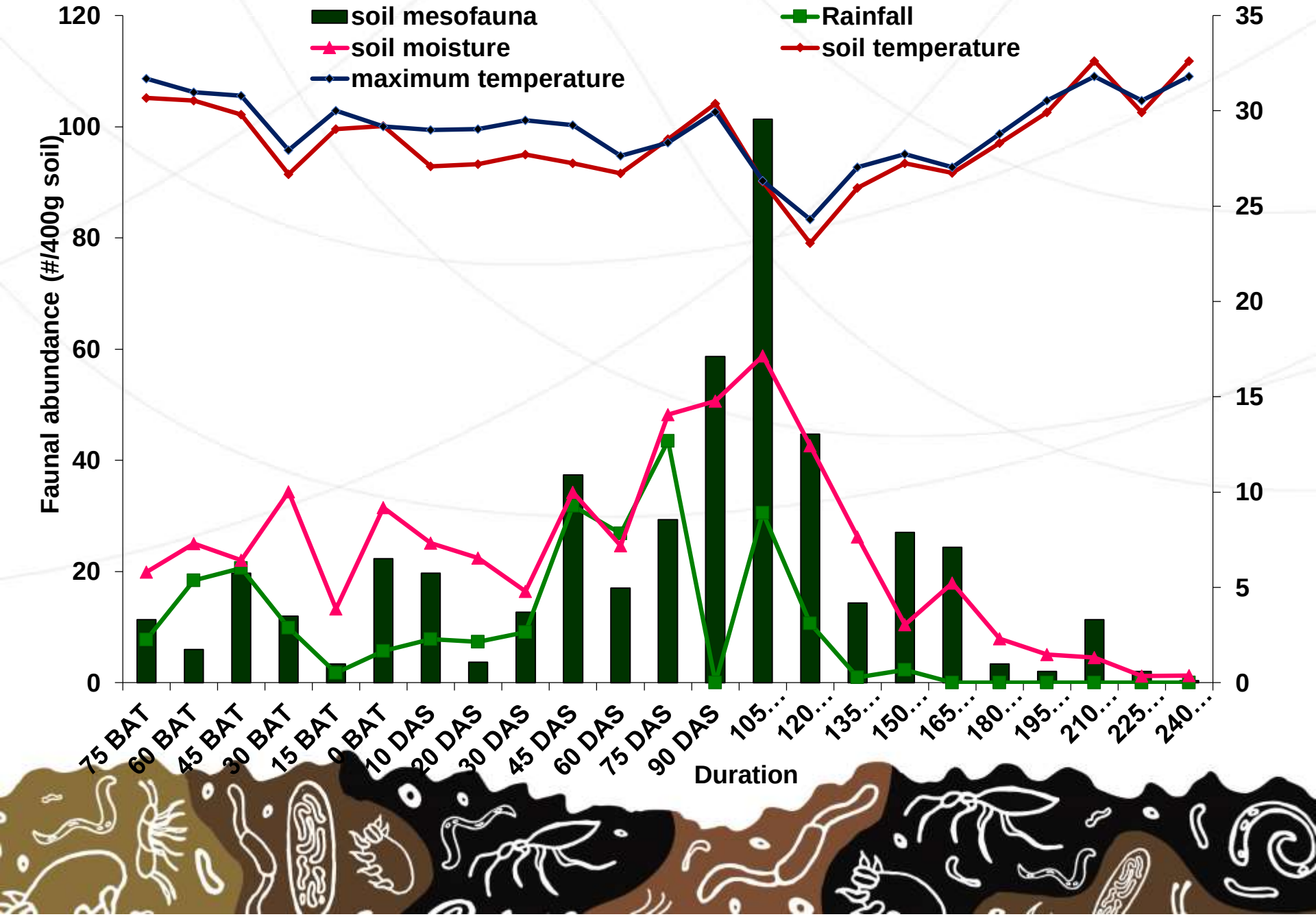
Why mass multiplication of mesofauna is required?

- -Fragile organisms
- -pore space of top layer of soil
- -Abiotic factors
- -Rainfall
- -Flood (water stagnation, soil erosion *etc*.)
- -Climate Change (Prolonged drought, reduced rainy days *etc*)
- -Termite foraging on plant residues

