



Original Article

# Beneficial arthropods in the edible amaranth ecosystem during the wet season

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## ARTICLE INFORMATION



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## ABSTRACT

The edible amaranth (*Amaranthus tricolor* L.) is an important vegetable growing around the world. The famous vegetable plant is known for two types: green and green-red amaranth. The purpose of the research is to study an abundance of beneficial arthropods in the edible amaranth ecosystem using pitfall trap. The study was conducted in the edible amaranth farmers plantation at Kanreapia Village, Gowa Regency, South Sulawesi in the wet season from August to December 2022. The pitfall trap was embedded into the ground at the same depth as the soil surface for 24 hours. The position of a pitfall trap in the center and every corner of the plot. The pitfall used five pieces for every plot (total 20 pitfall). The result showed important predator arthropods collected from pitfall traps were divided into two groups: spiders and insects. In this research, the beneficial arthropods are found in similar habitats in the edible amaranth. The highest percentage was Gryllidae such as *Gryllus* sp. (54.83%). The spiders group from Lycosidae, *Lycosa pseudoannulata* (25.80%) and from Oxyopidae, *Oxyopus* sp. (19.35%). The pitfall trap showed the percentage number of *Valanga* sp. (Acrididae) about 36%.

**Keywords:** Edible amaranth; Gryllidae; Lycosidae; Oxyopidae; Pitfall trap

## 1. Introduction

The edible amaranth (*Amaranthus tricolor* L.) family Amaranthaceae is the important and one of the major local crop commodities in Indonesia. The edible amaranth cultivation spread from Sumatra, Java, Kalimantan, and Sulawesi Islands. Commonly edible amaranth growth in the South Sulawesi farmers fields is divided into two types such as: green and green-red edible amaranth. They are dicotyledonous plants that are easy to grow, economically and harvest fast. However, the major problem of edible amaranth cultivation is spraying chemical pesticides impacts residual possibility on plant material. The development of edible amaranth in tropical countries had many pest insects such as: *Spodoptera* sp. (Kotikal et al., 2017; Perzabal-Ramos et al., 2018) and *Thrips* sp. (Aminah & Nasruddin, 2019).

The presence of arthropods in the edible amaranth ecosystem is very important because their function such as pests and beneficial organisms. Efforts to monitor the number of arthropods in the ecosystem used many tools based on color and technique trapped organisms. A pitfall trap is a famous tool for monitoring the number of arthropods in farmers crops. An easy technique possibly applied in edible amaranth and other plantation. Commonly pitfall traps used in the field are strongly related to the extensive use of conventional insecticides, resulted

in the development of pest resistance to insecticides, outbreak of secondary pest, dangerous for users, negative effect on environment and non target organism. Non target organism mean beneficial arthropods such as: pollinators, parasitoids, decomposer and predatory insects surrounding the plantation (Langmack et al., 2001; Kodandaram et al., 2010; Ruiz et al., 2011; Aminah et al., 2014; Kotikal et al. 2017). According to Alkoarta et al. (2003); Islam et al. (2013); Abdullah et al. (2017) based the technique and purpose, the different trap tools used depend on crop variety and insect target.

Shannon-Wiener index diversity as the common technique to measure the diversity of organisms in nature. The findings of Langmack et al. (2001), Abdullah et al. (2015), Aminah et al. (2013), Ikhsan et al. (2018) and Aminah & Nasruddin (2019) reported a few factors affected the fluctuation of biodiversity such as: 1) the biodiversity in the specific habitat increasing based the time; 2) the heterogeneity of habitat will affect the complexity of animal and plant species; 3) competition if the source of food cannot cover the consumers; 4) stability of climate; and 5) plant productivity because plant as the main producer in the food chain.

Based on the reason the purpose of the research is to study an abundance of beneficial arthropods in the edible amaranth ecosystem using pitfall traps. The result of

the research is very useful information for the management of potential beneficial arthropods improving the quality of edible amaranth and monitoring the presence of pest insects based on easier methods for farmers.

## 2. Materials and Methods

### 2.1. Research Site

The research was conducted in the field trial of the edible amaranth at Kanreapia Village, Gowa Regency, South Sulawesi, Indonesia in the wet season from August to December 2022.

### 2.2. Arthropods Samples

Before application of the treatment, the farmer agrees to all of the research treatments into their edible amaranth not applied by herbicide, insecticide, fertilizers and other chemical material. The edible amaranth seed for research used green varieties from farmers own plant. Before planting, the farmer mixed well the seeds of the edible amaranth with ash and sown followed the longitudinal path on the plot. The plot length = 7 m, width = 3 m, and height = 30 cm. The research used four plots, distance between plot about 2 m. The observation of the arthropods using pitfall trap was held in plot started 15 days after planting with intervals of seven days within eight weeks. The pitfall trap used plastic glass (diameter = 5 cm, height = 9 cm), filling half of glass with alcohol 70% and biodegradable detergent (2:1). In the morning, pitfall trap was embedded into the ground at the same depth as soil surface for 24 hours. The position of a pitfall trap in the center and every corner of the plot, five pitfall traps for every plot (total 20 traps).

