



Identification of Refugia Plants in Vegetable Crops in Agam, West Sumatera, Indonesia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRAF/2023/v9i4259

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/110359>

Original Research Article

Received: 02/11/2023

Accepted: 07/12/2023

Published: 16/12/2023

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

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area 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*, *Melastoma malabathricum*, *Brassica oleracea*, *Melampodium* spp., *Helianthus annuus*, *Coleus scutellarioides*, *Momordica charantia*, *Tagetes* spp., *Ipomoea* spp. dan *Tagetes erecta*.

Conclusion: There is various refugia plants in vegetable crops in Agam regency.

Keywords: Agam; refugia; vegetable.

1. INTRODUCTION

Vegetable is 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 source of carbohydrates, plant-bases protein, vitamins and minerals [1].

West Sumatera is one of vegetable producer in Sumatera 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 producer such as Solok, Tanah Datar and Agam because the fertile land of 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 Ampek Angkek, 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*, *Plutella xylostella* and aphids. Yield lost caused by these insects reached 70% [3]. Generally, the farmers used synthetic insecticides to control the pests. However, as 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. The pest control

of this way uses ecological 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 to identify the refugia plants in vegetable crops in Agam regency.

2. MATERIALS 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 Methods

Purposive random sampling was used as a method to determine the locations of the study. The criteria of location were there was refugia plant in vegetable plantation. The area of vegetable crops was ± 1 ha. According the criteria, 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 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 type of refugia plants around vegetable crops in Agam regency was the measured parameter. The refugia plants were identified according to the morphological performance.

3. RESULTS AND DISCUSSION

3.1 Refugia Plants in Vegetable Crops Plantation

Twelve (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 Fig. 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 of the ecosystem. It played as a food provider for natural enemies particularly for parasitoids. Parasitoid is a group of natural enemies that play a role in herbivore insect control in an agroecosystem [6]. Refugia is a microhabitat 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].

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 minimize energy by farmers to deliberately plant refugia plants.

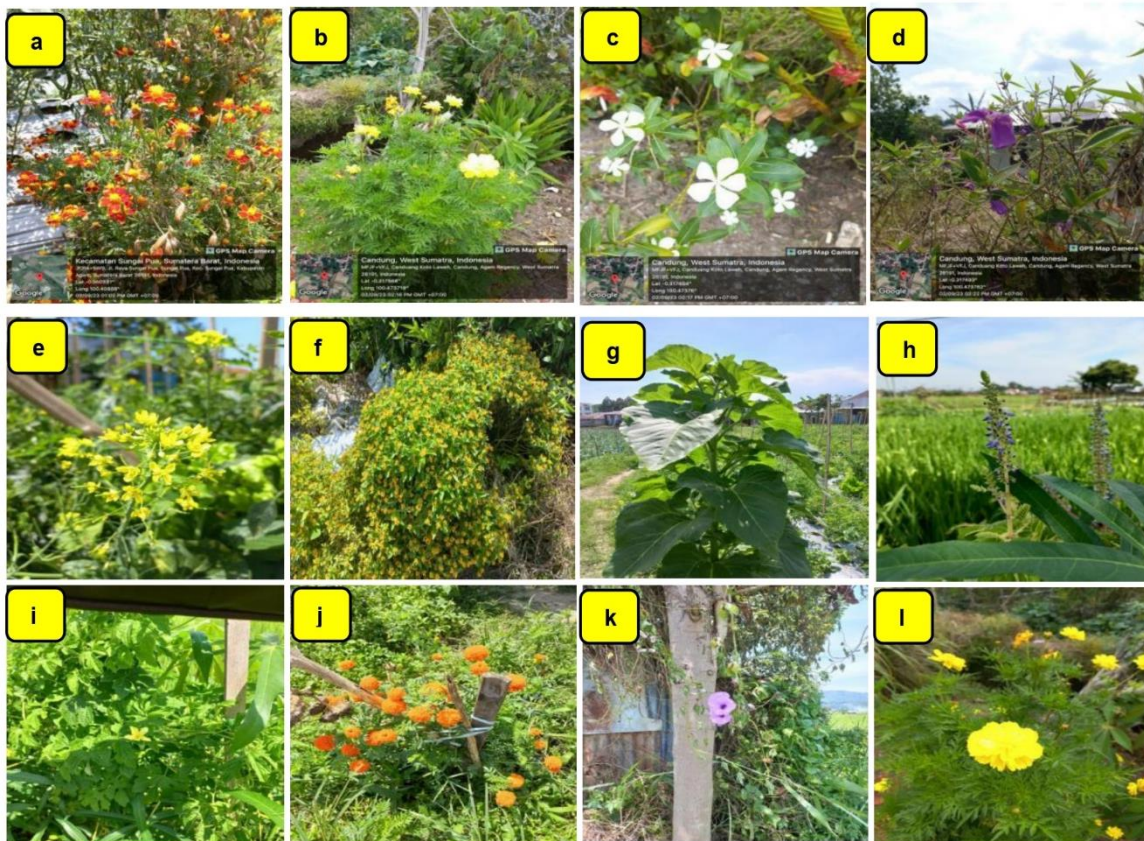


Fig. 1. Refugia plants in vegetable crops of Agam regency. a) *Tagetes* spp., b) *Cosmos* spp., c) *Catharanthus roseus*, d) *Melastoma malabathricum*, e) *Brassica oleracea*, f) *Melampodium* spp., g) *Helianthus annuus*, h) *Coleus scutellarioides*, i) *Momordica charantia*, j) *Tagetes* spp., k) *Ipomoea*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

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

No	Plants	Local name
1	<i>Tagetes</i> spp.	Bunga tahi ayam
2	<i>Cosmos</i> spp.	Kenikir
3	<i>Catharanthus roseus</i>	Tapak dara
4	<i>Melastoma malabathricum</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 tahi ayam
11	<i>Ipomoea</i> spp.	Bunga terompet
12	<i>Tagetes erecta</i>	Bunga tahi ayam

Several species of refugia plants found in the field such as *Helianthus annuus*, *Coleus scutellarioides*, *Momordica charantia* dan *Ipomoea* spp. were not planted by farmers. The purpose of these plants cultivation was not also for refugia plants. 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. were reported could increase the natural enemies index. The refugia increased the availability of nectar, pollen, 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 (Fig. 1). This result indicated also that the farmers have understood that related plants could be used as refugia plants. Plant species from the same genus had almost similar characteristics so the plants could substitute plants for another plants from the same genus [10].

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

4. CONCLUSION

Twelve (12) refugia plants were found in vegetable crops in Agam regency, *Tagetes* spp.,

Cosmos spp., *Catharanthus roseus*, *Melastoma malabathricum*, *Brassica oleracea*, *Melampodium* spp., *Helianthus annuus*, *Coleus scutellarioides*, *Momordica charantia*, *Tagetes* spp., *Ipomoea* spp. dan *Tagetes erecta*. The farmers in Agam regency have used refugia plants to control herbivore insect as pest.

ACKNOWLEDGEMENTS

The authors would like to thank to all participants who have participated and supported the research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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