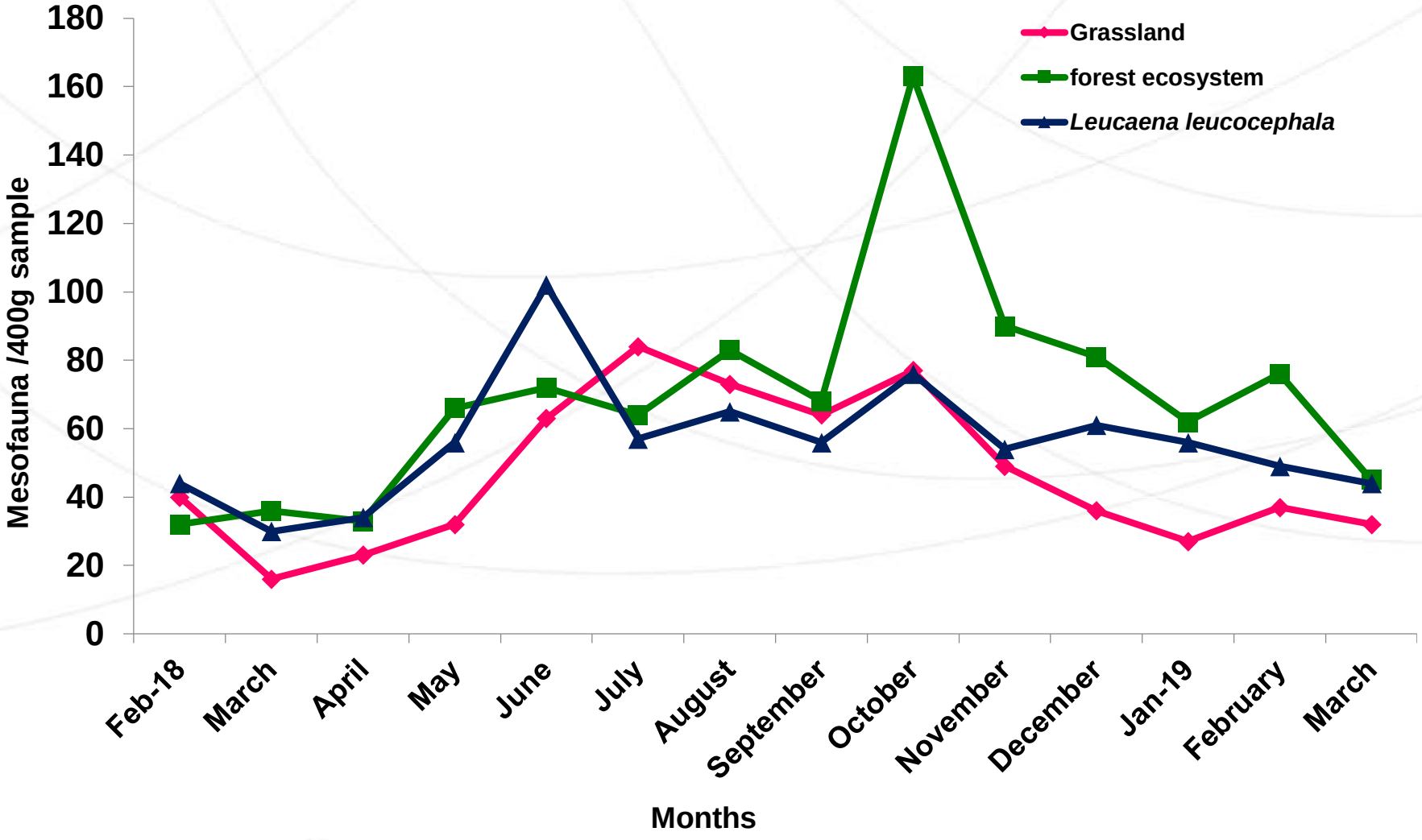
Maize litter after harvest of the crop

Maize litter after termite foraging

Influence of weather parameters on the abundance of soil mesofauna in agro-ecosystem



Abundance of mesofauna in different undisturbed ecosystems at different months



Media selected -Soil

-Farmyard manure (FYM)

-Coir peat

Food - Household vegetable waste

Water - Daily/ alternate days

Household Vegetable waste

Farmyard manure pit

Treatment details

Treatments	Quantity (Kg/pot)
T1= Soil alone	4.60
T2= Coir peat alone (CP)	0.70
T3= FYM alone	3.00
T4= 75% Soil + 25% CP	3.44+0.18
T5= 50% Soil + 50% CP	2.30+0.35
T6= 25% Soil + 75% CP	1.14+0.53
T7= 75% CP + 25% FYM	0.53+0.74
T8= 50% CP + 50% FYM	0.35+1.50
T9= 25% CP + 75% FYM	0.18+2.24
T10= 75% Soil + 25% FYM	3.44+0.74
T11= 50% Soil + 50% FYM	2.30+1.50
T12= 25% Soil + 75% FYM	1.14+2.24
T13= 33.3% Soil + 33.3% CP + 33.3% FYM	1.38+0.21+0.90

