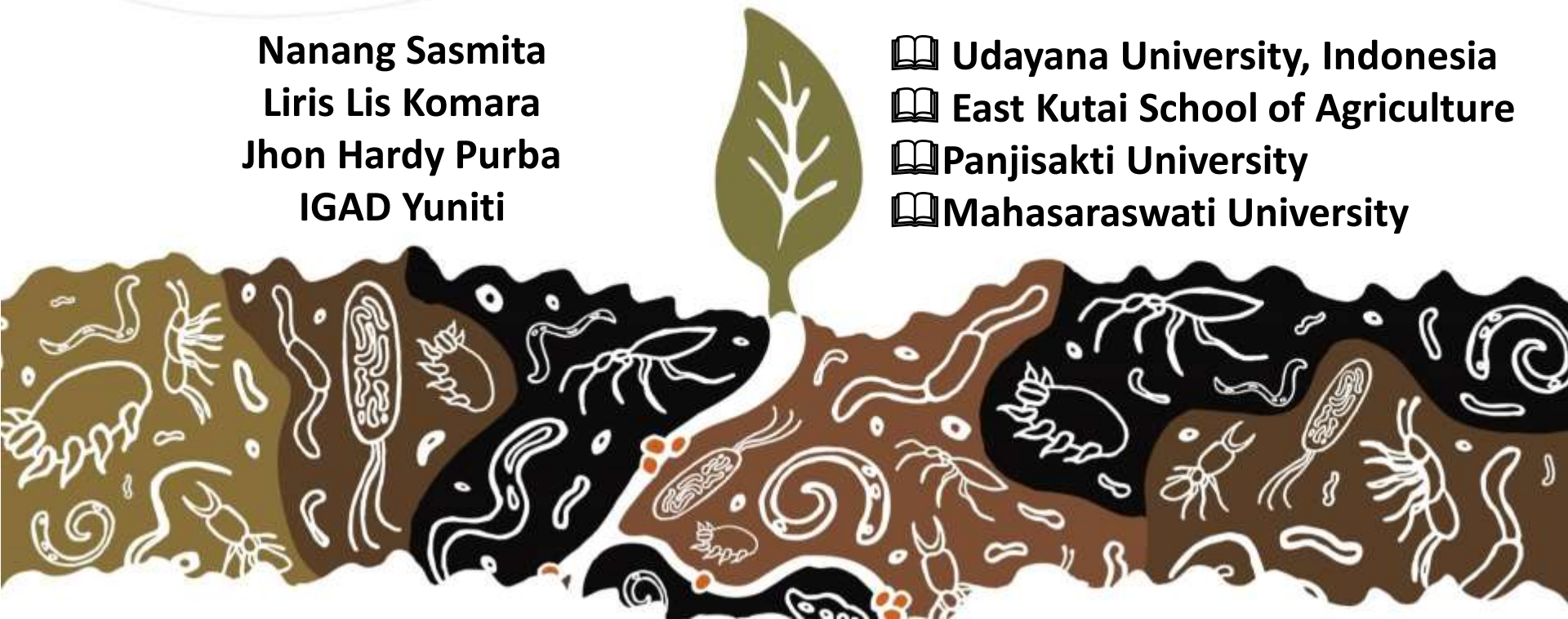# Soil Macrofauna Biodiversity in *Paraserianthes falcataria* and *Morus alba* Plant Agroforestry in Bali Island

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Introduction

- Indonesia has a lot of Agroforestry Area.

- The Bali agroforestry model is based on mango, cashew, orange, cocoa, coffee, coconut, mixed gardens, intercropping, and natural resource protection

- Mulberry *(Morua alba)* agroforestry was tested because it adapted well to the shade of *Paraserianthes falcataria*

- Soil fauna abundant are one of the factor that increase the Agroforestry land productivity.

