THE EFFECTIVENESS OF THE *Rorippa indica* L. Hiern WEED IN CONTROLLING ROOT KNOT DISEASE (*Meloidogyne* spp.) IN CUCUMBER PLANTS

Toto Sunarto[1]*, Danar Dono[1], Aep Wawan Irwan[1], Fiky Yulianto Wicaksono[1], Ineu Winarti[2]

[1]Faculty of Agriculture, Universitas Padjadjaran. Jl. Raya Bandung-Sumedang Km. 21, Jatinangor, Sumedang 45363, West Java, Indonesia

[2]Agrotechnology Undergraduate Program, Faculty of Agriculture, Universitas Padjadjaran. Jl. Raya Bandung-Sumedang Km. 21, Jatinangor, Sumedang 45363, West Java, Indonesia

*Correspondence: toto.sunarto@unpad.ac.id

ABSTRACT

Root knot nematodes (*Meloidogyne* spp.) are important plant-parasitic nematodes in cucumber (*Cucumis sativus* L.). The kamanilan weed (*Rorippa indica* L. Hiern) has the potential to be an environmentally friendly alternative for nematode control. This study aimed to determine the effectiveness of chopped R. indica in suppressing root-knot disease (*Meloidogyne* spp.) and its effects on cucumber plant growth. The study was conducted in the greenhouse and the Phytopathology Laboratory of the Plant Nematology Division, Faculty of Agriculture, Universitas Padjadjaran, Jatinangor. The study used a randomized block design consisting of 7 treatments and 4 replications. The treatments consisted of: control; chopped *R. indica* at 50 g, 75 g, 100 g, and 125 g/plant; chopped broccoli waste at 117 g/plant; and carbofuran at 2 g/plant. Each treatment was inoculated with 3000 second juveniles of *Meloidogyne* spp. The results showed that applying chopped *Rorippa indica* weeds effectively suppressed root-knot nematode (*Meloidogyne* spp.) in cucumber plants. Application of chopped *R. indica* weeds at a dose of 125 g/plant effectively suppressed the number of galls on cucumber roots (79.03%) and the number of second juvenile *Meloidogyne* spp. in the soil (73.68%).

Keywords: Cucumber; Gall; Root-knot nematode; *Rorippa indica*

Submitted : 12 December 2025
Accepted : 3 February 2026
Published : 10 February 2026

Sunarto, T., Dono, D., Irwan, A. W., Wicaksono, F. Y., Winarti, I. (2025). The effectiveness of the *Rorippa indica* L. Hiern weed in controlling root knot disease (*Meloidogyne* spp.) in cucumber plants. *Surjan, 2*(2), 51-57.

INTRODUCTION

The root-knot nematode (*Meloidogyne* spp.) is the cause of root swelling disease in cucumber plants. *Meloidogyne* spp. causes damage to the cucumber plant in excess of 76.1% (Prihatin et al., 2019). *Meloidogyne* spp. attacks cause swelling (gall) in plant roots, followed by chlorosis in the leaves, and stunting of the plants (Khotimah et al., 2020). Root swelling can inhibit nutrient uptake throughout the plant. It forms due to excessive cell division and enlargement in the perisicle tissue of the plant (Istiqomah & Pradana, 2017).

Control of this nematode still relies on synthetic nematicides, which can pollute the environment. Therefore, an environmentally friendly control alternative is needed, namely the use of plants as botanical nematicides (Ibrahim et al., 2023). Natural nematicides have the advantages of being more environmentally friendly, readily available, and leaving no residue. Nematicides are made from natural ingredients, including plant parts such as roots, leaves, stems, seeds, flowers, and fruit (Suanto et al., 2018). One plant that can be used as a natural nematicide is the kamanilan weed (*Rorippa indica*). *R. indica* is found in rice fields, roadsides, and mustard greens. The stems and leaves can be used as natural nematicides. Application of chopped and decomposed R. indica with soil can suppress the development of nematodes *Criconemoides* sp., *Helicotylenchus* sp., *Rorylenchulus* sp., and *Xiphinema* sp. in cucumber plants (Ibrahim et al., 2023).

