AL-KAUNIYAH: Jurnal Biologi, 15(2), 2022, 309-318
Website: http://journal.uinjkt.ac.id/index.php/kauniyah
P-ISSN: 1978-3736, E-ISSN: 2502-6720

SOIL TRANSMITTED HELMINT ON LETTUCE (*Lactuca sativa* L.) FROM PLANTATION AND POST-IRRADIATION

SOIL TRANSMITTED HELMINT PADA SELADA (Lactuca sativa L.) ASAL PERKEBUNAN DAN PASCA IRADIASI

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Naskah Diterima: 28 Januari 2022; Direvisi: 14 April 2022; Disetujui: 20 Juli 2022

Abstract

Soil-Transmitted Helminth (STH) is a group of intestinal parasitic nematode worms that can infect humans. One of the transmissions to humans is consuming lettuce grown on soil media. This study aims to identify the types of intestinal parasitic nematodes found in lettuce and soil from plantations based in the Regency of Bogor, Cianjur, and Bandung and analyze the prevalence, intensity, and dominance categories before and after irradiation. The irradiation dose used was 5 kGy with a gamma irradiation source [^{60}Co]. The descriptive method used in this study where the samples were collected from 9 sampling points at each study site. Identification showed that there were 3 types of intestinal parasitic nematodes found in lettuce, namely *Ascaris lumbricoides* (1,833 eggs), *Strongyloides stercoralis* (2 larvae), and *Trichuris trichiura* (91 eggs). The highest prevalence was found in *A. lumbricoides* (100%) which is classified %) classified as very severe contamination, very severe, and superinfection intensity of contamination criteria. The highest dominance of intestinal parasitic nematodes was found in *A. lumbricoides*. In the post-irradiated lettuce and soil samples was found eggs of *A. lumbricoides* and *T. trichiura*. The eggs of *A. lumbricoides* were the most common, 321 eggs were found in the post-irradiated lettuce, while 11 eggs of *T. trichiura* were found therein. Irradiation techniques can be used for the application of free-STH lettuce in the future, however, maintaining fresh food sanitation shall always be a priority preventive effort.

Keywords: Intestinal parasitic nematode worms; Lettuce; Post irradiated; Prevalence

Abstrak

Soil Transmitted Helminth (STH) merupakan kelompok cacing nematoda parasit intestinalis yang dapat menginfeksi manusia. Salah satu transmisi kepada manusia adalah mengonsumsi selada yang ditanam pada media tanah. Penelitian ini bertujuan untuk mengidentifikasi jenis cacing nematoda parasit intestinalis yang ditemukan pada selada dan tanah asal perkebunan di Kabupaten Bogor, Kabupaten Cianjur, dan Kabupaten Bandung serta menganalisis kategori prevalensi, intensitas, dan dominansinya sebelum dan pascairadiasi. Dosis iradiasi yang digunakan adalah 5 kGy dengan sumber iradiasi gamma [60Co]. Metode deskriptif digunakan pada penelitian ini, sampel dikoleksi dari 9 titik sampling pada setiap lokasi. Identifikasi menunjukkan terdapat 3 jenis cacing nematoda parasit intestinalis yang ditemukan pada selada yaitu Ascaris lumbricoides (1.833 telur), Strongyloides stercoralis (2 larva), dan Trichuris trichiura (91 telur). Prevalensi tertinggi ditemukan pada A. lumbricoides (100%) tergolong tingkat kontaminasi kategori selalu dengan kriteria kontaminasi sangat parah, intensitas kontaminasi kategori super infeksi. Dominansi cacing nematoda parasit intestinalis tertinggi ditemukan pada A. lumbricoides. Pada selada dan sampel tanah pasca iradiasi ditemukan telur A. lumbricoides dan T. trichiura. Telur A. lumbricoides merupakan yang terbanyak, pada selada pasca iradiasi ditemukan 321 sedangkan T. trichiura ditemukan 11. Teknik iradiasi dapat digunakan untuk aplikasi selada bersih dari STH di masa datang namun menjaga sanitasi pangan segar merupakan usaha preventif prioritas.