House hold waste			
French bean	Amaranths leaves and stem	Fenugreek leaves waste	Cereal and Pulses(immature, pests and disease attacked one)
Cluster bean	Ridge gourd scrapes	Drumstick leaves	
Peas	Cucumber scrape	Used curry leaves	
Field bean	Okra	Lettuce	
Cabbage	Betel leaves	Banana	
Knol- khol	Ginger	Orange	Sieved flour waste
Cauliflower	Tomato	Papaya	
Potato, sweet potato scrapes	Chow-chow scrape	Matured/fallen leaves/ Pruned plant parts	Tea and coffee waste
Onion	Chillies	Pomegranate	Small paper wastes, bills etc.
Garlic	Bell pepper	Jasmine	
Radish leaves and scrapes	Bottle gourd	Rose	
Beet root scrapes	Brinjal	Hibiscus	
Spinach, Mint, coriander leaves and stem	Carrot scrape	China aster, Marigold, Chrysanthemum	

Different media with vegetable wastes

Back yard (25 sq.m.)

Methodology

Soil, Coir peat and Farm yard manure alone and in combination were used as media

↓

The pot size was 30cm width at top and 20cm width at bottom and 30 cm height

↓

The mesofauna rich soil was collected from the grassland, forest plantation and *Leucaena leucocephala* plantation and mixed well . About 400g of mixed soil/pot was placed on the surface of the medium in the pots (November 2017)

↓

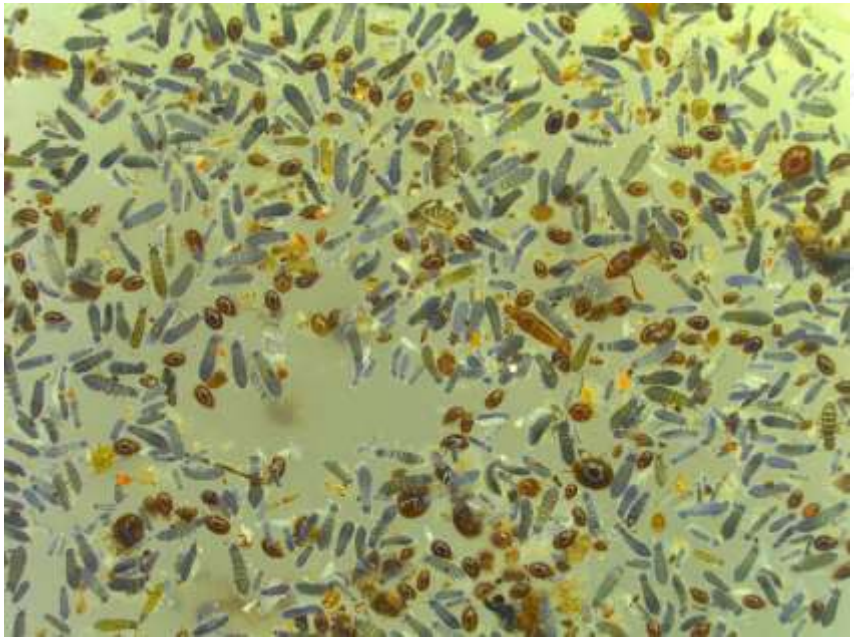
Household vegetable wastes (250g /pot) were placed over the soil surface of the pots at weekly interval. These pots were watered (1l/pot) daily.