R. indica also has potential as a compost ingredient to improve soil fertility and health. Brassicaceae plant waste at a dose of 117 g per 5 L of soil, consisting of radish (*Raphanus sativus*), broccoli (*Brassica oleracea* var. *italica*), cabbage (*Brassica oleracea* var. *capitata*), and kamanilan (*R. indica*), can suppress the phytonematode population of *Criconemoides* sp. between 50.05%-74.98%, *Helicotylenchus* sp. 100%, *Rotylenchulus* sp. between 17.39%-66.67%, and *Xiphinema* sp. between 49.91%-100% (Ibrahim et al., 2023). The most effective Brassicaceae plant in suppressing nematodes is broccoli waste, which shows increased phytonematode inhibition at 8 Weeks After Planting (WAP). R. indica, a member of the Brassicaceae family, contains glucosinolates, flavonol glycosides, phenolic compounds, rorifone, roripamide, 1-chloro-1-methylcyclohexane, benzimidanol, and 2-methoxy-4-vinylphenol. Volatile isothiocyanate derivatives derived from glucosinolates suppress soil-borne pathogens (Ibrahim et al., 2023). Isothiocyanate (ITS) compounds produce toxic allelochemicals that can disrupt nematode respiratory function. Nematodes respire by diffusion, and during this process, ITS compounds enter the body, causing death and reducing the nematode population (Prihatin et al., 2019).

Meloidogyne spp. control of the use of chopped *R. indica* weeds on cucumber plants has not been widely studied. The purpose of this study was to examine the effect of chopped *R. indica* weeds decomposed with soil on the development of the nematode *Meloidogyne* spp. and to determine an effective dose of *R. indica* in suppressing root knot disease caused by *Meloidogyne* spp. in cucumber plants.

MATERIALS AND METHODS

The experiment was conducted in the Greenhouse and Plant Nematology Laboratory, Division of Plant Nematology, Faculty of Agriculture, Padjadjaran University, Jatinangor. The research was conducted from December 2024 to March 2025.

The materials used in this experiment consisted of kamanilan weeds (*Rorippa indica*), pasteurized soil and manure, and rice husk charcoal in a 2:1:1 ratio, Metavy F1 cucumber plants, sodium hypochlorite (0.5% NaOCl), and *Meloidogyne* spp. inoculum. The tools used included: an analytical balance, polybags, seedling pots, a hand counter, a binocular microscope, a Baermann funnel, and sieves with pore diameters of 750, 50, and 35 µm.

The research used a randomized block design with 7 treatments and 4 replications. The treatments were as follows: control (without chopped *Rorippa indica* weed), *R. indica* at doses of 50 g, 75 g, 100 g, and 125 g per plant, broccoli waste at a dose of 117 g per plant, and carbofuran at a dose of 2 g per plant. Each treatment was inoculated with 3,000 second juveniles of *Meloidogyne* spp. Observational data were analyzed using analysis of variance (ANOVA) using Statistical Product and Service Solution (SPSS) software. If significant differences were found between the treatment means, Duncan's multiple-range test was performed at the 5% significance level.

Soil Pasteurization

Soil weighed 42 kg, and 21 kg of manure were pasteurized at 70°C for 3 hours, cooled, and then placed in polybags. Each polybag contained 3 kg of soil.

Preparation of Chopped Weeds (*Rorippa indica*)

Rorippa indica weeds were obtained from Ciparay, Bandung Regency. The leaves and stems of R. indica were chopped into 1 cm pieces, then weighed according to treatment and placed in polybags containing 3 kg of nematode-inoculated soil. They were then watered and tightly sealed for two weeks. The polybags were then opened, left for 3-5 days, and then planted with one-week-old cucumber seedlings (Ibrahim et al., 2023). The next observation was conducted 8 weeks after transplanting.

Sowing Cucumber Seeds

Cucumber seeds were sown in pots containing pasteurized soil, and the pots were kept in a greenhouse until the seeds were 7 days old.

Preparation of *Meloidogyne* spp. Inoculum

Meloidogyne spp. inoculum was taken from the roots of tomato plants infected with nematodes from Lembang, West Bandung Regency. The plant roots were cleaned and cut to 0.5-1.0 cm in length. The roots were then soaked in a 0.5% sodium hypochlorite (NaOCl) solution in a beaker and stirred for 5 minutes. They were then filtered using 750 µm, 50 µm, and 35 µm sieves. Nematodes retained on the 50 µm and 35 µm sieves were rinsed with water and collected in a beaker. The number of nematodes in 1 ml of nematode suspension was then standardized. A total of 3,000 second-stage juvenile *Meloidogyne* spp. were inoculated into each polybag before *R. indica* application and before planting cucumbers.