***Keywords**: Cacing parasit nematoda intestinalis; Pascairadiasi; Prevalensi; Lettuce*

Permalink/DOI: http://dx.doi.org/10.15408/kauniyah.v15i2.24513

INTRODUCTION

Healthy and fresh food have become a necessity for today's urban societies. The necessity of eating a balanced diet and leading a healthy lifestyle is beginning to dawn on the millennial generation. One way to live a healthy life is to choose plant-based cuisine. The best foods to choose from to meet such demands are fruits and vegetables. Food innovation has been made possible with a healthy menu thanks to the creation of a menu that changes over time. One factor supporting the development of a vegetarian lifestyle in today's youth may be the rise of modern restaurants and cafes with dishes made of fruit and vegetable combinations.

Lactuca sativa L., also known as lettuce, is a vegetable that can be eaten raw without being cooked. In terms of morphology, lettuce clearly shows distinct divisions between its leaves, stems, and roots (Tjitrosoepomo, 2016). This vegetable has two seeds that are commonly grown, particularly in the cool-climate highlands. It contains a lot of minerals. The nutritional composition of 100 g of lettuce is as follows: 15,000 calories, 0.15 g fat, 2.87 g carbs, 1.36 g protein, 1.3 g fiber, 0.78 sugar, 22 mg calcium, 0.04 mg vitamin A 540 SLI, 0.5 mg iron, 25 mg phosphorus, and 94.98 g (Agricultural Research Service, 2021). Carotene, anthocyanin, chlorophyll, glucose, fructose, and sucrose are other nutrients abundant in lettuce (Simko, 2019).

Lettuce is frequently used as a fresh vegetable, side dish, or in salads. The leaf is the component that is typically eaten, however, the leaf stalk is occasionally added to cuisine as well. A vegetable with a small stature, lettuce has some stems that are literally buried in the ground (Tjitrosoepomo, 2016). This plant develops in a sitting position, making it simple for the leaves to come into contact with dirt or other objects directly, especially after rain. On lettuce leaves that will be eaten, parasitic organisms or pests are frequently found (Fadhilah, 2016). This study found the presence of worm eggs which were classified as Soil Transmitted Helminth (STH) contained in lettuce collected from several locations. Amoah et al. (2018) reported that the use of mud as an additional source of nutrients on agricultural land had an impact on human health. Infection with worm eggs and larvae stored in silt can increase the risk of helminthiasis in humans. The source of contamination of *A. lumbricoides* comes from the mud used as a nutrient addition on agricultural land in Senegal. The worms found were at the egg and larval stages (Prianto et al., 2006). Another study report also found *A. lumbricoides* in several small stalls in Wonogiri (Nugroho et al., 2010).

Soil-Transmitted Helminth (STH) is a group of parasitic worms that require soil to complete their life cycle. Egg and larval stages are often found in moist soil. Transmission of contaminated eggs or larvae from soil to lettuce can be through wind or water flow. The use of sewer water from household flows contributes to worm eggs that infect the human digestive system (Andrianto, 2017). Eggs or larvae of STH group worms that have been reported are *Ascaris lumbricoides*, *Trichuris trichiura*, *Strongyloides stercoralis*, and hookworms (Necator americanus, Ancylostoma spp.) (Anbumani & Mallika, 2011; Rostami et al., 2016; Robertson, 2018, Alcántara et al. al., 2020).

Utilizing irradiation methods is one way to lessen the infection of microorganisms in fresh vegetables. Food can be irradiated using radioactive materials or accelerators to protect it from damage and deterioration as well as to rid it of pathogenic microorganisms. When providing such food, efforts are made to ensure its quantity, quality, and safety. As a result, the employment of diverse techniques or technologies necessitates accuracy and caution. There are many ways of food processing that can provide protection for food to be consumed, including drying, pasteurization, freezing, salting, or adding food additives. Another promising alternative is to use food irradiation techniques, which is a process using ionization energy to kill microbes (BPOM, 2019a). To break the chain of distribution of microorganisms such as eggs and larvae of parasitic worms belonging to STH, it is necessary to start with irradiation using gamma rays. The recommendation used is a moderate dose, which is 1–10 kGy.