- The soil fauna improves physical soil fertility, topsoil production, combines topsoil materials, forms organic aggregates and soil minerals

- Purpose of the study: to determine the diversity of soil macrofauna on Bali agroforestry planted with mulberry and *Paraserianthes falcataria*
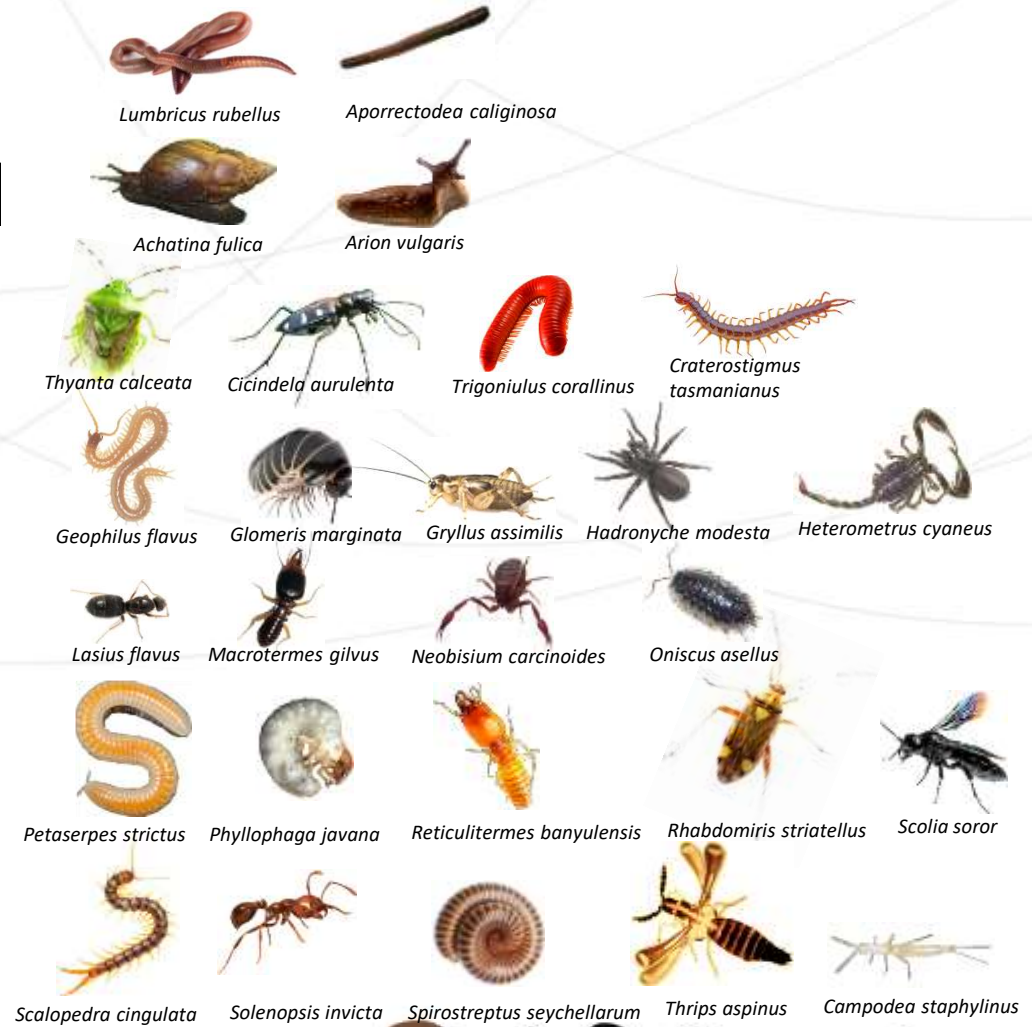
Methodology

➤ The location of an agroforestry center in Bali.

➤ Location at 900 meters above sea level an altitude .

➤ Location temperature is 20-26 degrees Celsius.

➤ Sengon and mulberry agroforestry plots with 4 Randomized Block Design treatments: mulberry spacing 50x100 cm, 100x100 cm, 100x 150 cm under the *Paraserianthes falcataria* stand and control, each treatment was repeated 3 times.

➤ The macrofauna data collection using monPengumpulan data monolit hand sortation technique.

➤ The 30 x 30 cm plot size rith 30 cm depth, the number of plots per treatment is 9 plots so that a total of 36 observation plots..

➤ Analysis of soil macrofauna uses the approach of the species index, importance value, Shannon-Wienner species diversity index, and the Shannon-Wienner species evenness index.

