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SPIDER DIVERSITY AS AN EFFORT TO MITIGATE INSECT PESTS IN THE LINGSAR VEGETABLE FARMING AREA, WEST LOMBOK REGENCY

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Abstract: Arthropods have many roles in an ecosystem, including as pest biocontrol agents. Spiders are part of a group of arthropods that carry out this function by being predators of insect pests. This research aims to analyze the diversity of spider types in the Lingsar District Vegetable Area, West Lombok Regency. Data was collected from January to April 2023 using a survey method with sweeping nets three times per week and pitfall traps every week on five routes (west, south, east, centre, and north). Identification of spider types is carried out referring to morphological characteristics, guided by the identification book. The samples obtained were analyzed using the Shannon-Weiner diversity index (H'). The research results showed that the spider species identified in the Lingsar Vegetable Area comprised 11 species belonging to 10 families. Zoropsis spinimana from the Zoropsidae family was found in all sampling lines and was the species with the highest number of individuals. The species with the lowest number of individuals found in only one route are Ctenus hibernalis (Ctenidae) and Cryphoeca silvicola (Cybaeidae). The diversity index ranges from 1.188-1.654 (medium category), with the highest diversity in the middle route. The list of names of spider types obtained has the potential to be used as a basis for developing biocontrol of agricultural pests using their natural enemies in the form of spiders on horticultural crops such as vegetables.

Keywords: *Biodiversity, Spider, Lingsar*

INTRODUCTION

Spiders (Arachnid) are one of the most abundant groups of predatory arthropods in terrestrial ecosystems and consume prey in the form of insects in large quantities. The existence of spider species in the ecosystem plays a vital role in controlling insect pests without causing damage to [1]. Spiders are natural enemies of insect pests through predation and passivism [2-3]. [4] found that spiders are potential predators of *Lepidotrigona terminate* bees.

On agricultural land, spiders act as generalist predators and biological control agents for several insect pests, such as the planthopper group (planthopper; leafhopper), usually found in rice paddy ecosystems planted with rice [5-6]. A specific example is a type of facultative communal spider such as Cyrtophora citricola, which is used to control the pest Tuta absoluta, a pest of tomato plants worldwide. This type of spider, which is significant, can catch more prey by making a web that traps its prey [7]. In rice fields planted with rice, spiders are usually found during the entire planting period, from seeding to harvest. Species richness is high during rice grain ripening because spider prey is abundant [8-3]. [9] found that spiders from the Tetragnathidae group were found to be dominant as predatory arthropods in rice fields planted with rice. Pest regulation through the presence of natural predators is essential for adequately protecting commodity crops [10].

Vegetables are included in agricultural commodities that are cultivated to meet food needs. Vegetable cultivation is increasing and popular with the community, using small land areas as productive green areas through hydroponic and verticulture techniques [11-12]. Many farmers develop vegetable horticulture because this commodity has high economic value [13]. In West Lombok, one of the areas that is a centre for vegetable cultivation is the Lingsar sub-district. The vegetables cultivated in this area include large chillies, cayenne peppers, long beans, tomatoes, kale, cucumbers, and spinach. There are three types of vegetables from the list of vegetables that have high production value in Lingsar, namely large chilli commodities (1379 quintals (2021); 641 quintals (2022), kale (6381 quintals (2021); 9066 quintals (2022)), spinach (753 quintals (2021); 1380 quintals (2022) [14].

One of the challenges to successful vegetable production is determined by the presence of vegetable insect pests, which have the potential to damage vegetables, but this can be reduced by the presence of natural predators, which have the potential to reduce the impact of insect pests. Among the natural enemies of these insect pests are spiders. However, scientific information regarding the ecological aspects of spiders, including their diversity and distribution, especially in the Lingsar District, is still limited, meaning that the role of spiders in mitigating vegetable pests and even biological pest controllers cannot be utilized optimally. Therefore, research related to the ecological aspects of spiders, especially diversity and distribution in the vegetable area of Lingsar

District, is essential to carry out in order to determine the types of spiders and their potential as a natural biocontrol of pests in vegetables.

RESEARCH METHOD

Time and Place

This research was carried out from January to April 2023 in the vegetable area of Lingsar District, West Lombok (Figure 1). Data collection was carried out once per week, covering five routes (North, South, East, West, Central) using a survey method with sweeping net at three sampling times, namely 08.00-12.00 WITA, afternoon (14.00-17.00 WITA) and evening (20.00 WITA). – 24.00 WITA). The samples obtained were stored on papilot paper. Data was also collected using the pitfall trap method with a trap installation time of one week. The samples obtained were then taken to the Biology Education Laboratory, Faculty of Teacher Training and Education (FKIP), Mataram University, for species identification based on morphological characteristics referring to [15-16].

Data Analysis

Determining the complexity of biotic and abiotic community interactions and the stability of a community can be determined by looking at species diversity [17]. The calculation of spider species diversity obtained refers to the Shannon-Weiner diversity index (H'), which is calculated using the formula:

$$H': -\sum(p_i)(\ln p_i), \text{ which } P_i=n_i/N$$

Pi=proportion of individuals of species i; ni=number of individuals of the i-th species; N=total number of individuals of all species [18].

RESULT AND DISCUSSION

Composition of Spider Species

The spiders obtained comprised 11 species belonging to 10 families, with Tetragnathidae having relatively higher member representation than other families (Table 1). The Zoropsis spinimana (Zoropsidae) type was observed in all sampling lines and was found to have the highest number of individuals among the other species. The genus Zoropsis was first proposed by Simon (1878), with Zoropsis spinimana (Dufour, 1820) being one example of a species from this genus. Currently, this genus consists of fifteen known species commonly found around settlements and under leaf litter in forests [19]. On the other hand, four species from four different families are only observed in one observation route, namely Pholcus phalangioides (Pholcidae) and Naphyrus pulex (Salticidae) in the eastern route. In comparison, the other two are Ctenus hibernalis (Ctenidae) and Cryphoeca silvicola (Cybaeidae) in middle lane and these two species were the lowest species for which the number of individuals was obtained during the study (Table 1).