↓

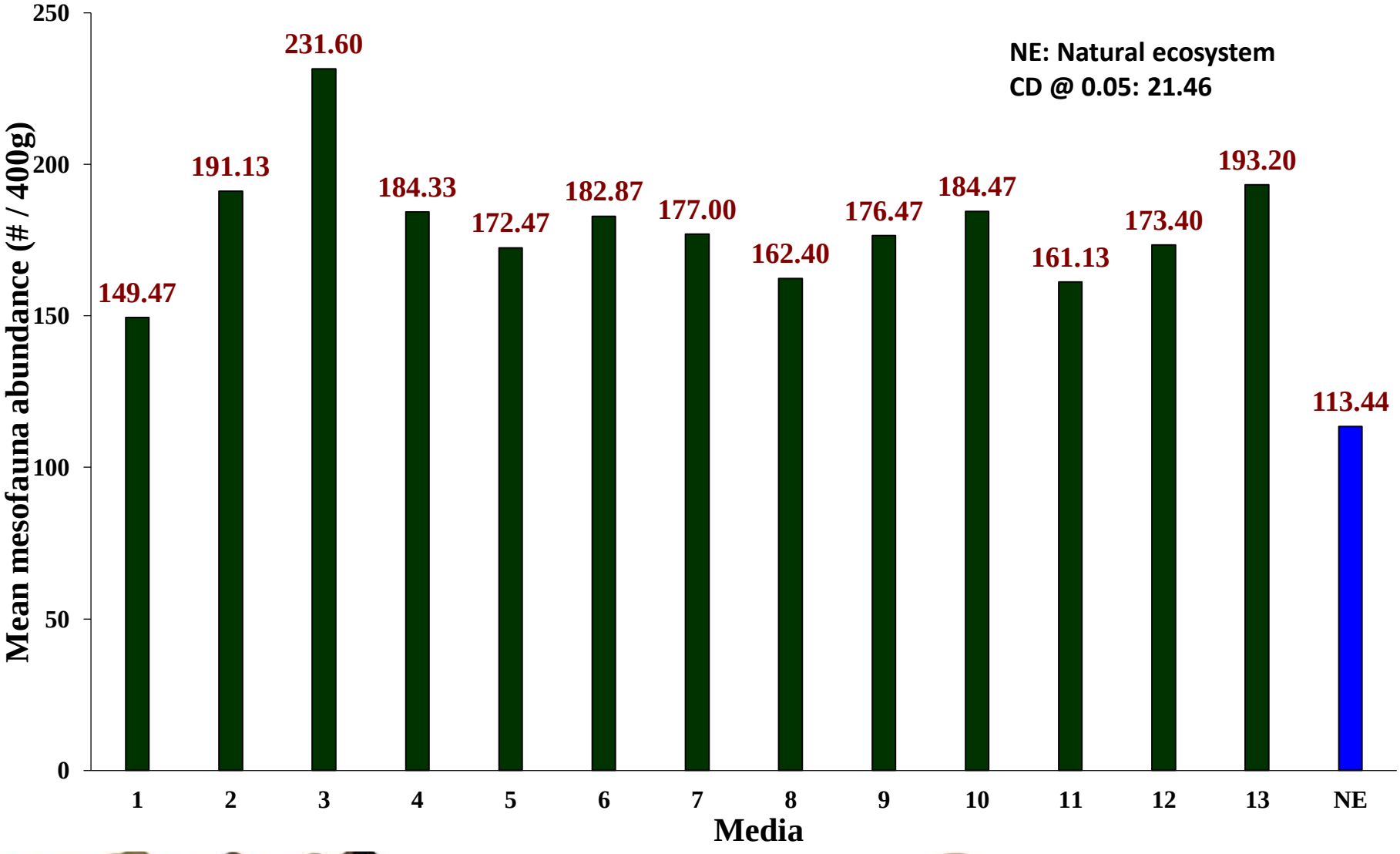
Soil samples(200g/pot) were drawn from each at the monthly interval (after one year, once in two months)

↓

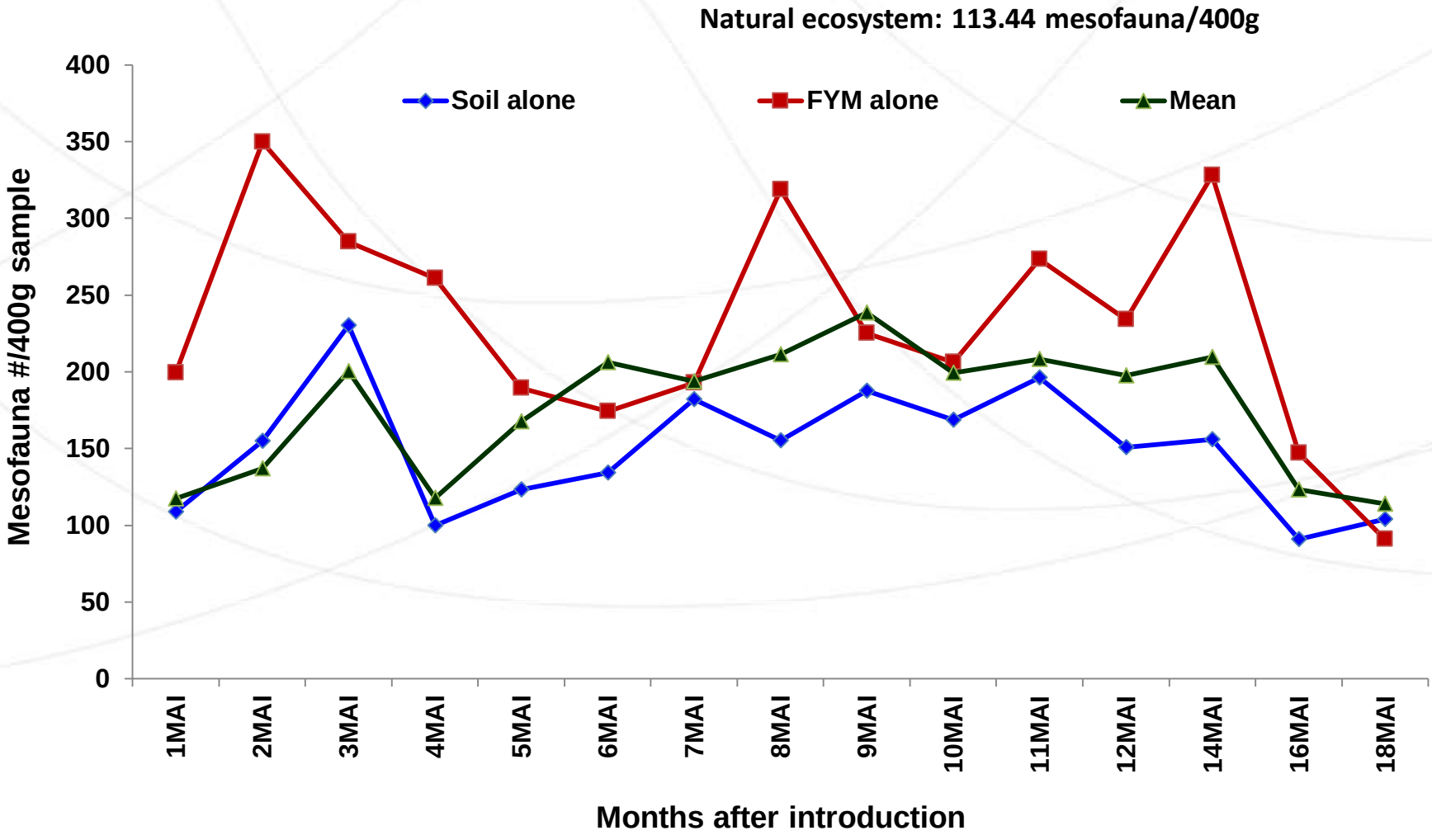
Mesofauna extracted –Rothamsted modified Mc Fadyen high gradient funnel apparatus



