

BIOLOGY

# Arthropod Diversity Survey



	/	/
School Name	Student Name	Group
	/ DD-MM-YYYY /	/
Site	Date Time	Recent Weather Conditions

## INTRODUCTION

## Background

Arthropods are biologically distinct groups of animals, whose physical characteristics and diversity enabled them to support a wide range of ecological communities through millions of years of existence. Arthropods are said to comprise about three-fourths of the animals existing on Earth and are found both on land and water.

Arthropods could take the form of: (1) Insects (2) Crustaceans (3) Spiders (Arachnids) (4) Millipedes (Diplopods) and (5) Centipedes (Chilopods). By this information alone, you have an idea of just how broad and diverse their domain could be. In this course, we will study this wonderful group of creature in our field sites and laboratories, their ecological role and their relation with the Biome.

# Aims and Objectives

- · To appreciate the existence of a variety of ecosystems in the local environment.
- To familiarize Winkler samplings methods to collect Arthropods.
- To identify Arthropods specimens using keys.
- To study the microhabitats in woodland and grassland and the relation with Arthropods.
- To conduct survey on Rhopalocera (Butterflies) along transect and point.

## Equipment

## For animal sampling

## For measurement of physical factors

x1 x1

x1 x1

x1

Butterfly net	x2	Anemometer
Drawing brush	x2	Compass
Cotton gloves	x1 Pair	Hydro-thermometer
Clip board	x1	Light meter
Frame quadrat	x1	Soil thermometer
Insect magnifying box	x1	
White plastic tray	x1	
Trowel	x1	
Measuring tape	x2	
Plastic basket	x2	
Plastic box	x1	
Plastic vial	x6	
Woodland identification kit	x1	
Grassland identification kit	x1	
Winkler mesh bag	x1	
Winkler sifter	(Share)	

#### Remarks

- No smoking is allowed at the site.
- · Put on long-sleeved shirts, jeans and hats with wide brim.
- Never climb up trees.
- · Do not reach into holes.
- · Dead specimen of vertebrates should not be collected or closely examined.
- · Be careful upon handling those spiny plants and the animals that may bite.
- · Never ingest any fruits, seeds or leaves of wild plants.
- Never pollute/damage the environment. Minimize trampling.
- · Team leader should organize members to work in a serious and efficient way.
- · Members should co-operate with the leader.

Since time is limited, you should work efficiently. If you do have extra time, you are highly recommended to carry out your own investigations, provided that it is safe to do so.

## FIELD WORK

## Collection of Arthropods by Winkler Samples

Winkler samples are an efficient method of sampling leaf litter Arthropods. The method involves sifting bulk samples of leaf litter and rotten wood by agitating them vigorously in a bag above a coarse mesh screen.

In the woodland field site, pick all leaf litter including little surface topsoil within 1m<sup>2</sup> frame using gloves and put them into the Winkler Sifter (Bigger pieces of rotten wood and branches are removed or minced by hand or appropriate equipment before placing in the sifter). Hold the two handles to sift the litter by agitating them vigorously in a bag with a coarse mesh screen inside, until all the litter in the frame is sifted.





Left: Winkler Sifter Right: Sifting (LLAMA)

## 2.1. Quadrat sampling

**A.** Measure Abiotic factors (Air and soil temperature, Relative humidity, Light intensity, Wind direction and wind speed) for inside and outside woodland and record in Table 1.

B. Quadrat Count

Put a quadrat in a representative area inside woodland. Record species count of each type of living organism listed in Table 2.

2.2. Active searching- Microhabitat inside and outside WoodlandA. Locate at least 2 microhabitats (on both woodland and grassland), active search for 3 minutes on each microhabitat, collect the related data (Species name and number of species) and record them in Table 3.

**B.** With plastic vials, nets, and drawing brushes; catch animals at different microhabitats inside the study area and identify them with the keys provided. Observe any damages on leaves by animals.



Rhopalocera (Butterflies) Survey by Transect Count and Point Count

**Quadrat Count and** 

**Active Searching** 

#### 3.1 Transect Count

Along an approximately 350m path on (a) the Mini Great Wall Trail/ (b) Uphill slope Trail to our Field Studies Center, record all butterflies species seen within 10 meters from either side of the path. Record the no. of species encounter in Table 4.

