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Conservation Coccinella sp. as Predator of Green Peach Aphid Myzus persicae Sulzer on Potato Intercropping

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Abstract - Green peach aphid, *Myzus persicae* (Sulzer), is the major pest on potato in Karo Highland, North Sumatera. This aphid also vector of *Potato leafroll virus* (PLRV) and *Potato Virus Y* (PVY). This study aims to determine the kind of plants intercropping to be applied with potato plant at organic farming system, in order to conservation *Coccinella* sp. as potenstial predator of *Myzus persicae* Sulzer. This study design by Split plot design with the main plot is farming systems (conventional and organic) and the subplot is the planting system (monoculture potato; potato-cabbage; potato-mustard; potato-celery; potato-cabbage-mustard; Potato-cabbage-celery; potato-mustard-celery; potato-cabbage-mustard-celery). The data was analyzed by ANOVA and Tukey test. Intercropping system potato-cabbage-mustard-celery, potato-cabbage-mustard, potato-mustard-celery and potato-mustard significantly increasing population of *Coccinella* sp. on potato field with organic farminf system. At the intercropping system found the lowest populations of *M. persicae,* and the highest crop production. Planting season February-April found the higher population of *Coccinella* sp. than planting season May-August on organic farming.

Keywords- *Coccinella* sp., intercropping, potato, *Myzus persicae*

INTRODUCTION

Of all the predaceous beetle groups, perhaps the most familiar to non-specialists is the lady beetle family, Coccinellidae. It is widely known that this charismatic group includes many beneficial species that are voracious predators of pestiferous aphids and scale insects [1]. *Coccinella transversalis* Fabricus was one of the spesies of Coccinellids which commonly found feeding on aphids in vegetable crops. They are the most commonly known of all beneficial insects and as important predaceous both in their larval and adult stages on various important crop pests such as aphids, coccids and other soft bodies insects including aphids [2]. The occurrence of *C. transversalis* has been reported from countries such as India, Nepal, Sri Lanka, Bangladesh, Indochina, Indonesia, Australia and New Zealand [3]. Many studied showed that both larvae and adult stage of *C. transversalis* can often be attributed to the same plants and feed on the same insect species [4].

Conservation biological control in agroecosystems requires a landscape management perspective, because most arthropod species experience their habitat at spatial scales beyond the plot level, and there is spillover of natural enemies across the crop–noncrop interface [5]. Conservation biological control agent is the practice of enhancing natural enemy efficacy through modification of the environment or of existing pesticide practices [6]. Recent scientific reviews have considered that conservation of biological control agent have focused to habitat manipulation with plant provided food for natural enemies.

The green peach-potato aphid *Myzus persicae* (Sulzer) is a main pest of potato in the Karo highlands and Simalungun Region of North Sumatra [7]. *M. persicae* can attack potato plant from young plant, especially high population at young leaves. It caused damaged on young plant tissues, causing water stress, wilting and reduced growth rate of the plant. Prolonged aphid infestation can cause appreciable reduction in the yield of potato. Early season infestation is particularly damaging to potato, even if the aphids are subsequently removed. This aphid also a vector of viruses, and yield loses caused by these viruses can be as high as 90% depending on cultivar, infestation and environmental conditions [8].

Intercropping is the cultivation two or more crops at the same time in the same field. Many crops can be used for intercropping. Intercropping is the way to increase the diversity in the farming system. More diversity in the farming system generally means more stability, resulting in risk spreading and reduced pest and disease incidence [9]; [10]. Increasing within-field vegetation diversity (e.g. intercropping) often reduces pest insect populations compared with monocultures [11]; [12]. Various plant at the same time in the same field can be provide food and place for natural enemies.

The objective of this study was to determine the design of intercropping most appropriately applied to potato at organic farming system, in order to conservation *Coccinella* sp. as potenstial predator of *Myzus persicae* Sulzer.