Planting Cucumber Plants

Cucumber seedlings, 7 days after sowing, were transplanted into polybags filled with chopped, decomposed weeds and soil.

Observations were made at 4 and 8 weeks after planting (WAP) for the following: the number of root galls, the number of second juvenile Meloidogyne spp. in 100 ml of soil, plant height, dry weight of roots, and dry weight of plant shoot.

The number of galls was observed by carefully uprooting the cucumber plants and cleaning the roots. The number of galls on the roots was counted. Observations of the number of second juvenile *Meloidogyne* spp. were conducted by taking 100 ml of soil around the cucumber roots, extracting it using a Baermann funnel, and incubating it for 24 hours. The second juvenile *Meloidogyne* spp. were then counted using a binocular microscope. Plant height was measured from the base of the stem to the growing point at 4 and 8 weeks after planting. Observations of root dry weight and plant shoot dry weight were conducted by uprooting the cucumber plants, cleaning the roots, oven-drying the roots and aerial parts at 50°C for 24 hours, and weighing them using an analytical balance.

Supporting observations were made on the temperature and relative humidity in the greenhouse during the experiment.

RESULTS AND DISCUSSION

Results

Number of galls on cucumber roots

Average number of galls on cucumber roots at 8 weeks after planting (Table 1). The application of chopped *Rorippa indica* weeds significantly suppressed the number of galls in cucumber roots compared to the control (without chopped *R. indica* weeds). The application of chopped *R. indica* weeds at a dose of 125 g per plant resulted in the lowest gall number (6.00 galls) in cucumber roots, with a 79.03% suppression rate. This was similar to the gall number applied with broccoli waste (117 g/plant) and carbofuran (2 g/plant). However, it differed from the gall number applied with chopped *R. indica* weeds at 50, 75, and 100 g/plant, and the control. The application of carbofuran (2 g/plant) resulted in the lowest gall number (5.12 galls) with an 82.09% suppression rate.

Number of second juveniles (J2) of *Meloidogyne* spp. in soil

The average number of second juveniles of *Meloidogyne* spp. in 100 ml of soil (Table 2). At 4 WAP and 8 WAP, the application of chopped *Rorippa indica* weeds had no effect on the number of second juveniles of Meloidogyne spp. in the soil compared to the control (without chopped *R. indica* weeds). At 4 WAP, the application of *R. indica* at 75 g, 100 g, 125 g/plant, and broccoli waste of 177 g/plant increased the number of second juveniles *Meloidogyne* spp. in the soil.

Observations 8 weeks after planting showed that the application of *R. indica* decreased the number of second juveniles (J2) of *Meloidogyne* spp. in the soil. Application of *R. indica* at a dose of 125 g/plant resulted in the lowest number of J2 *Meloidogyne* spp. (1.25 J2) with the highest suppression (73.68%).

Cucumber plant height

Average cucumber plant height after application of *R. indica* weed shreds (Table 3). At 4 WAP and 8 WAP, the application of *R. indica* weed shreds had no effect on cucumber plant height, but tended to increase plant height compared to the control. At 4 WAP, the application of 100 g of *R. indica*/plant resulted in the tallest plants (176.25 cm), compared with the control (150.50 cm), broccoli waste (164.50 cm), and carbofuran (158.75 cm). At 8 weeks after planting (WAP), the application of 117g of broccoli waste per plant produced the tallest plants (188.75 cm), followed by *R. indica* at 100 g/plant and carbofuran, which reached the same height as the control (184.75 cm).

Table 1. Average number of galls and percentage of suppression due to application of *R. indica* weed shreds at 8 WAP

Treatment	Average number of galls	Percentage of suppression (%)
A. Control (without *Rorippa indica* weeds)	28.62±7.97 c	0.00%
B. *R..indica* dose 50 g/plant	26.87±17.68 c	6.11%
C. *R. indica* dose75 g/plant	25.50±17.25 c	10.91%
D. *R. indica* dose100 g/plant	17.37±10.87bc	39.30%
E. *R..indica* dose 125 g/plant	6.00±3.08 a	79.03%
F. Broccoli waste dose 117 g/ plant	9.12±3.68 ab	68.12%
G. Carbofuran 2 g/plant	5.12±1.31 a	82.09%

Note: Numbers followed by the same lowercase letter indicate no significant difference according to Duncan's multiple range test at the 5% significance level.