### 2.3. Statistical Analysis

The arthropods abundance (Wolda, 1978; Gibb & Oseto, 2005; Herlinda et al., 2008 and Mardiyanti et al., 2013). with the formula (1):

$$\text{Abundance} = \frac{a}{b} \times 100\% \quad (1)$$

Whereas:

a : Number of arthropods

b : Total number of arthropods

## 3. Results

Commonly many arthropods are collected in research with purpose of identification and determining their role in the ecosystem. Every arthropod species has a specific role in nature. Table 1 shows the important predator arthropods collected from pitfall traps. Based on the data, the arthropods predator are divided into two group: spiders and insects. In this research, the beneficial arthropods are found in similar habitat on the edible amaranth. The highest number of percentage was Gryllidae such as *Gryllus* sp. (54.83%). The spiders group from Lycosidae, *Lycosa pseudoannulata* (25.80%) and from Oxyopidae *Oxyopus* sp. (19.35%). The total number of collected beneficial arthropods in the wet season is only 31 individuals. The result showed that the rainy days in wet conditions limited the activity of beneficial arthropods then showed a lower number. In this research, the percentage of Gryllidae more higher than spiders. We assumed that

*Gryllus* sp. is more mobile and easily prey insect pests as their food.

**Table 1.** The abundance of the important arthropods predator on the edible amaranth ecosystem.

Order/Family	Genus/Species	Abundance (%)
Orthoptera/Gryllidae	<i>Gryllus</i> sp.	54.85
Araneae/Lycosidae	<i>Lycosa pseudoannulata</i>	25.80
Araneae/Oxyopidae	<i>Oxyopus</i> sp.	19.35

## 4. Discussion

Besides cricket, for many decades, spiders or arachnids have played the role of potential predators in crop ecosystems. Commonly they are suitable for living in natural habitats with reduced chemical material. Based our research, the pitfall trap only worked well in the dry season and trapped falling arthropods or insects especially those living in the soil surface. According to Fountain et al. (2007); Barberi et al. (2010); Justin and Preetha (2014); Menta and Remelli (2020) state that commonly predators interested visit the plant because presence of prey as their food and an important meeting point for the same species. Widiarta et al. (2006); Pearson & Tooker (2017); Aminah and Syatrawati (2019) and Aminah et al. (2020) stated that beneficial insects such as predators able to detect the presence of prey used antennae and organs related to their activities. The presence number of prey surrounding the plant indicated food-related increasing the number of beneficial arthropods working in these areas.

As we know, pest insects play an important role in the successful harvest of agricultural products. Hidayat and Sosromarsono (2003); Aminah et al. (2013) and Abdullah et al. (2017) reported successful arthropod traps in the ecosystem affected by the season and types of insects trapped. For example, pitfall traps are commonly used for arthropods living on the soil surface. Sometimes on a rainy day, a few insects fall from the plant canopy then trapped in the pitfall trap. According to Langmack et al. (2001), Indriyati & Wibowo (2008); Mardiyanti et al. (2013), Aminah & Syatrawati (2019) and Islam et al. (2023) stated that habitat management is very important in conserving natural enemies such as beneficial arthropods in the crop. The pitfall also trapped some *Valanga* sp. (Orthoptera: Acrididae). As we know this insect is a very destructive pest in agriculture. Ability to adapt in new areas supporting successful of their presence in the agroecosystem.

The presence of crops as a food source in a limited time gives benefit of insect development in nature. Commonly many food sources resulting insects natural enemies in higher population number and size better more than poor field or dry land. The manipulating of plant resources very useful increasing number of beneficial arthropods in agricultural landscapes. Manipulating habitat need more attention to avoid starvation of beneficial arthropods surrounding the habitat. For example, management of weed production flowers as the best way conserve the natural enemies in crop. The one recommendation avoid outbreak pest insects with monitoring activities to detect the presence of them using

suitable traps based on the landscape structure, pattern and crop variety.

Research from Ruiz et al. (2011), Aminah et al. (2013), Pearson and Tooker (2017); Menta and Remelli (2020) reported that commonly the percentage of arthropods species and abundance increasing by the presence of vegetation cover and methods controlling pest insects in the field. The communities under vegetation mainly respond to food availability and the presence of natural enemies. The availability of plants as a source of food and refugia seems to play a critical role as a reserve and source of arthropods. The decreasing vegetation cover and changes in vegetation patterns can lead to a significant loss of more arthropods.

## 5. Conclusion

We concluded that pitfall traps in the wet season in the edible amaranth ecosystem showed the highest number of percentage Gryllidae such as *Gryllus* sp. (54.83%). The spiders group from Lycosidae, *Lycosa pseudoannulata* (25.80%) and Oxyopidae, *Oxyopus* sp. (19.35%).

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