#### 3.2 Point Count

Do 10-minute point count at (a) Pavilion (end point of transect count) / Fa Ping farmland, record all butterflies species seen within a radius of 10 meters distance in Table 5.

#### 3.3 Record on Abiotic factors

Students will also measure the abiotic factors (Air temperature, Relative humidity, Light intensity, Wind direction and Wind speed), and number of flowering plants present along the transect and within the Point Count survey area. Data collected is marked on Table 4 and 5.

★Inspect trunks, branches as termites can galleries up to 2 m in height.

 $\bigstar$  Break dead logs and branches to search for termites.

★ Scoop a few soil samples with a spade.★ Stir and inspect inside of litter.

★Never disturb any animal nests

★Avoid collect animal samples that are

rarely seen in the habitat, or the containers do not give a sizable environment

## LABORATORY WORK

 		Equipme	nt		
Gloves	x1	Plastic vial	x1	Glass petri dish	x4
Plastic tray	x1	Blunt forceps	x2	Stereomicroscope	e x2
Siftate	x1	Fine forceps	x2	Arthropods identification keys	s ×1
Winkler Bag	x1	Leaf litter tray	x1	Ethanol	(Share)

#### 4.1. Winkler extraction

**Winkler Extraction** 

and Classification

of Arthropods

Transfer all litter collected from mesh bag to a siftate above a plastic container. Litter arthropods are concentrated in the finer "siftate" that passes through the screen. Arthropods are then extracted from the siftate by a passive extraction method, in which the siftate is placed in thin mesh sacks and then suspended and enclosed within an outer cloth "Winkler bag." The Winkler bag tapers to a cup of ethanol at the bottom. After loading the sample, the Winkler bag is closed at the top and suspended in a sheltered location. Arthropods fall from the litter and accumulate in the ethanol, and the sample is taken off after 3 days.



Left: Putting siftate in mesh sack. Right: Placing sack in Winkler bag. (LLAMA)

4.2. Classification of Arthropods

Classified the prepared collected Arthropods sample in Order and record the number found in Table 6.

Following are the Arthropods Order to be classified:

Focal Taxa / Order	Examples		
Hymenoptera	Ants, Wasps, Bees, Sawflies		
Collembola	Springtails		
Biattaria	Cockroaches		
Isoptera	Termites		
Hemiptera	True bugs, Cicadas, Whiteflies		
Coleoptera	Beetles		
Pseudoscorpions	False scorpions		
Acariformes	Mites		
Aranea	Spiders		
Chilopoda	Centipedes		
Diplopoda	Millipedes		
Isopoda	Woodlice		
Lepidoptera	Butterflies, Moths		
Diptera	True flies, Hoverfly, Cranefly, Blowfly		
Orthoptera	Crickets, Grasshoppers, Earwigs		

★ Transfer the siftate slowly and carefully to avoid remains losing, place the drop out litter back to the siftate if there is any collected by the plastic container.

## LABORATORY WORK

## 5 Biological Investigation

Use the identification kit, reference books, and stereomicroscope provided to identify specimens collected from the woodland and extra leaf litter sample.

#### 5.1. Leaf litter analysis

A. Place the extra leaf litter collected in a plastic tray. Describe it with respect to the degree of decomposition, color and smell etc.
B. Sort out animals with drawing brushes.

5.2. Investigate collected animal samples

Observe any adaptive features of the animals you have collected using stereomicroscope. You can examine their

- A. Structural adaptation,
- B. Behavioral adaptation,

**C.** Different body parts and relate to their niche found. Record the findings in Table 7.  $\star$  Beware of aggressive animals hidden in the leaf litter.

★ Transfer the animals in the glass chamber specified after identification, and clean up the vials.

## Arthropods Ecological



## Discussions and Conclusions

\*Compare and contrast the environment inside and outside woodland. What are the limiting factors that affect the animals' niche? You may also consider their fundamental niche and realized niche.

★Illustrate the adaptive features of Arthropods collected.

★Based on the organisms collected or observed, construct energy pyramid/ food chains/ web to show the trophic levels/ energy flow of these organisms.

★Point out the Importance/ Biological roles (e.g. cycling of materials) of Arthropods in the ecosystem, and explain why they can be so successful in colonizing the environment.