Root dry weight and shoot plant dry weight

Average root dry weight and shoot plant dry weight of cucumber plants (Table 4). In the 8 WAP observation, the application of chopped *Rorippa indica* weeds did not affect the dry weight of the roots and the dry weight of the shoot of the cucumber plant compared to the control (without chopped *R. indica* weeds). The highest dry weight of the roots was found in the application of carbofuran 2g/plant, namely 4.50 g, in the application of *R. indica* 50 g/plant (dry weight of the roots 4.37 g), and in the control (3.50 g). The highest shoot plant dry weight (42.50 g) was achieved with 75 g of R. indica/plant, compared with 36.12 g in the control.

Table 2. average number of second juveniles (J2) due to application of *R. indica* weed shreds at 4 and 8 WAP

Treatment	Average number of J2 *Meloidogyne* spp.	Percentage of suppression (%)
4 WAP		
A. Control (without *Rorippa indica* weeds)	3.00 ±1,82	0.00
B. *R. indica* dose 50 g/plan	1.00 ±0,81	58.33
C. *R. indica* dose 75 g/plant	1.00 ± 2,00	58.33
D. *R..indica* dose 100 g/plant	1.50 ±1,29	50.00
E. *R. indica* dose 125 g/plant	3.75 ±3,77	-25.00
F. Broccoli waste dose 117 g/plant	4.25 ± 2,21	-41.67
G. Carbofuran 2 g/plant	3.00 ±1,63	0.00
8 WAP		
A. Control (without *Rorippa indica* weeds)	4.75 ± 1,26	0,00
B. *R. indica* dose 50 g/plant	4.00 ± 2,94	15.78
C. *R. indica* dose 75 g/plant	3.50 ± 5,74	26.31
D. *R. indica* dose 125 g/plant	2.75 ± 2,63	42.10
E. Gulma *R. indica* dosis 125 g/tanaman	1.25 ± 1,26	73.68
F. Broccoli waste dose 117 g/plant	3.75 ± 2,87	21.05
G. Carbofuran 2 g/plant	2.75 ± 1,89	42.10

Note: Numbers followed by the same lowercase letter indicate no significant difference according to Duncan's multiple range test at the 5% significance level.

Table 3. Average height of cucumber plants due to the application of *R. indica* at 4 WAP and 8 WAP

Treatment	Average plant height (cm)	
	4 WAP	8 WAP
A. Control (without *Rorippa indica* weeeds)	150.50 ± 34.34	159.50 ± 31.00
B. *R. indica* dose 50 g/plant	159.50 ± 19.55	175.50 ± 15.42
C. *R. indica* dose 75 g/plant	166.75 ± 33.87	179.75 ± 28.18
D. *R. indica* dose 100 g/plant	176.25 ± 11.15	184.75 ± 11.84
E. *R. indica* dose 125 g/plant	151.75 ± 18.66	182.25 ± 12.12
F. Broccoli waste dose 117 g/plant	164.50 ± 24.66	188.75 ± 11.73
G. Carbofuran 2 g/plant	158.75 ± 19.71	184.75 ± 27.17

Note: The average treatment did not significantly differ in plant height, so no further testing was conducted.

Table 4. Average dry weight of roots and shoots due to the application of *R. indica* at 4 WAP and 8 WAP

Treatment	Average of dry weight (g)	
	Root	Shoot
A. Control (without *Rorippa indica* weeeds)	3.50 ± 1.47	36.12 ± 7.18
B. *R. indica* dose 50 g/plant	4.37 ± 3.20	37.37 ± 12.12
C. *R. indica* dose 75 g/plant	2.50 ± 1.47	42.50 ± 18.02
D. *R. indica* dose 100 g/plant	3.62 ± 2.59	39.75 ± 24.98
E. *R. indica* dose 125 g/plant	3.00 ± 1.08	33.75 ± 10.90
F. Broccoli waste dose 117 g/plant	4.37 ± 4.50	33.50 ± 11.44
G. Carbofuran 2 g/plant	4.50 ± 2.71	41.75 ± 26.41

Note: The average treatment did not significantly differ in dry weight, so no further testing was conducted.