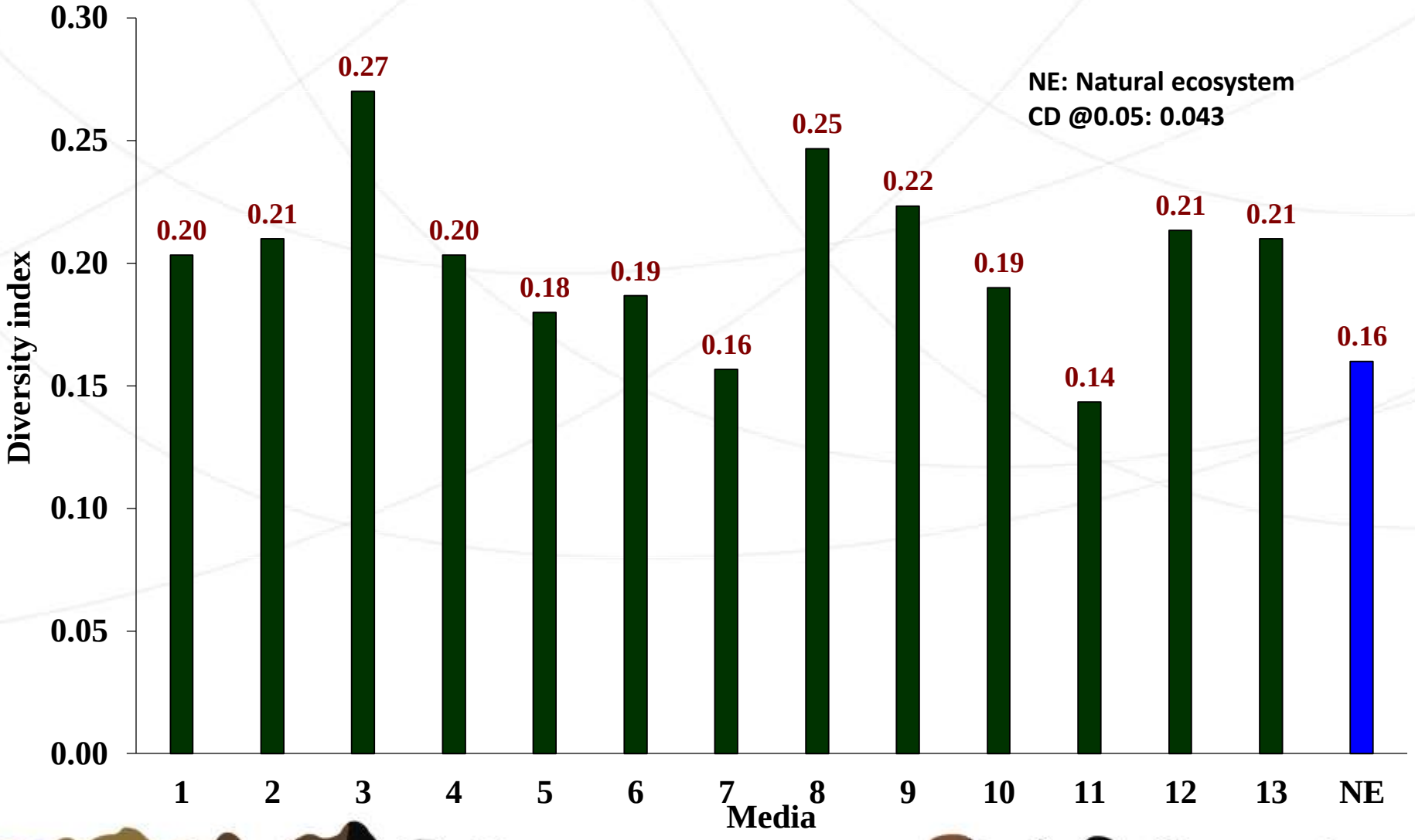
Mean mesofauna abundance in different media