★State some human activities that may pose survival threats on Arthropods in Hong Kong.

★Explain the importance of leaf litters in woodland.

\*List the pros and cons of each sampling method applied. Use the data obtained from the field to explain.

★ State the errors and limitations of the investigation (e.g. sampling methods, procedures). Suggest any improvements for further study.

## References

1. Leaf Litter Arthropods of MesoAmerica- What are Winkler samples https://sites.google.com/site/longinollama/what-are-winkler-samples

2. Project of ALAS Arthrpods of La Selva- Winkler Samples (1999) http://viceroy.eeb.uconn.edu/ALAS/winkler00.html

## **DATA SHEET**



### Table 1. Physical factors measurement inside and outside Woodland

Location of	Temperature (°C)		Relative	Wind Cread (m/c)		
the frame quadrat	Air	Soil	Humidity (%)	wind Speed (m/s)	Light intensity (lux)	
Inside Woodland						
Outside Woodland						

## Table 2. (0.5m x 0.5m) Quadrat count - All living organisms encounter

		1	2	3	4
	Species		-		
lassata	Amount				
Insects	Species	5	6	7	8
	Amount				
	Species	1	2	3	4
Other Arthropods	Amount				
	Species	5	6	7	8
	Amount				
Other Animals	Species	1	2	3	4
	Amount				
	Species	5	6	7	8
	Amount				
Other	Species	1	2	3	4
Living Organisms	Amount				



## Table 3. Active searching- Microhabitat animal sampling in Grassland and Woodland

Find at least 4 micro-habitat in woodland and grassland, try to identify and count the animals your found and record them down. (You can take photo records for un-identified species)

Micro- habitat*		Animal Samp	ling	Micro- habitat*	Animal Sampling				
1 Woodland	Species			2 Woodland	Species				
/ Grassland	Amount			/ Grassland	Amount				
3 Woodland	Species			4 Woodland	Species				
/ Grassland	Amount			Grassland	Amount				
5 Woodland	Species			6 Woodland	Species				
/ Grassland	Amount			/ Grassland	Amount				
7 Woodland	Species			8 Woodland	Species				
/ Grassland	Amount			/ Grassland	Amount				

\*Delete as appropriate

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## Table 4. Transect count- Rhopalocera (Butterfly) survey record

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Survey location*	(Transec	*Del	ete as appropriate			
	Temperature (°C)	Relative Humidity (%)	Light Intensity (lux)	Wind Speed (m/s)	Wind Direction	1
Start point						]
End point						

No. of flowering plantsrecorded along the transect
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Species name/ Family name	No. of species encounter	Species name/ Family name	No. of species encounter
1		2	
3		4	
5		6	
7		8	
9		10	



## Table 5. Point count- Rhopalocera (Butterfly) survey record

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	uivey	iocui

location\* Pavilion (Start point of Transect A) / Fa Ping farmland (End point of Transect B)

\*Delete as appropriate

	Temperature (°C)	Relative Humidity (%)	Light Intensity (lux)	Wind Speed (m/s)	Wind Direction
Start point					
End point					

No. of flowering plants recorded	
around the survey area	

Species name/ Family name	No. of species encounter	Species name/ Family name	No. of species encounter
1		2	
3		4	
5		6	
7		8	
9		10	

## Table 6. Arthropods classification record

Focal Taxa / Order	Structural characteristics	No. of animals found	Biological role
Hymenoptera 膜翅目			
Collembola 彈尾目			
Biattaria 蜚蠊目			
Isoptera 等翅目			
Hemiptera 半翅目			

## Table 6. Arthropods classification record (Con't)

Focal Taxa / Order	Structural characteristics	No. of animals found	Biological role
Coleoptera 鞘翅目			
Pseudoscorpions 擬蠍目			
Acariformes 蟎形總目			
Aranea 蜘蛛			
Chilopoda 蜈蚣			
Diplopoda 馬陸			
lsopoda 等足目			
Lepidoptera 鱗翅目			
Diptera 雙翅目			
Orthoptera 直翅目			

After investigation, point out the (1) Survival threats that the animals may encounter in their niche, and (2) Their related Adaptation (Structural and / Behavioral) in Table 7.

## Table 7. Investigate collected animal samples

Survival threats	Related adaptive features