THE PERSENCE OF MACROFAUNA IN *Paraserianthes falcataria* AND *Morus alba* AGROFORESTRY FIELD

PHYLUM	CLASS	FAMILY
Annelida	Clitellata	Lumbricidae
Mollusca	Gastropoda	Achatinidae Arionidae
Arthropoda	Arachnida Chelicerata Chilopoda Diplopoda Entognatha Insecta Malacostraca	Atracidae Campodeidae Carabidae Craterostigmidae Formicidae Geophilidae Glomeridae Gryllidae Miridae Neobisiidae Oniscidae Pentatomidae Polyzoniidae Rhinotermitidae Scarabaeidae Scoliidae Scolopendridae Scorpionidae Spirostreptidae Termitidae Thripidae Trigoniulidae

Lumbricus rubellus

Aporrectodea caliginosa

Achatina fulica

Arion vulgaris

Thyanta calceata

Cicindela aurulenta

Trigoniulus corallinus

Craterostigmus tasmanianus

Geophilus flavus

Glomeris marginata

Gryllus assimilis

Hadronyche modesta

Heterometrus cyaneus

Lasius flavus

Macrotermes gilvus

Neobisium carcinoides

Oniscus asellus

Petaserpes strictus

Phyllophaga javana

Reticulitermes banyulensis

Rhabdomiris striatellus

Scolia soror

Scalopedra cingulata

Solenopsis invicta

Spirostreptus seychellarum

Thrips aspinus

Campodea staphylinus

THE PERSENCE OF MACROFAUNA IN *Paraserianthes falcataria* MONOCULTURE FIELDS

PHYLUM	CLASS	FAMILY
Annelida	Clitellata	Lumbricidae

Lumbricus rubellus

Aporrectodea caliginosa

Arthropoda	Chilopoda Diplopoda Insecta	▪Craterostigmidae ▪Forficulidae ▪Formicidae ▪Geophilidae ▪Gryllidae ▪Lumbricidae ▪Polyzoniidae ▪Staphylinidae ▪Termitidae ▪Trigoniulidae