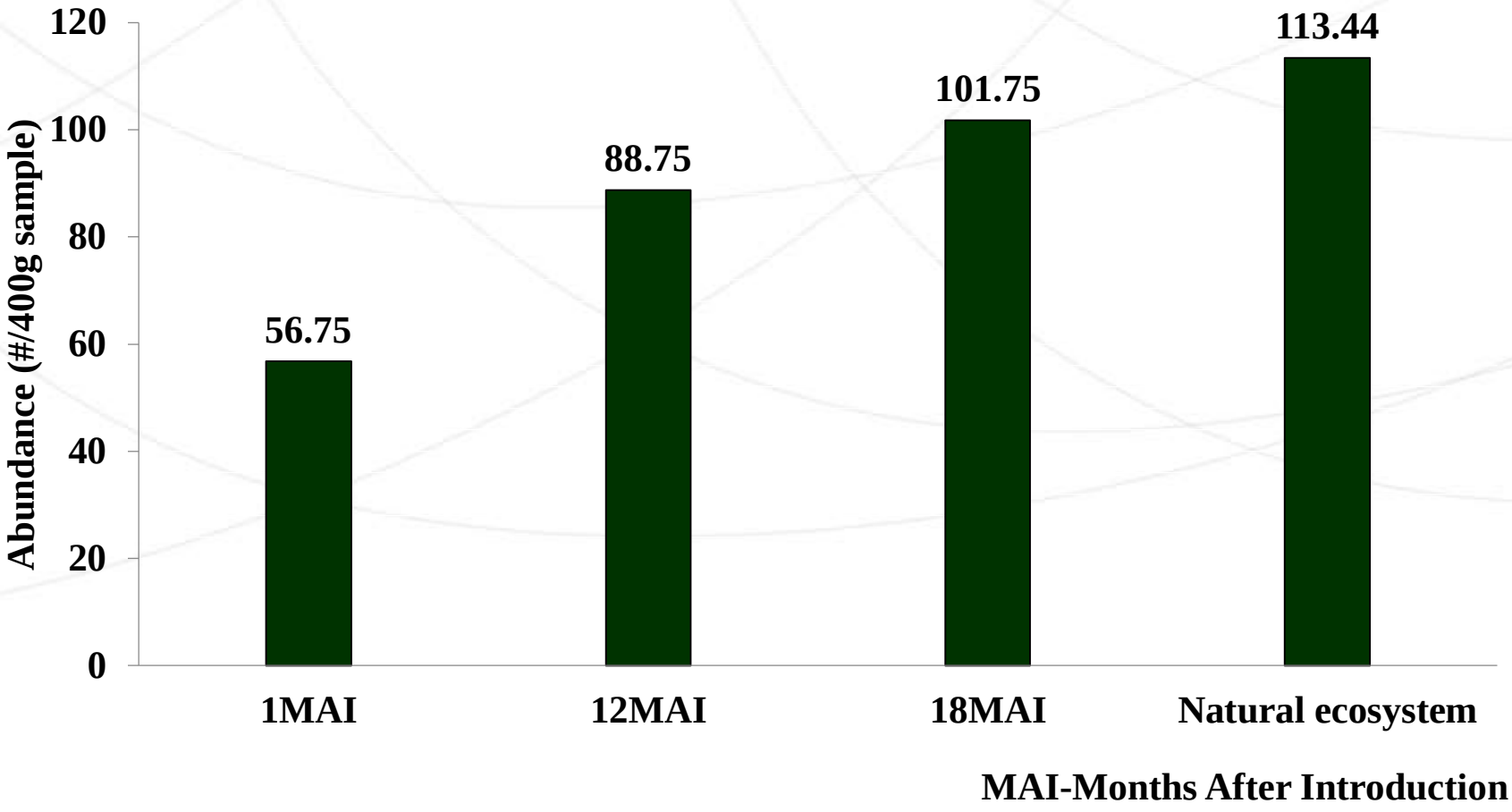
Mean mesofauna abundance in different media at different duration