The irradiation technique has received approval from the Codex General Standard for Food Irradiation, which was prepared based on the decision of the Joint Expert Committee on Food Irradiation (JECFI) formed by FAO-WHO, and the International Atomic Energy Agency (IAEA). The standards and guidelines issued by the Codex serve as an international reference in carrying out the irradiation process and the trade of irradiated foods. Based on this statement, irradiation techniques are developing in Indonesia. Irradiation technique is most widely used in phytosanitary to reduce the risk of insects and microorganisms. For this reason, it is necessary to conduct a study to analyze the presence of STH types, criteria, and percentage of prevalence and intensity of STH in lettuce.

MATERIAL AND METHOD

This study used a survey method, lettuce samples and soil samples were collected using a purposive sampling technique. The sampling locations were lettuce plantations located in Bogor Regency, Cianjur Regency, and South Bandung Regency, West Java Province. Sample preparation, identification, and data analysis were carried out at the Integrated Laboratory Center (PLT) UIN Syarif Hidayatullah Jakarta. The process of irradiating lettuce samples was carried out at the Multipurpose Panorama Irradiator (*Irpasena*) of BRIN, located at Jalan Pasar Jumat, South Jakarta.

The tools used in this study include glassware (cup, measuring cup, dropper, spatula, test tube, cuvette, centrifuge tube, object glass, and coverslip), Olympus microscope BXS1T-32PO1, microscope camera, soil tester, thermo-hygrometer digital, centrifuge, cooler box, test tube rack, and digital scale. Panoramic Multipurpose Irradiator (Irpasena) with gamma irradiation source [^{60}Co] was used for lettuce irradiation at a dose of 5 kGy. The materials used were saturated NaCl solution, distilled water, clear plastic bags, lettuce, and soil for the growth media.

Lettuce and Soil Sample Preparation

Samples of lettuce were taken from three separate districts' worth of lettuce plantations. Nine sampling locations were chosen within each plantation, resulting in the collection of 27 samples of lettuce. Lettuce samples are placed in labeled, transparent plastic containers and delivered to a lab for identification. 10 g of soil was removed from each lettuce collection, stored in a clear plastic bag with a label on it, and then put in a cooler. To ascertain their impact on the occurrence of STH, abiotic parameters such as soil temperature and humidity, air temperature and humidity, soil acidity, wind speed, and light intensity were measured, recorded, and evaluated.

Identification of Soil Transmitted Helminth (STH) on Lettuce and Soil

STH examination on lettuce and soil samples using the floatation method refers to Utami (2016) and Rostami et al. (2016). Each sample of lettuce was weighed as much as 200 g and placed separately. The sample was finely sliced ± 5 mm and immersed in a 1 L beaker containing 500 mL of saturated NaCl solution for 30 minutes. The sample was stirred using a spatula, the lettuce was removed from the beaker and left for 1 hour.

The saturated NaCl solution remaining from soaking lettuce was taken 10–15 mL, and centrifuged at 1,500 rpm for 5 minutes. The centrifuge tube was transferred to a test tube rack, filled with the remaining saturated NaCl solution until the water surface in the tube looks convex. At the top of the centrifuge tube was carefully placed a cover slip, then allowed to stand for 40 minutes. The cover slip is placed in such a way that it adheres to the slide, and is labeled and examined microscopically.

Examination of soil samples followed the floatation method. A total of 2 g of soil samples were weighed using an analytical balance. The soil sample was put into a centrifuge tube containing 8 mL of saturated NaCl solution. Samples were centrifuged at 2,000 rpm for 5 minutes. Next, the centrifuge tube is placed on a test tube rack and filled with saturated NaCl solution until the surface looks convex.