Table 1. Types, distribution and number of spider specimens in the Lingsar vegetable area

No	Family	Species	Track					∑Specimen
			West	South	East	Central	North	
1	Anyphaenidae	*Hibana gracilis*	0	0	0	+	+	3
2	Ctenidae	*Ctenus hibernalis*	0	0	0	+	0	1
3	Cybaeidae	*Cryphoeca silvicola*	0	0	0	+	0	1
4	Linyphiidae	*Anguliphantes angulipalpis*	+	+	+	0	+	20
5	Lycosidae	*Trochosa terricola*	+	0	+	+	+	31
6	Oxyopidae	*Oxyopes salticus*	+	0	+	+	+	17
7	Pholcidae	*Pholcus phalangioides*	0	0	+	0	0	2
8	Salticidae	*Naphyrus pulex*	0	0	+	0	0	3
9	Tetragnathidae	*Tetragnatha nitens*	0	+	0	+	+	8
10	Tetragnathidae	*Tetragnatha straminea*	0	+	0	+	0	2
11	Zoropsidae	*Zoropsis spinimana*	+	+	+	+	+	45

Annotation: +=Found;0=Not Found

The spider species found in the Lingsar vegetable area were higher than those found by [20] in eggplant vegetables, with five species belonging to 2 families, and higher than the families from the cashew plantation location (8 families), having a number of the same family as those found in coffee plantations. However, each spider species is higher, namely 19 species (cashew) and 46 species in coffee plantations [21-22]. The number of spiders in this study was also

much lower than those in oil palm plantations bordering forests, with 68 species (15 families) [23]. Vegetated habitats greatly influence the composition and distribution of spiders [24]. Then, spiders are usually abundant in areas generally covered by a canopy in all microhabitats [25].

Biodiversity of Spiders

The spider diversity index (H') values obtained were 1.188-1.654. The central and eastern routes have almost the same H' and are higher than the other routes. The southern route has the lowest H value (Figure 2). The H' value obtained indicates that the diversity of spiders in the Lingsar vegetable area is moderate, as stated by [26]. Regarding diversity in a location, it is in the medium category if it has a value in the range of one but below 3. Certain factors, such as species evenness and richness, can influence low and high diversity. Diversity that tends to be moderate to low indicates the dominance of certain species in a community [27]. The moderate diversity of spiders in the vegetable area is probably due to the influence of vegetation cover that is less diverse and less shaded.

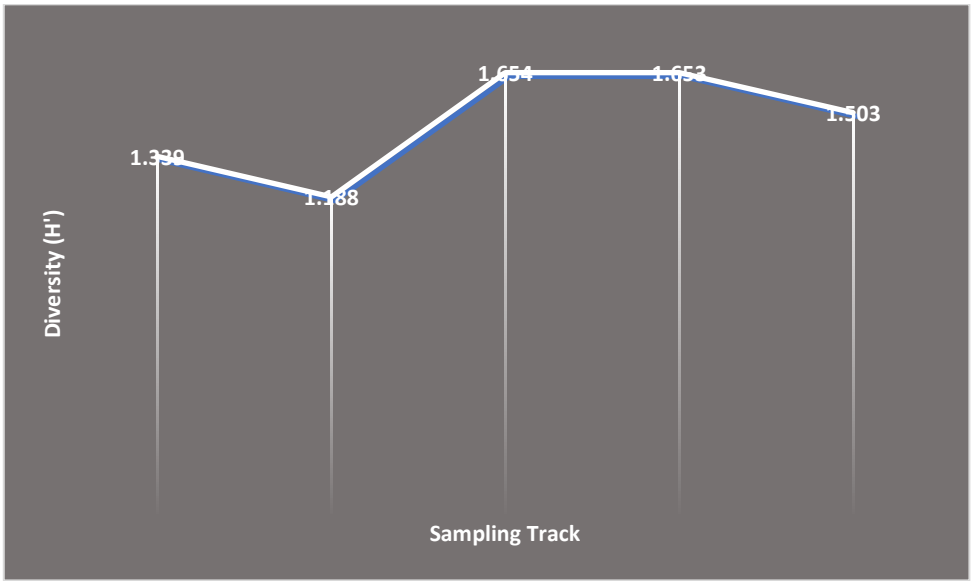

Figure 2. Diversity index (H') of spiders found on the observation route in the Lingsar vegetable area, West Lombok

The diversity of spiders in the Lingsar vegetable area is lower than that of spiders in the Banyubiru Labuan Pandeglang Tourism Village, which is characterized by settlements and forests with an H' range of 1.67 to 2.14 [28] and as reported by [23] namely 2.43 to 3.11. However, it has a higher H' than spiders found in rice paddy ecosystems in several locations (H'=0.750-1.881) [29]. [24] stated that spiders' diversity, abundance and species richness are generally higher in plantation and forest areas compared to agricultural areas such as corn fields, referring to the wide variety of vegetation that plays an essential role in the composition of spiders in a habitat. [30] explained that spider assemblages significantly differed between forested and agricultural sites, which strongly correlated with riparian variables such as vegetation and soil types.

CONCLUSION

The composition of spiders in the Lingsar vegetable area has low diversity. The data obtained in the form of a list of spider names can be used as a basis for selecting spiders that have the potential as biocontrol agents for agricultural pests to be developed and conserved, especially for the needs of natural enemies of pests in horticultural crops such as vegetables.

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