Diversity indices in different media



Abundance of soil mesofauna in backyard soil samples



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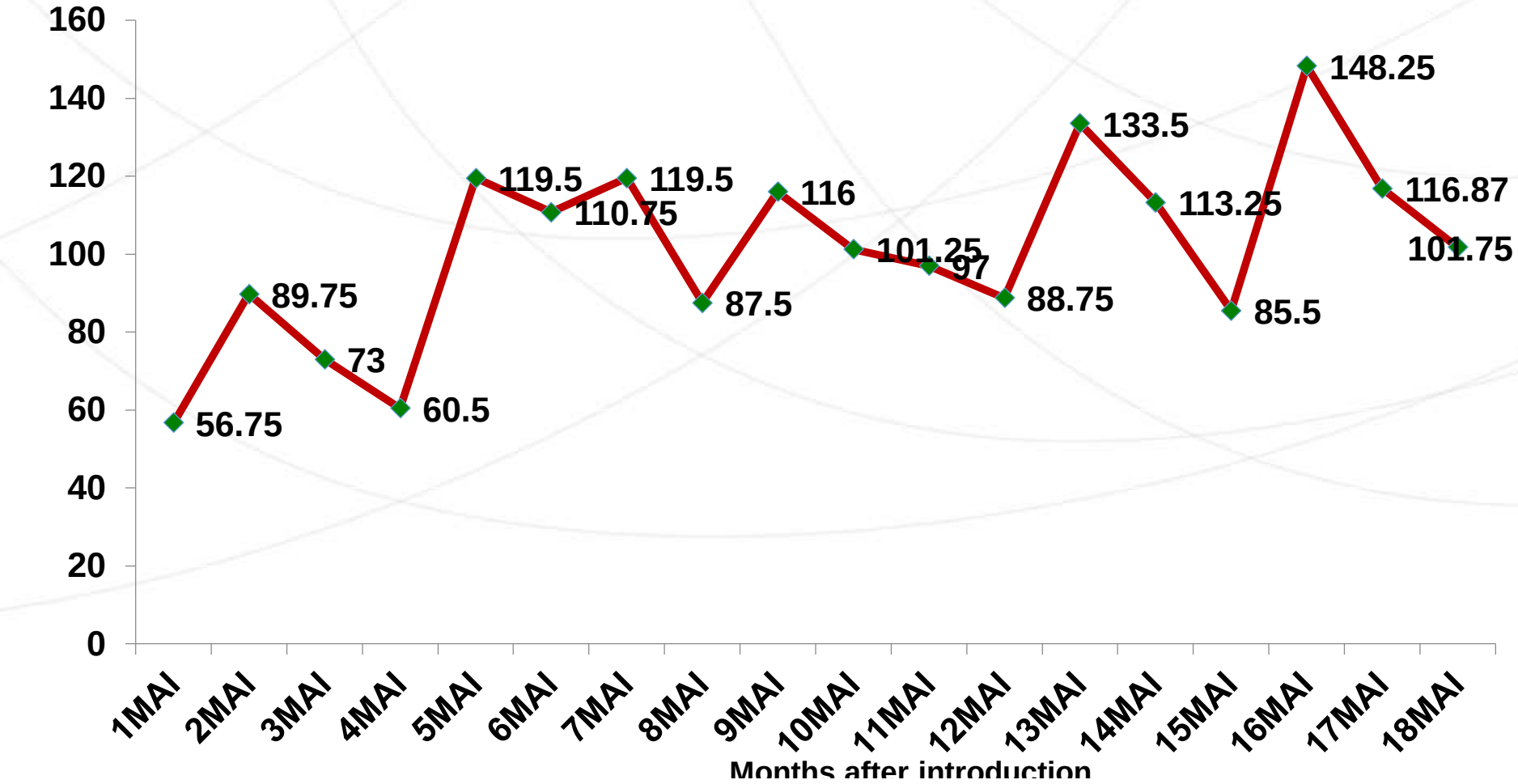