At the top of the tube, a cover slip was carefully placed and allowed to stand for 40 minutes. Then the cover glass was lifted and positioned on the slide, labeled, and observed using a microscope. Identification of STH is done based on the shape, size and color, then adjusted according to the Atlas of Medical Parasitology (Prianto et al., 2006). Medical Parasitology Books (Soedarmo et al., 2008; Purnomo, 2009; Soedarto, 2011), and Atlas of Medical Parasitology (Rai et al., 1996).

Data Analysis

Soil-Transmitted Helminth which was identified was calculated for prevalence, dominance, and intensity referring to (Maulana et al., 2017) namely prevalence= $\frac{\sum \text{sample contaminated with STH}}{\sum \text{sample examined}} x\, 100\%$, intensity (ind/fruit) was calculated by the formulation= $\frac{\sum \text{type of STH A which contaminates the sample}}{\sum \text{the sample contaminated with STH A}}$ while dominance uses the formulation $\frac{\sum \text{one type of STH which contaminates the sample}}{\sum \text{total STH that contaminates the sample}}\, 100\%$

Table 1. Criteria for the prevalence of STH contamination (Maulana et al., 2017)

Level of contamination	Note	Prevalence (%)
Constantly	Very severe infection	100–99
Almost constantly	Severe infection	98–90
Frequently	Intermediate infection	89–70
Very frequently	Very frequent infection	69–50
Commonly	Normal infection	49–30
Often	Frequent infection	29–10
Sometimes	Gradual infection	9–1
Rarely	Rare infection	<1–0.1
Very rarely	Very rare infection	<0.1–0.01
Almost never	Almost no infection	<0.01

Table 2. Criteria for the intensity of STH contamination (Maulana et al., 2017)

Level of contamination	Intensity (ind/buah)
Very low	<1
Low	1–5
Moderate	6–55
Sever	51–100
Very severe	>100
Superinfection	>1000

To determine the effect of irradiation on the presence of STH, irradiation of lettuce and soil samples was carried out at a dose of 5 kGy referring to BPOM (2019b) with 2 replications each. Furthermore, lettuce and soil samples after irradiation were examined using the same method.

RESULTS

In this study, 3 types of STH were identified, namely *Ascaris lumbricoides*, *Strongyloides stercoralis*, and *Trichuris trichiura*.

Figure 1. Egg morphology of *Trichuris trichiura* (a), *Ascaris lumbricoides* unfertilized (b), and *A. lumbricoides* corticated (c) on lettuce and soil media samples

Worms *A. lumbricoides* and *T. trichiura* were found in the egg stage while *S. stercoralis* was in the larval stage. The type and amount of STH found in lettuce and soil can be seen in Table 3. The presence of Soil-Transmitted Helminth on lettuce and soil after irradiation has changed both in form and amount as listed in Table 4.

Table 3. Type and amount of Soil-Transmitted Helminth on lettuce and plantation soil in Regency of Bogor, Regency of Cianjur, and Regency of South Bandung

Jenis *Soil-Transmitted Helminth*	Origin of sample						Total
	Regency of Bogor		Regency of Cianjur		Regency of Bandung		
	Lettuce	Soil	Lettuce	Soil	Lettuce	Soil	
Ascaris lumbricoides	497	288	611	71	725	160	2.352
Strongyloides stercoralis	0	1	0	0	2	7	10
Trichuris trichiura	52	17	21	10	18	9	127
Subtotal	549	306	632	81	745	176	2.489

Table 4. Type and amount of Soil-Transmitted Helminth on lettuce and post-irradiated plantation soil in Regency of Bogor, Regency of Cianjur, and Regency of South Bandung

Jenis *Soil-Transmitted Helminth*	Origin of sample						Subtotal
	Regency of Bogor		Regency of Cianjur		Regency of Bandung		
	Lettuce	Soil	Lettuce	Soil	Lettuce	Soil	
Ascaris lumbricoides	79	51	88	10	154	31	413
Strongyloides stercoralis	0	0	0	0	0	0	0
Trichuris trichiura	11	7	0	0	0	0	18
Total	90	58	88	10	154	31	431

