

Original Research Article
**Identification of Refugia Plants in Vegetable
Crops in Agam, West Sumatera**

ABSTRACT

Aims: The study aimed to identify the refugia plants in vegetable crops in Agam regency, West Sumatera, Indonesia.

Study design: Purposive random sampling

Place and Duration of Study: The research was conducted in vegetable plantations in Agam regency, West Sumatera and Laboratory of Weeds, Faculty of Agriculture, Andalas University, Padang, Indonesia from May to October 2023.

Methodology: Purposive random sampling was used as method in the study. Three districts were chosen as sampling locations (Ampek Angkek, Banuhampu and Sungai Pua). In each district, two nagari (Sub-district) were chosen to determine vegetable plantations. In each nagari, two widest areas of crop plantation were chosen as locations. The refugia plants were collected and brought to Laboratory to identify. The identification was conducted in Laboratory of Weed, Faculty of Agriculture, Andalas University.

Results: 12 refugia plants were found in vegetable crops in Agam regency, *Tagetes* spp., *Cosmos* spp., *Catharanthus roseus*, *Melastomamalabathricum*, *Brassica oleracea*, *Melampodium* spp., *Helianthus annuus*, *Coleus scutellarioides*, *Momordica charantia*, *Tagetes* spp., *Ipomoea* spp. dan *Tagetes erecta*.

Conclusion: There are various refugia plants in vegetable crops in Agam regency

Keywords: Agam, refugia, vegetable

1. INTRODUCTION

Vegetable is a common name of food material from high water content plant and consumed in fresh condition or after minimal processing. It is an important commodity in supporting national food security. This commodity has a wide variety and acts as a source of carbohydrates, plant-based protein, vitamins and minerals [1].

West Sumatera is one of vegetable producers in Sumatra Island. It supports the neighboring provinces' demand for this commodity. The vegetable cultivation in this area is generally located around volcanoes. There are two main volcanoes in West Sumatera, Mount Marapi and Mount Talang. Several regencies were main producers such as Solok,

Tanah Datar and Agam because the fertile land of ~~these area~~these areas was affected by these mounts [2].

Agam is one of important regency in producing vegetable in West Sumatera. The vegetables are generally cultivated around Mount Marapi. For several districts, almost the majority of the population are vegetable farmers such as AmpekAngkek, Banuhampu and Sungai Pua. The cultivated vegetables are cabbages, carrot, chilli, eggplant and tomato.

In vegetable cultivation, herbivore insect is a serious problem. Several species of herbivore insects were reported in vegetable crop in Agam such as *Crocidolomia binotalis*, *Spodoptera litura*, *S. frugiperda*, *Plutellaxylostella* and aphids. Yield ~~lost~~lost caused by these insects reached 70% [3]. Generally, the farmers used synthetic ~~insecticide~~insecticides to control the pests. However, as ~~technology~~technological development and farmer's knowledge begins to increase, the farmers have used several alternative efforts to control the pests, including preventive effort.

One of the preventive efforts in controlling the pest is the use of refugia plants ~~use~~. The pest control of this way uses ecological ~~principle~~principles, maintaining population stability in an agroecosystem or landscape, so the population balance is maintained [4]. The refugia plants provide a source of food or shelter for natural enemies such as predators and parasitoids. The presence of natural enemies in an agroecosystem of landscape causes the ecosystem balance [5]. In balance ecosystem, the status of herbivore insects is not pests. The research ~~aimed~~aimed to identify the refugia plants in vegetable crops in Agam regency.

2. MATERIAL AND METHODS

The research was conducted in vegetable plantations of Agam regency, West Sumatera and Laboratory of Weed, Faculty of Agriculture, Andalas University, Padang, West Sumatera, Indonesia. The research was conducted from May to October 2023.

2.1 Method

Purposive random sampling was used as a method to determine the locations of the study. The criteria of location ~~was were~~ there was refugia plant in vegetable plantation. The area of vegetable crops was ± 1 ha. According to the criteria, three districts were chosen as sampling locations (AmpekAngkek, Banuhampu and Sungai Pua). In each district, two nagari (sub-district) were chosen to determine vegetable plantations. In each nagari, two widest area of crop Plantation were chosen as locations.

The refugia plants were collected and brought to the Laboratory to identify. The identification was conducted in the laboratory of Weed, Faculty of Agriculture, Andalas University, Padang, Indonesia. The species determination was conducted according to morphological differences.

2.2 Parameter and data analysis

~~The parameter was~~ the type of refugia plants around vegetable crops in Agam regency was the measured parameter. How and why only this variable?

How this parameter was analyzed to generate the results?

Elaborate.....

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3. RESULTS AND DISCUSSION

3.1 Refugia plants in vegetable crops plantation

The result showed that 12 refugia plants was found in vegetable plantations in Agam regency, West Sumatera, Indonesia (Table 1). The description of refugia plants can be seen in Figure 1. Generally, the refugia plants were not well known by vegetable farmers in Agam regency. This result was represented by the number of refugia plants in the field. However, this result also indicated that various refugia plants were planted by farmers.

Refugia was an important part in of an the ecosystem. It played as a food provider for natural enemies particularly for parasitoids. Parasitoid was a group of natural enemies that played a role in herbivore insect controlling in an agroecosystem [6]. Refugia was a micro habitat that provided spacial or temporal shelter for natural enemies such as predator and parasitoid and also supporting biotic interaction components in ecosystem such as pollinator insects [7].