Geophilus flavus

Gryllus assimilis

Paederus riparius

Forficula auricularia

Trigoniulus corallinus

Craterostigmus tasmanianus

Solenopsis invicta
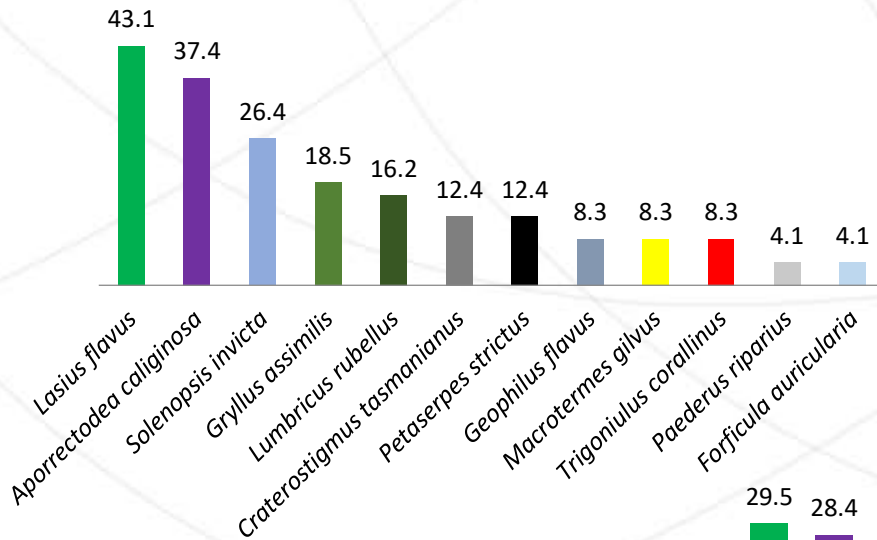

Petaserpes strictus

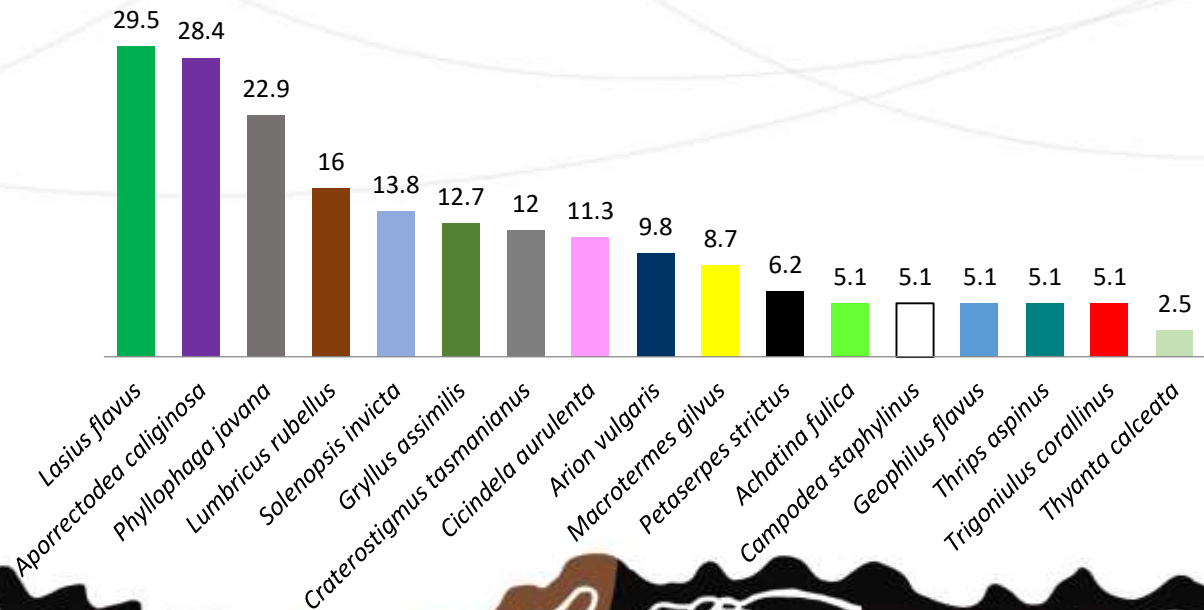*Lasius flavus*

Macrotermes gilvus

Results

Important value Index of soil macrofauna in *Paraserianthes falcataria* monoculture (%)

Values (left to right):
- *Lasius flavus* — 43.1
- *Aporrectodea caliginosa* — 37.4
- *Solenopsis invicta* — 26.4
- *Gryllus assimilis* — 18.5
- *Lumbricus rubellus* — 16.2
- *Craterostigmus tasmanianus* — 12.4
- *Petaserpes strictus* — 12.4
- *Geophilus flavus* — 8.3
- *Macrotermes gilvus* — 8.3
- *Trigoniulus corallinus* — 8.3
- *Paederus riparius* — 4.1
- *Forficula auricularia* — 4.1

❑ 27 species of soil macrofauna from 25 families and 21 orders were found in agroforestry patterns, while monoculture patterns found 12 species of macrofauna from 10 families and 10 orders.

Important value Index of soil macrofauna at spasing 50 x 100 cm of *Paraserianthes falcataria* and Mulberry agroforestry (%)