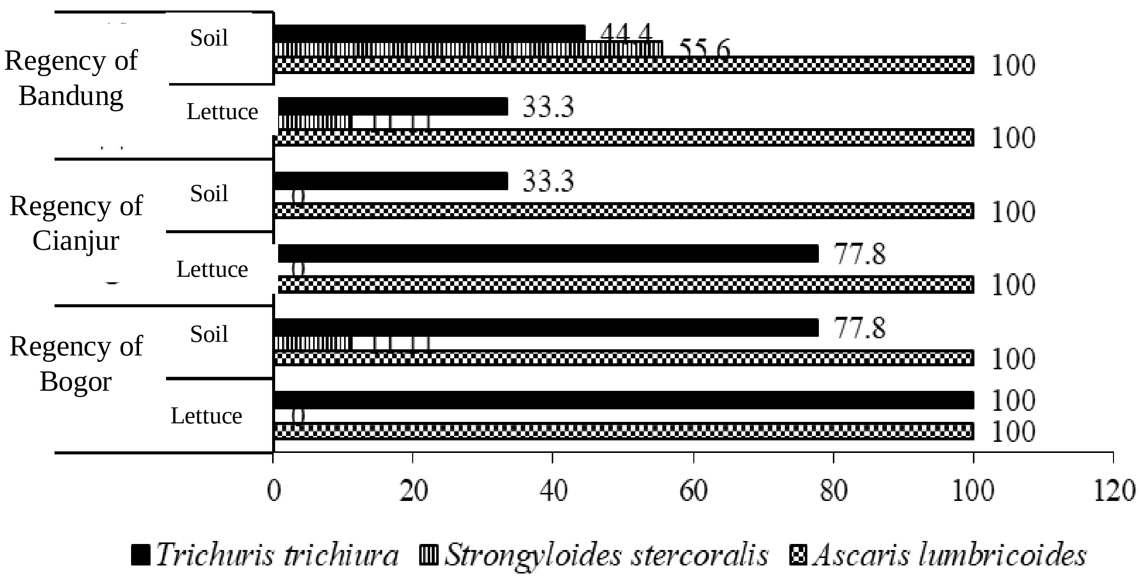

Figure 2. Prevalence (%) of Soil-Transmitted Helminth found in the Regency of Bogor, Regency of Cianjur, and Regency of Bandung

Table 5. The intensity of Soil-Transmitted Helminth found in the Regency of Bogor, Regency of Cianjur, and Regency of Bandung

Type of parasite	Regency of Bogor		Regency of Cianjur		Regency of Bandung	
	Lettuce	Soil	Lettuce	Soil	Lettuce	Soil
Ascaris lumbricoides	5.522,2	3.200	6.788,9	788,9	8055,6	1.777,8
Strongyloides stercoralis	0	11,1	0	0	200	140
Trichuris trichiura	577,8	188,9	233,3	33,3	2600	36