Discussion

Number of galls on cucumber roots

The higher the dose of *R. indica* weed shreds, the lower the number of galls on the roots. The decrease in the number of galls indicates that *R. indica* weed shreds have potential as a biofumigant that can suppress nematode development. This is because *R. indica* weeds contain glucosinolates that break down into isothiocyanate compounds (ITCs) during decomposition in soil. These compounds are toxic to nematodes by disrupting their respiratory systems and metabolism (Sarwar & Kirkegaard, 2004; Gimsing & Kirkegaard, 2006). Glucosinolates that are degraded in soil into ITC compounds act as allelochemicals that can kill nematodes by disrupting their respiratory systems (Ibrahim et al., 2023).

Number of second juveniles (J2) of *Meloidogyne* spp. in soil

At 4 WAP, the application of *R. indica* at 75 g, 100 g, 125 g/plant, and broccoli waste of 177 g/plant increased the number of second juveniles *Meloidogyne* spp. in the soil. This is thought to be due to the early phase of organic matter decomposition, which can provide a food source for soil microorganisms, including nematodes (Khotimah et al., 2020).

Observations 8 weeks after planting showed that application of *R. indica* decreased the number of second juveniles (J2) of *Meloidogyne* spp. in the soil. Application of *R. indica* at a dose of 125 g/plant resulted in the lowest number of J2 *Meloidogyne* spp. (1.25 J2) with the highest suppression (73.68%). This effect indicates that the active compounds from *R. indica* decomposition begin to effectively suppress nematode numbers after the decomposition phase reaches its optimal point. These results indicated that the active compounds derived from *R. indica* begin to exert effective activity after the decomposition process reaches an optimal level, consistent with Ibrahim's (2023) findings that the highest antinematode activity in Brassicaceae plants occurs 8 weeks after treatment.

The active compound decomposed is thioglucoside, a volatile compound that forms isothiocyanate (ITS) compounds when it reacts further with water in the environment. This compound gives plants, especially Brassicae, their distinctive aroma (Bones & Rossiter, 1996). Previous research has shown that crushing Brassica plants and adding them to the soil produces toxic compounds (ITS), which hydrolyze to volatile compounds that act as biofumigants to control soil pathogens (Anita, 2012).

Cucumber plant height

At 8 weeks after planting (WAP), the application of 117g of broccoli waste per plant produced the tallest plants (188.75 cm), followed by *R. indica* at 100 g/plant and carbofuran, which produced the same height of 184.75 cm as the control (159.50 cm). Plant height is a vegetative growth parameter influenced by factors such as photosynthetic activity, water availability, and nutrient availability. Furthermore, root galls can inhibit water absorption, reducing efficiency and ultimately affecting plant height. Decreased plant growth can result from reduced nutrient absorption, which is influenced by nematicide application. This occurs because the active ingredient in nematicides acts as an inhibitor of plant root development (Kusumarini et al., 2020).

Root dry weight and shoot plant dry weight

The highest shoot plant dry weight (42.50 g) was achieved with 75 g of *R. indica*/plant, compared with 36.12 g in the control. This suggests that controlling root-knot nematodes positively affects plant growth and biomass (Bartlem et al., 2014). Nematodes that infect roots inhibit the flow of photosynthates from aboveground and disrupt nutrient uptake (Rambe et al., 2022).

Temperature and relative humidity

Environmental temperature and relative humidity influence cucumber plant growth and the development of *Meloidogyne* spp. nematodes. Daily temperatures during the experiment ranged from 23.9°C to 29.1°C, with daily humidity ranging from 47% to 91%. The average temperature was 26.5°C, and the average relative humidity was 71.3%. According to Amin (2018), the optimal temperature for cucumber plant growth is around 21.1°C to 26.7°C. Relative humidity in the range of 70–80% is considered sufficient for vegetative and generative growth of cucumbers (Febriani et al., 2021). The optimum temperature for nematode development is around 25–28°C (Raihana et al., 2018), and the optimum humidity is 87–93% (Pratiwi et al., 2020). The average temperature and humidity in a greenhouse are suitable for cucumber plant growth and nematode development.