The result showed that 12 species of refugia plants were found in the field. Generally, the refugia plants were only planted by a few farmers. This condition was caused by the synthetic pesticide that was still relied on by farmers to control herbivore insects. From 12 refugia plants in the field, *Brassica oleracea* was the dominant species found in vegetable crops in Agam regency. generally, this plant was left by farmers after harvesting due to there were still many cultivated plants such as shallot and chili plants around *B. oleracea*. This method could be minimize energy by farmers to deliberately plant refugia plants.

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Table 1. Refugia plants that found in vegetable crops in Agam regency

No	Plants	Local name
1	<i>Tagetes</i> spp.	Bunga tahiyam
2	<i>Cosmos</i> spp.	Kenikir
3	<i>Catharanthus roseus</i>	Tapakdara
4	<i>Melastomamalabathricum</i>	Sikanduduk
5	<i>Brassica oleracea</i>	Brokoli
6	<i>Melampodium</i> spp.	Melampodium kuning
7	<i>Helianthus annuus</i>	Bunga matahari
8	<i>Coleus scutellarioides</i>	Piladang
9	<i>Momordica charantia</i>	Gambas/ pario
10	<i>Tagetes</i> spp.	Bunga tahiyam
11	<i>Ipomoea</i> spp.	Bunga terompot
12	<i>Tagetes erecta</i>	Bunga tahiyam

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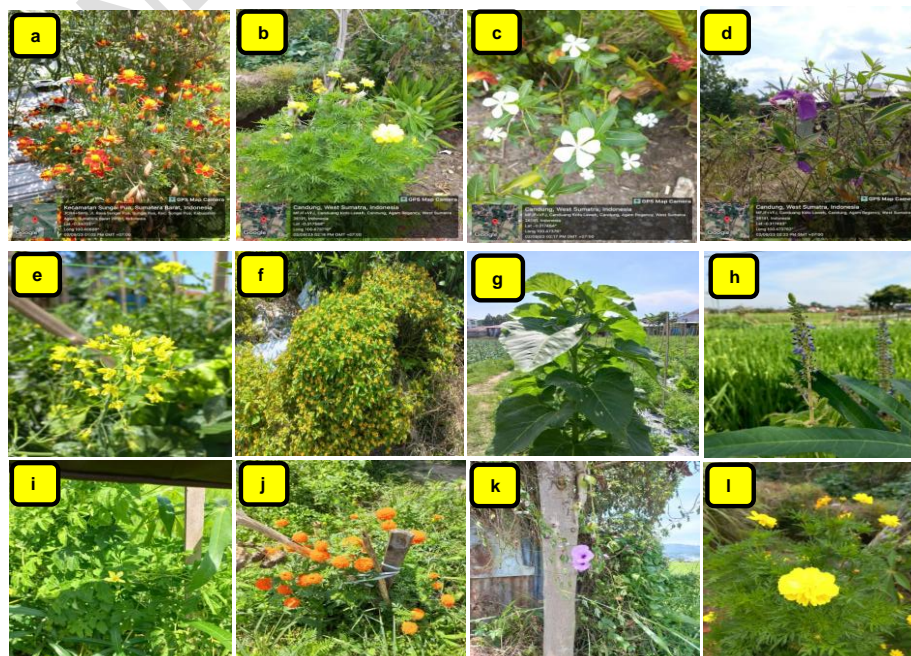


Figure 1. Refugia plants in vegetable crops of Agam regency. a) *Tagetes* spp., b) *Cosmos* spp., c) *Catharanthus roseus*, d) *Melastomamalabathricum*, e) *Brassica oleracea*, f) *Melampodium* spp., g) *Helianthus annuus*, h) *Coleus scutellarioides*, i) *Momordica charantia*, j) *Tagetes* spp., k) *Ipomoea* spp., l) *Tagetes erecta*.

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Several species of refugia ~~plant-plants~~ found in the field such as *Helianthus annuus*, *Coleus scutellarioides*, *Momordica charanti* dan *Ipomoea* spp. were not ~~many~~ planted by farmers. The purpose of these plants cultivation was not also for refugia ~~plantplants~~. For *M. charantia*, generally, this plant was planted by farmers to obtain its fruit as food and its food is typical cuisine of Minangkabau people, a majority tribe of West Sumatera. However, the small number of these plants also affected the ecosystem diversity. The *H. annuus* (sunflower) cultivation and *Cosmos* spp. ~~was-were~~ reported could increase the natural enemies index. The refugia increased the availability of nectar, pollen, ~~-and~~ and alternative hosts [8][9].

The study also proved that a genus of plants consisted of many species. For genus *Tagetes*, the identification result revealed that it consisted of three species (Figure 1). This result indicated also that the farmers ~~has-have~~ understood ~~that about the similar related?~~ plants could be used as refugia plants. Plant species from ~~a-the~~ same genus had almost similar characteristics so the plants could ~~be~~ substitute ~~plant-plants~~ for another plants from ~~a-the~~ same genus [10].

According to the result, the vegetable farmers of Agam regency ~~had understood~~ realized ~~that about~~ Integrated Pest Management (IPM) can be used to control herbivore insects. The benefits of refugia plants were microhabitat for natural enemies, nectar source s for pollinator insect and a balance agroecosystem. The balance d ecosystem is highly related to the herbivore insect as a pest. A balance d ecosystem caused the insect herbivore status ~~was-be~~ also as herbivore.

4. CONCLUSION

Twelve (12) refugia plants were found in vegetable crops in Agam regency, *Tagetes* spp., *Cosmos* spp., *Catharanthus roseus*, *Melastomamalabathricum*, *Brassica oleracea*, *Melampodium* spp., *Helianthus annuus*, *Coleus scutellarioides*, *Momordica charantia*, *Tagetes* spp., *Ipomoea* spp. dan *Tagetes erecta*. What's next?
State the importance of this finding and the strategies for their effective use in biological IPM.

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