MATERIAL AND METHODS

This study consisted of two experiments. The first done at planting season from February to April and the second done at planting season from May to August. This study arranged by by Split plot design with main plot is farming systems (conventional and organic farming) and the subplot is the design of cropping (monoculture potato; potato-cabbage; potato-mustard; potato-celery; potato-cabbage-mustard; Potato-cabbage-celery; potato-mustard-celery; potato-cabbage-mustard-celery). The parameter of this study are population of *Coccinella* sp., population of *M. persicae*, and crop production. Sampling was performed at 9 and 11 weeks after planting. Population of *Coccinella* sp. estimate by collected per potato plant, by selecting three plants from each replicate. *Myzus persicae* were counted on three tagged leaves on each plant, one each in the top, middle and lower regions of three randomly selected plants, avoiding the border rows, from each plot. Mean aphid population per leaf was calculated at the end of the season. The data was recorded on the same leaves on weekly basis. The data was analyzed by ANOVA and Tukey test.

RESULT AND DISCUSSION

a. Population of Coccinella sp.

Analysis of variance showed that farming system and planting system significantly affect the population dinamic of Coccinella sp. at 9 and 11 weeks after planting (Table 1, 2). The highest population of Coccinella sp. found at organic farming which planting system intercropping potato-mustard and intercropping potato-cabbage-mustard-celery, which recorded at 9 and 11 weeks after planting. Population density of *Coccinella* sp. showed significant variations every observation. Comparing planting season Feb-April and May-August, there are significantly different. Population of *Coccinella* sp more higher at planting season Feb-April than planting season May-August.

Decreasing population of natural enemies on conventional farming because of continuous application pesticide to control the pest. Pesticide also killed beneficial insect at the field. It can be seen from number of *Coccinella* sp. are higher in organic farming systems than conventional system at first planting season and second planting season. The population of natural enemies more higher at intercropping system than

monoculture system. Therefore, intercropping could be recommended as a conservation strategy to increasing natural enemies at the field in order to reducing pest population [13].

Table 1. Population of *Coccinella* sp. at 9 weeks after planting

Farming system	Planting System	Planting season: Feb - April	Planting season: May-Aug	Average
Conventional farming	Monocultur potato	1.58	1.92	1.75ab
	Potato-cabbage	1.33	1.67	1.50a
	Potato-mustard	2.33	1.83	2.08ab
	Potato-celery	1.42	1.42	1.42a
	Potato-cabbage-mustard	2.25	2.42	2.34ab
	Potato-cabbage-celery	1.42	1.67	1.55ab
	Potato-mustard-celery	1.67	1.92	1.80ab
	Potato-cabbage-mustard-celery	1.83	1.92	1.88ab
	Average	1.73	1.85	1.79a
Organic farming	Monocultur potato	2.58	3.42	3.00abc
	Potato-cabbage	2.83	4.00	3.42bc
	Potato-mustard	7.50	5.75	6.63d
	Potato-celery	2.75	3.50	3.13abc
	Potato-cabbage-mustard	5.50	5.75	5.63d
	Potato-cabbage-celery	2.50	3.83	3.17abc
	Potato-mustard-celery	5.75	5.92	5.84d
	Potato-cabbage-mustard-celery	6.92	5.25	6.09d
	Average	4.54	4.68	4.61b

Note: BNJ Tukey test at 5 %.

Table 2. Population of *Coccinella* sp. at per plant 11 weeks after planting

Treatment	Planting Season: Feb - April	Planting Season: May-Aug	Average
Farming System			
Conventional farming	1.18	1.04	1.11a
Organic farming	1.86	1.65	1.75b
Average	1.61	1.40	
Planting System			
Monocultur potato	1.49	1.50	1.32ab
Potato-cabbage	1.35	1.34	1.35ab
Potato-mustard	1.88	1.57	1.73cd
Potato-celery	1.40	1.02	1.21a
Potato-cabbage-mustard	1.78	1.39	1.59bcd
Potato-cabbage-celery	1.45	1.45	1.45abc
Potato-mustard-celery	1.54	1.54	1.54bc
Potato-cabbage-mustard-celery	1.96	1.75	1.80d
Average	1.61b	1.45a	1.50