CONCLUSION

The application of chopped *Rorippa indica* effectively suppresses root-knot disease (*Meloidogyne* spp.) in cucumber plants. Application of chopped *R. indica* weeds at a dose of 125 g per plant effectively suppressed the number of galls on cucumber roots (79.03% suppression) and the number of second juvenile *Meloidogyne* spp. in the soil (73.68%).

R. indica dose 125g/plant can be used as an environmentally friendly alternative for controlling root knot disease (*Meloidogyne* spp.) in cucumber plants.

REFERENCES

Amin, A.R. (2018). Understanding Cucumber Cultivation Through the Utilization of Information. *Media. Jupiter*,14(1),66-71. https://journal.unhas.ac.id/index.php/jupiter/articlr/download/31/29

Anita, B. (2012). Crucifer vegetable leaf wastes as biofumigants for the management of root nematode (*Meloidogyne hapla* Chitwood) in celery (Apium graveolens L.). *Journal of Biopesticides, 5.*

Bartlem, D.G., Jones, M.G.K., & Hammes, U. Z. (2014). Vascularization and nutrient delivery at root-knot nematode feeding sites in host roots. *Journal of Experimental Botany*, *65*(7), 1789-1798. https://doi.org/10.1093/jxb/ert415.

Bones, A. M., & Rossiter, J. T. (1996). The myrosinase-glucosinolate system, its organisation and biochemistry. *Physiologia Plantarum*, *97*(1), 194-208. https://doi.org/10.1111/j.1399-3054.1996.tb00497.x.

Febriani, D.A., Darmawati, A., & Fuskhah, E. (2021). The Effect of Tea Dregs Compost and Chicken Manure Doses on the Growth and Production of Cucumbers (*Cucumis sativus* L.). *Jurnal Buana Sains*, 21(1), 2527–5720.

Ibrahim, A.Y., Supramana, & Giyanto. (2023). Soil Nematode Population in Brassicaceae Plant Waste Treatment. I*ndonesian Journal of Phytopathology*, 19(1), 19-29. https://doi.org/10.14692/jfi.19.1.19-29.

Istiqomah, D. & Pradana, A.P. (2017). Review: environmentally friendly root knot nematode (*Meloidogyne* spp.) control techniques. *J. HPT Tropika*, 2(1), 1–10.

Khotimah, N., Sritamin, N., & Wijaya, I. (2020). Population Development of Root Knot Nematodes (*Meloidogyne* spp.) and Level of Damage to Several Plants in the Solanaceae Family. *Tropical Agrotechnology* ISSN, 2301, 6515.

Kusumarini, N., Sayifudin, S., Dwi Kautsar, F., & Syekhfani, S. (2020). The Role of Organic Matter in Reducing the Impact of Pesticide Exposure on Soil Fertility and Nutrient Uptake of Mustard Greens.

Journal of Soil and Land Resources, 7(1), 127-133. https://doi.org/10.21776/ub.jtsl.2020.007.1.16.

Prihatin, Supramana, & Harahap, I. S. (2019). Effectiveness of Brassicaceae Plant Waste Biofumigation for Controlling Root Knot Nematodes (*Meloidogyne* spp.) in Cucumber Plants.

Rambe, A. R., Nurrahmatillah, A., Hasanah, N., Azzahra, B., Prasetio, L. H., & Advinda, L. (2022). Introduction and Control of *Meloidogyne incognita* and *Meloidogyne javanica* as Nematodes Attacking Watermelon (*Citrullus lanatus*) Roots. 2(No. 2), 54–61.

Suanto, E., Sudirman., & Muthahanas, I. (2018). Effectiveness of betel leaf extract (*Piper betle* L.) in suppressing egg hatching and infectivity of *Meloidogyne* spp. *Crop. Argo*, 11(1), 1-6. *11*(1), 1–6.

Sunarto, T., Dono, D., Irwan, A. W., Wicaksono, F. Y., Winarti, I. (2025). The effectiveness of the *Rorippa indica* L. Hiern weed in controlling root knot disease (*Meloidogyne* spp.) in cucumber plants. *Surjan, 2*(2), 51-57.