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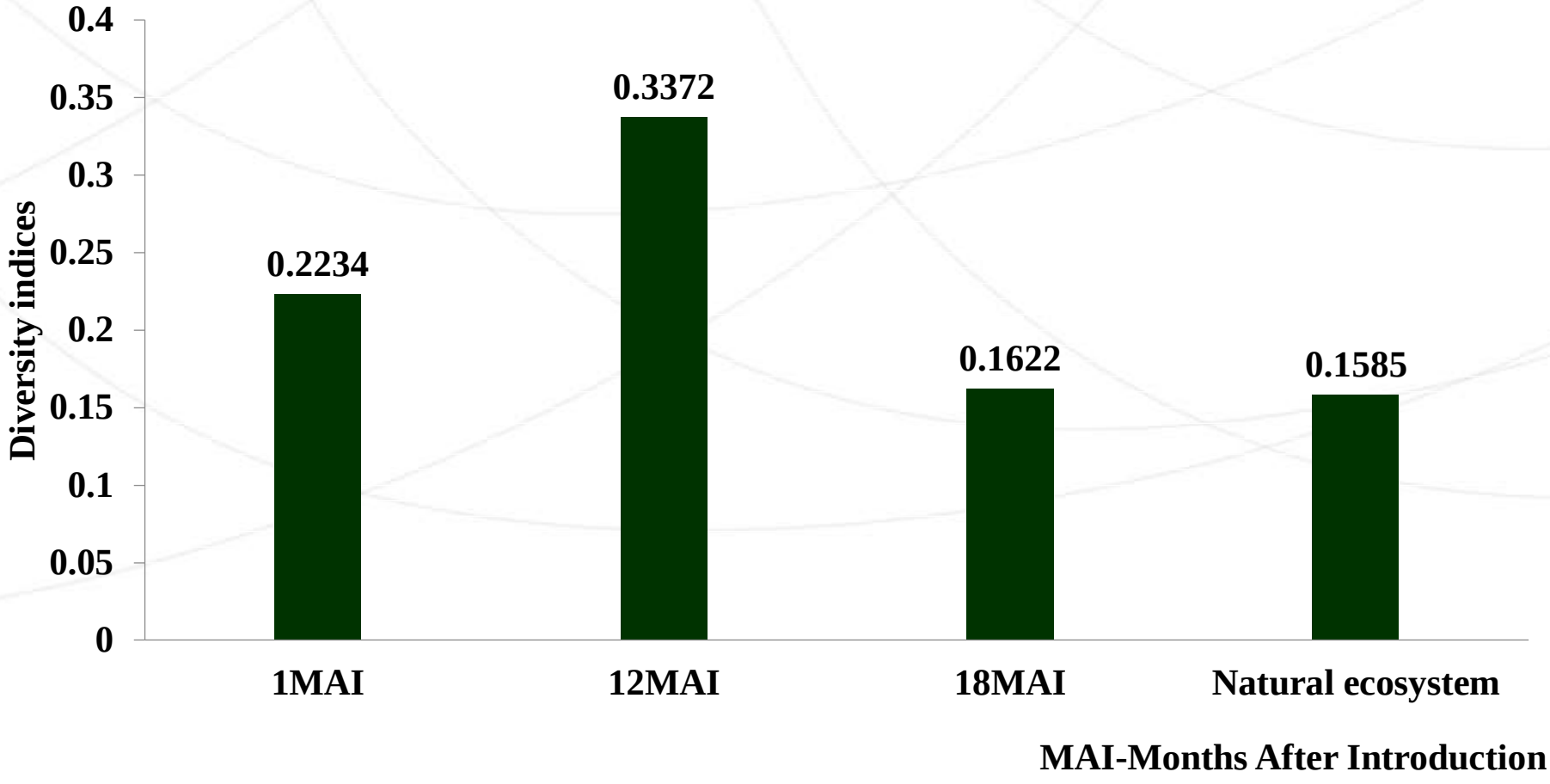

Sl. No.	Taxonomic group	Occurrence of soil organisms (%)			
		Natural ecosystem at peak activity *	Best media (FYM alone)	Least preferred media (soil alone)	Back yard (soil alone)
	Cryptostimata	39.09	5.0	2.44	16.39
2.	Mesostigmata	8.12	8.0	2.44	13.66
3.	Other Acari	5.08	21.0		
4.	Poduriidae	3.55	19.0	30.49	9.84
5.	Entomobryidae	6.09	5.0	3.66	8.19
6.	Onychiuridae	24.88	4.0	34.15	37.16
7.	Symphyla				6.01
8.	Pseudoscorpions			1.23	
9.	Isopoda			2.44	1.64
10.	Psocids	1.01			1.09
11.	Centipede larvae	2.03		1.23	2.19
12.	Earwigs			2.44	1.09
13.	Spiders	0.51			0.55
14.	Hemiptera			2.44	0.55
15.	Dipterans maggot	0.51	8.0	2.44	
16.	Coleopteran grubs	3.04	12.0	2.44	1.64
17.	Ants	6.09	18.0	9.76	
18.	Earthworm immature			2.44	

Conclusion

1.All media harboured higher mesofauna abundance throughout the year compared to mesofauna of natural ecosystems. Coir peat is suitable for urban dwelling. An agency can collect the mass multiplied mesofauna rich media and distribute to the farmers or can be used in terrace or backyard gardens.

2.Soil mesofauna diversity can be maintained in an institute of different regions to protect the indigenous soil mesofauna for future use.

3.The farmers can use backyard or farmyard manure heap to multiply native soil mesofauna. Mesofauna rich coir peat or FYM or combination of these two can be easily applied in the degraded land.

4.The diversity of mesofauna and microflora can be replenished by introducing a small quantity of topsoil and litter of the undisturbed ecosystems.

Thank You
for
your attention