Values (left to right):
- *Lasius flavus* — 29.5
- *Aporrectodea caliginosa* — 28.4
- *Phyllophaga javana* — 22.9
- *Lumbricus rubellus* — 16
- *Solenopsis invicta* — 13.8
- *Gryllus assimilis* — 12.7
- *Craterostigmus tasmanianus* — 12
- *Cicindela aurulenta* — 11.3
- *Arion vulgaris* — 9.8
- *Macrotermes gilvus* — 8.7
- *Petaserpes strictus* — 6.2
- *Achatina fulica* — 5.1
- *Campodea staphylinus* — 5.1
- *Geophilus flavus* — 5.1
- *Thrips aspinus* — 5.1
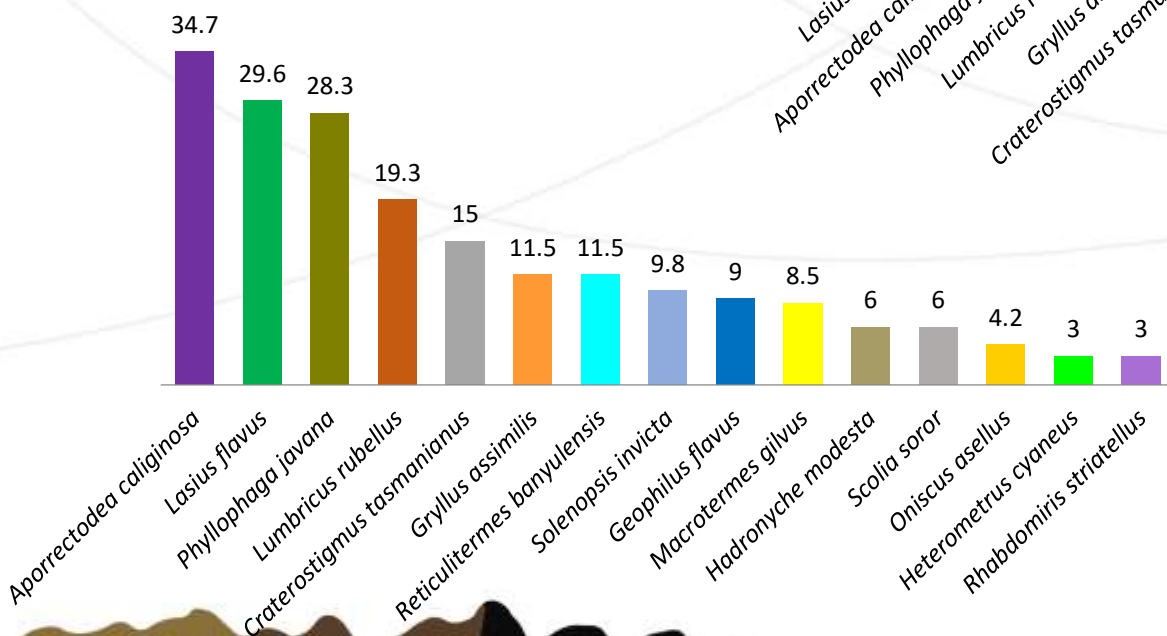- *Trigoniulus corallinus* — 5.1
- *Thyanta calceata* — 2.5

❑ two species of soil macrofauna classified as soil engineers play a role in the soil organic matter decomposition, namely *Aporrectodea caliginosa* (Lumbricidae) and *Lumbricus rubellus* (Lumbricidae
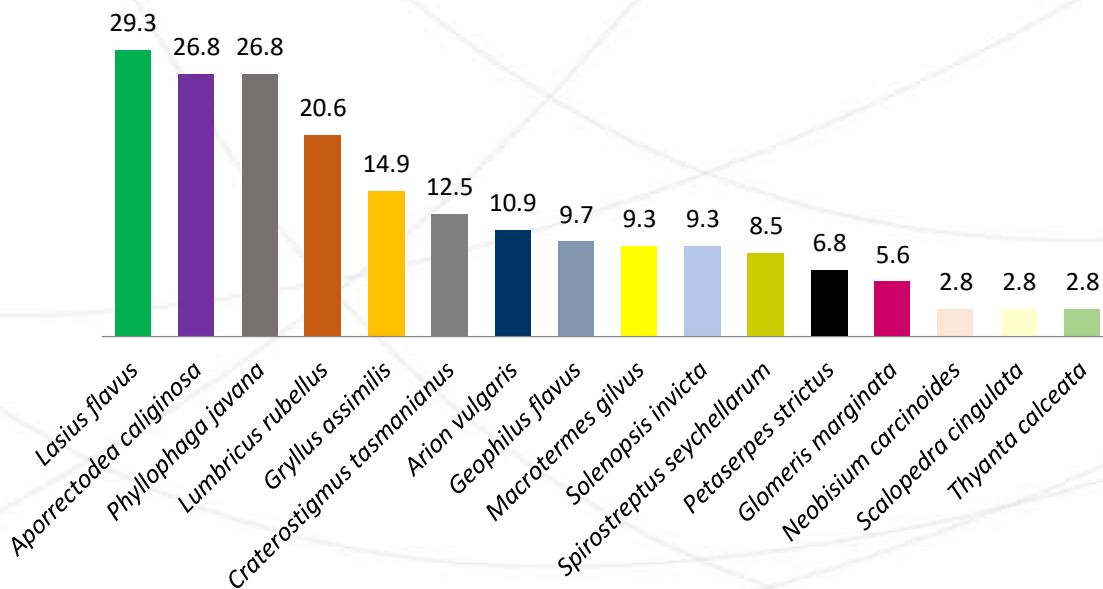
Results