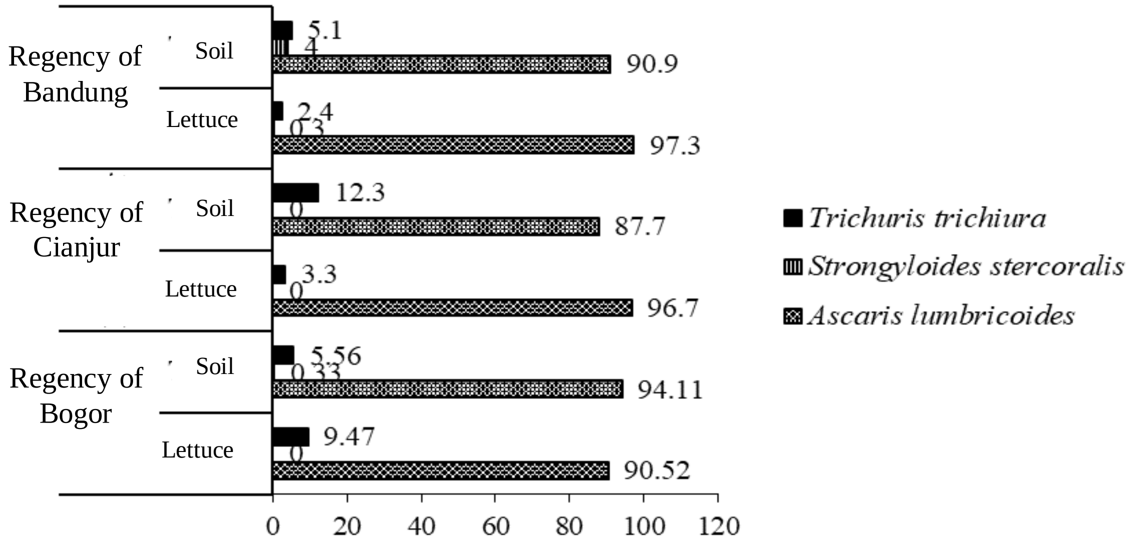

Figure 3. Dominance (%) of Soil-Transmitted Helminth found in the Regency of Bogor, Regency of Cianjur, and Regency of Bandung

Table 6. The range of abiotic factors at the study site

Abiotic parameter	Range
Air temperature (°C)	29–33.6
Soil temperature (°C)	27–30
Air humidity (%)	34–86
Soil humidity (%)	28–30
Degree of acidity (pH)	6.1–7.0
Light intensity (Klux)	9.00–9.55

DISCUSSION

The parasitic worms found in the lettuce samples were *Ascaris lumbricoides*, *Strongylus stercoralis*, and *Trichuris trichiura* (Figure 1). These three types of worms are intestinal parasites that often infect humans (Soedarto, 2011). This parasite requires soil to incubate eggs into a larval stage. The eggs and larvae of this worm can be transmitted to humans through fresh vegetables that are eaten directly without being processed by cooking. In Egypt, this worm is found in fresh vegetables such as kale and lettuce (Eraky et al., 2014). Research conducted by Andrianto (2017) reported the contamination of this worm in fresh food. Meanwhile, Nugroho et al. (2010) reported the findings of this worm as a parasite on cabbage. *Ascaris lumbricoides* was most commonly found in cabbage in Jember and was published by (Suhaillah & Tianingsih, 2017).

Ascaris lumbrocoides is a nematode worm parasitic intestinalis with the highest number found in lettuce and soil, namely 2,352 individuals (Table 3). The eggs of *A. lumbricoides* were mostly found in lettuce from plantations in the Regency of Bandung (725 individuals). All samples examined were contaminated with the presence of worms found in the egg stage. The shape of *A. lumbrocoides* eggs found in this study was fertile, decorticated, and infertile eggs (Figure 1). The eggs of these worms have an albumin layer that can protect them from drying out and mechanical damage (Soedarmo et al., 2008). This defense mechanism of adaptation allows the eggs to survive and hatch into larvae as the successor to the next generation. The eggs of this worm were reported to be found in cooked cabbage at Pasar Baru Gresik (Suhaillah & Tianingsih, 2017).

Strongyloides stercoralis was not found in the samples collected from the Regency of Cianjur. The larvae of this worm were found in lettuce samples collected from the Regency of Bandung. In addition to the lettuce samples, larval stages were recorded in soil from the same location. This worm is rarely reported from fresh vegetables and soil but can be observed because it is classified as a worm that requires soil as a transmission medium in completing its life cycle. The life cycle of this worm is from hatching eggs to rhabditiform larvae. This larval stage is an active phase of eating so that the esophagus looks dilated. The rhabditiform larvae will turn into filariform larvae, which will then mature and mate to produce eggs again (Prianto et al., 2006; Soedarto, 2011). The existence of these worm larvae was also reported in the study (Fadhilah, 2016) by observing STH collected from food stalls and traditional markets in South Tangerang.