Note: BNJ Tukey test at 5 %.

b. Population of *M.persicae*

Analysis of variance showed that planting season, farming system and planting system significanly affect the population dinamic of M. persicae. This is because the particular pest that attacks potato leaves generally begin to attack the potato crop during a month after planting. Population of M. persicae sifnificantly affect by kind of intercropping plant. The lowest population found at intercropping potato-mustard at 9 and 11 weeks after planting (Table 3). Population density of *M. persicae* showed significant variations every observation. *M. persicae* remained a consistent pest with different densities throughout the different intercropping crop and planting season.

c. Crop Production

Analysis of variance showed that planting season did not significantly affected crop production. On the otherhand, farming system and planting system significanly affect the crop production of potato. The highest crop production found at conventional farming system and at intercropping potato-cabbage (Table 4). There are significant correlation between Population density of Coccinella sp., population of M. persicae and crop production of potato.

Table 3. Population of *M. persicae* at 9 and 11 weeks after planting

	Treatment	Planting Season: Feb - April	Planting Season: May-Aug	Average
9 weeks	Farming System			
	Conventional farming	5.62	4.32	4.67a
	Organic farming	5.83	5.51	5.67b
	Average	5.73	4.98	5.26
	Planting System			
	Monocultur potato	8.14	6.11	7.13d
	Potato-cabbage	4.25	5.00	4.62ab
	Potato-mustard	3.89	4.06	3.97a
	Potato-celery	4.56	4.33	4.45ab
	Potato-cabbage-mustard	4.28	4.58	4.43ab
	Potato-cabbage-celery	6.00	4.94	5.47bc
	Potato-mustard-celery	6.86	5.50	6.18c
	Potato-cabbage-mustard-celery	6.31	5.35	5.83bcd
	Average	5.54b	4.98a	5.26
11weeks	Farming System			
	Conventional farming	4.32	2.93	3.63
	Organic farming	4.76	2.93	3.83
	Average	4.55	2.94	3.74
	Planting System			
	Monocultur potato	5.64	2.86	4.25c
	Potato-cabbage	3.39	2.81	3.10ab
	Potato-mustard	3.44	2.53	2.99a
	Potato-celery	4.50	3.22	3.86abc
	Potato-cabbage-mustard	4.44	2.81	3.62abc
	Potato-cabbage-celery	5.00	3.28	4.14c
	Potato-mustard-celery	5.19	2.75	3.97abc
	Potato-cabbage-mustard-celery	4.83	3.25	4.04bc
	Average	4.55b	3.30a	3.92

Note: BNJ Tukey test at 5 %.

Table 4. Crop production

Treatment	Planting Season: Feb - April	Planting Season: May-Aug	Average
Farming System			
Conventional farming	22.90	23.01	22.96b
Organic farming	20.47	21.40	20.83a
Average			22.27
Planting System	21.12	23.26	22.2bc
Monocultur potato	23.64	22.72	23.18cd
Potato-cabbage	26.49	26.18	26.33e
Potato-mustard	18.92	18.41	18.67a
Potato-celery	26.02	24.99	25.51de
Potato-cabbage-mustard	18.48	19.28	18.88a
Potato-cabbage-celery	18.25	21.44	19.84ab
Potato-mustard-celery	23.08	24.04	23.56cd
Potato-cabbage-mustard-celery	22.00	22.54	22.27
Average			

Note: BNJ Tukey test at 5 %.

CONCLUSION

Intercropping system potato-cabbage-mustard-celery, potato-cabbage-mustard, potato-mustard-celery and potato-mustard significantly increasing population of *Coccinella* sp. on potato field with organic farminf system. At the intercropping system found the lowest populations of *M. persicae,* and the highest crop production. Planting season February-April found the higher population of *Coccinella* sp. than planting season May-August on organic farming.

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