Chart: Important value Index of soil macrofauna at spasing 100 x 100 cm of *Paraserianthes falcataria* and Mulberry agroforestry (%)

Species	Value
Lasius flavus	29.3
Aporrectodea caliginosa	26.8
Phyllophaga javana	26.8
Lumbricus rubellus	20.6
Gryllus assimilis	14.9
Craterostigmus tasmanianus	12.5
Arion vulgaris	10.9
Geophilus flavus	9.7
Macrotermes gilvus	9.3
Solenopsis invicta	9.3
Spirostreptus seychellarum	8.5
Petaserpes strictus	6.8
Glomeris marginata	5.6
Neobisium carcinoides	2.8
Scalopedra cingulata	2.8
Thyanta calceata	2.8

Important value Index of soil macrofauna at spasing 150 x 100 cm of *Paraserianthes falcataria* and Mulberry agroforestry (%)

Species	Value
Aporrectodea caliginosa	34.7
Lasius flavus	29.6
Phyllophaga javana	28.3
Lumbricus rubellus	19.3
Craterostigmus tasmanianus	15
Gryllus assimilis	11.5
Reticulitermes banyulensis	11.5
Solenopsis invicta	9.8
Geophilus flavus	9
Macrotermes gilvus	8.5
Hadronyche modesta	6
Scolia soror	6
Oniscus asellus	4.2
Heterometrus cyaneus	3
Rhabdomiris striatellus	3

❑ the patterns of *Paraserianthes falcataria* and *mulbery* agroforestry spacing of 50 x 100 cm, 100 x 100 cm and 150 x 100 cm were dominated *by Aporrectodea caliginosa* (Lumbricidae), *Lasius flavus* (Formicidae) and *Phyllophaga javana* (Scarabaeidae). *Phyllophaga javana* is mostly in agroforestry land related to the manure provision

Soil Macrofauna Biodiversity Index

No	Parameters	Monoculture	Agroforestry 01 (50 x100 cm)	Agroforestry 02 (100 x 100 cm)	Agroforestry 03 (150 x 100 cm)
1.	n_i	12,00	17,00	16,00	15,00
2.	N	53,00	92,00	83,00	78,00
3.	H′	2,21	2,58	2,55	2,44
4.	R′	2,77	3,53	3,39	3,21
5.	E′	0,89	0,91	0,92	0,90

Discussion

❑ The Shannon-Wienner (H ') diversity index between 2.44-2.58, shows the diversity of soil macrofauna in the medium category agroforestry pattern is greater than 1.

❑ The richness of soil macrofauna (R′) in monoculture 2,77, while agroforestry 3,21-3,53. The wealth value of monoculture macrofauna is relatively low (<3.5), while the *Paraserianthes falcataria* and mulberry agroforestry is classified as moderate (> 3.5).

❑ The species evenness index(E') shows that the monoculture and agroforestry patterns are not much different. With the level of evenness large enough 0.89 to 0.92 shows that the species is spread evenly.

❑ The diversity of soil macrofauna in *Paraserianthes falcataria* and mulberry agroforestry is higher, the planting distance is getting tighter, the index diversity is increasing.

❑ The soil macrofauna species number in agroforestry are related to the availability and quality of soil organic matter and the remnants of plant biomass as a food source.

Conclusions

❖ Soil macrofauna in agroforestry were found in 27 species from 25 families and 21 orders. The diversity and richness of soil macrofauna species in the *Paraserianther falcataria* and mulberry agroforestry systems are classified as moderate (H '= 2.44 - 2.58).

❖ The dominant macrofauna are Aporrectodea caliginosa, Lumbricus rubellus, Phyllophaga javana and Solenopsis invicta.

❖ Lumbricus rubellus Litter-eater worms are effective in organic matter decomposition can increase soil fertility and nutrient availability because the process of decomposition of organic matter becomes 2-5 times faster than without the presence of organisms.

❖ The effect of plant spacing on soil macrofauna community structure is relatively moderate at tight spacing with mean index R '= 3.53

❖ Macrofauna diversity in the soil shows a relatively high correlation with soil organic matter content, the dominance of lower vegetation and soil moisture.

❖ Macrofauna diversity at ground level shows a relatively high correlation with plant spacing and sunlight penetration.

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