Trichuris trichiura found in the study sample was at the egg stage. The eggs of this parasitic nematode worm have specific characteristics in the form of protrusions at both ends of the egg that are not found in the eggs of other intestinal parasitic nematodes. This protrusion is known as the mucoid plug/polar plug/clear knob. The eggs have a yellowish oval shape. This morphology is similar to the description found in the Atlas of Medical Parasitology (Prianto et al., 2006). *T. trichiura* eggs were found in all samples collected from plantations at the study site (Table 3). This parasitic worm is also found in fresh vegetables in Egypt (Eraky et al., 2014). Gresik New Market (Suhaillah & Tianingsih, 2017), traditional markets, food stalls, and modern markets in South Tangerang (Fadhilah, 2016).

In lettuce and post-irradiated soil media, parasitic worm eggs were still found but their numbers were reduced compared to samples from plantations (Table 4). Eggs were found in unfertilized and corticated forms, fertile eggs were not detected in this observation. It is possible that the irradiation process can cause damage to the albumin layer of the egg. The loss of the protective albumin layer causes the eggs to be mechanically damaged and become infertile (Soedarto, 2011). *S. stercoralis* larvae were not found in the post-irradiated samples. It is possible that the larvae are not tolerant to the irradiation process so they were not found in the observations. Food irradiation may be carried out with the aim of freeing food from pathogenic microorganisms but not reducing the nutritional value of the food in question. This statement has been stated in the form of Regulation of the Food and Drug Supervisory Agency Number 18 of 2019 (BPOM 2019b; 2019a). Pathogenic micro-organisms found in foodstuffs include fungi, bacteria, microorganisms such as eggs of microscopic worms, nematode parasites, and intestinalis. Irradiation techniques are also carried out on phytosanitary to protect fresh food ingredients such as exported fruits and vegetables so that they are free from insect contamination such as ants and other micro-organisms (BPOM, 2019b).

The highest prevalence value was found in *A. lumbricoides* (Figure 2), which was 100%. This figure shows that contamination is very severet (Table 1) occurred in all samples of lettuce and soil media that were observed to be in the category of always contamination level (Maulana et al., 2017). The presence of pathogenic/parasitic micro-organisms can actually be minimized by washing fresh food vegetables and fruits using running water. Eggs and larvae of intestinal parasitic nematode worms recorded in this observation need attention so that sanitation becomes an important focus in consuming fresh food so that its benefits are more optimal. The use of sewer water that flows from housing can be a source of contaminants that carry waste from households such as MCK waste that has not been managed properly. Some vegetable farmers in the Regency of Bogor and Regency of Bandung use sewer water that flows along the edge of the land to water their plantations in the dry season. This allows the transmission route of intestinal parasitic nematode worm eggs to spread to other areas. Furthermore, the eggs of this intestinal parasitic nematode worm continue its life cycle on plantation soil and attach to plant parts either through moving air or water transmission.

The highest contamination intensity of lettuce and soil media samples from plantations in the three districts was found in *A. lumbricoides* (Table 2). The level of contamination of *A. lumbricoides* was in the range of 788.9–8055.6, this figure was at the level of very severe and super infection contamination. The highest dominance of intestinal parasitic nematode worms was also found in this species (Figure 3). Unhealthy sanitation management is one of the causes of lettuce contamination. The morphology of lettuce leaves in the form of sheets increases the possibility of attachment of eggs and larvae to the organs of this plant. Another supporting factor is the abiotic aspect that supports the presence of this species in both lettuce and soil samples (Table 5). The temperature of the soil media ranged from 28–30 C with an acidity level close to the neutral category (soil pH 6.1–7.0) which was a comfort zone for the presence of this species at the observation site (Table 6). This happens not only in Indonesia but intestinalis parasite contamination has been reported in several developing countries such as India (Anbumani & Mallika, 2011), Pakistan, Nigeria, Egypt, and even Iran (Rostami et al., 2016).

In lettuce and soil samples after 5 kGy gamma irradiation, *S. stercoralis* was not found. The dose of 5 kGy is classified as a moderate dose recommended by BPOM (2019b) but can reduce contamination of microorganisms including eggs of intestinal parasitic nematode worms. This study found a decrease in the number of eggs (fertile and infertile) of *A. lumbricoides* and *T. trichiura* in lettuce and soil media samples. *T. trichiura* eggs were only found in post-irradiated samples from plantations in the Regency of Bogor. The eggs of the parasitic nematode worm *T. trichiura* do not have an albumin layer like the eggs of *A. lumbricoides*. The albumin layer functions as a protector from mechanical damage, keeps the eggs moist, and can serve as a food reserve for the embryo (Prianto et al., 2006; Andrianto, 2017). Thus, *T. trichiura* eggs are easily damaged. Gamma-ray irradiation dose of 5 kGy can reduce the number of eggs of this worm in all samples observed. The ^{60}Co irradiation source has damaged the amino acids in eggs so that their growth is disrupted. Similar damage was also found in oriental fruit fly eggs on post-irradiated salak fruit (Astuti et.al., 2019). In this study, the effect of irradiation on the growth of eggs that failed to hatch was seen. The development of the third instar larvae of the oriental fruit fly failed to pupate by in vivo and in vitro approaches.

The irradiation technique is an alternative that can be used to obtain fresh food that is free from microorganism contamination in the future (BPOM, 2019a). So far, no residue has been reported in fresh food after irradiation. Irradiation techniques can maintain the quality of fresh food by regulating the growth of harmful and pathogenic microorganisms (Sharma et al., 2020), increasing the shelf life of fresh fruits and vegetables, and controlling the germination of tubers (Moniruzzaman et al., 2016). In the world, irradiation technique helps many cases in the medical field. Food irradiation techniques can help reduce the presence of Plant Pest Organisms (OPT) in foodstuffs such as vegetables and fruit. The success of the irradiation technique is reported to be very helpful for phytosanitary documents which are important documents for the export of fresh food (Sasmita et al., 2015). This study reported the effect of gamma-ray irradiation on the quality of the mango fruit of the gedong variety as a phytosanitary treatment. The presence of pests such as ants and mealybugs on mangosteen, salak, and other export commodities can be minimized using irradiation techniques (Astuti et al., 2019). Irradiation technique high doses have been used to sterilize food so that it can be used for a long time (Santosa et al., 2020). Irradiation techniques are also reported to be able to control mosquitoes as vectors of several diseases through the Barren Insect Technique (Ramadhani et al., 2017). The use of irradiation techniques according to regulations can be developed to improve the quality of human life in the future, but maintaining food sanitation, especially fresh food, remains a priority preventive effort.

CONCLUSIONS AND SUGGESTIONS

The intestinalis parasitic nematode worms identified in lettuce were *Ascaris lumbricoides* (1,833 eggs), *Strongyloides stercoralis* (2 larvae), and *Trichuris trichiura* (91 eggs). The highest prevalence was found in *A. lumbricoides* (100%) classified as very severe contamination with the criteria of very severe contamination intensity and super infection. The highest dominance of intestinal parasitic nematodes was found in *A. lumbricoides*. In lettuce and post-irradiated soil samples found eggs of *A. lumbricoides* and *T. trichiura*. The eggs of *A. lumbrocoides* were the most numerous, post-irradiated lettuce was found 321 while *T. trichiura* was found 11 (fertile or infertile conditions). Suggestions that can be given to avoid contamination of Soil-Transmitted Helminth eggs and larvae on fresh food is to wash them using clean running water.

ACKNOWLEDGEMENT

The author would like to thank the Community Service Institute, Research and Publishing Center of UIN Syarif Hidayatullah Jakarta for the support provided so that this study can be carried out and published.

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