The Journal of Applied Sciences Research

Journal homepage: http://www.journals.wsrpublishing.com/index.php/tjasr

Online ISSN: 2383-2215 Print ISSN: 2423-4400

Original Article

Evaluation of Ginger (*Zingiber Officinale* Roscoe) Rhyzome Extract against Whitefly (*Bemisia Tabaci* Genn.) on Tomato (*Lycopersicon Lycopersicum* L.)

Malik, U. *, Sadiq, I.A., Mani, U.; Badamasi, H. and Ahmed I. A.

Samaru College of Agriculture, Division of Agricultural Colleges, Ahmadu Bello University, Zaria. Nigeria

ARTICLE INFO

Corresponding Author:
Malik Usman
usmanmalik2016@gmail.com

How to Cite this Article:
Malik, U., Sadiq, I.A., Mani, U.; Badamasi, H. and Ahmed I. A.. (2015). Evaluation of Ginger (*Zingiber Officinale* Roscoe) Rhyzome Extract against Whitefly (*Bemisia Tabaci* Genn.) on Tomato (*Lycopersicon Lycopersicum* L.). *The Journal of Applied Sciences Research*, 2(2): 93-96.

Article History:
Received: 18 April 2015
Accepted: 21 May 2015

ABSTRACT

Field experiments were conducted during the dry seasons of 2010 and 2011 to evaluate ginger (Zingiber officinale Roscoe) rhyzome against Whiteflies *(Bemisia tabaci* Genn.) population on tomato. (*Lycopersicon Lycopersicum* L.*)* at the Department of Crop Protection Student teaching Plot, Institute for Agricultural Research, Ahmadu Bello University, Zaria. Treatment consist ginger extract, sherpa plus and untreated control, each replicated four times. Experiment was laid out in a randomized block design. Another experiment was conducted during the 2012 and 2013 dry seasons to determine the minimum effective dosage of ginger. (*Zingiber officinale* Roscoe) found to be effective .Ginger rhyzome was effective at 15% concentration against whitefly population. The performance was good as that of a conventional chemical insecticide, Sherpa plus® *(Cypermethrin and dimethoate).* In another trial with different concentrations of extract of ginger rhizomes equivalent of 10%, 7.5%, 5.0% and 2.5% w/v respectively were tested against whitefly on tomato, their efficacy in reducing whitefly population on tomato increased with increase in concentration of extract. The efficacy of the aqueous extracts at 100 g/litre of ginger rhizomes was significantly higher $P < 0.05$ than lower concentrations.

Keywords: ginger rhyzome, sherpa plus® *(cypermethrin and dimethoate)*, tomatoes, whitefly.

INTRODUCTION

Tomato, *Lycopersicon lycopersicum* L. (Family: Solanaceae) is a widely grown fruit the world over (Agrios, 2005). It is a native to South America (Nonneoke, 1989), but was introduced into West Africa through slave trade and traders from West Indies to Portugal (Tindall, 1988). Global production is about 89.9 million metric tonnes from an area of about 3170,000 (Samuel *et al*., 2011) very popular vegetable throughout Nigeria. Nigeria is the second largest tomato producer in Africa (Bodunde *et al.*, 1993). It can be pressed to paste and juice and for drinks (Babalola et al 2010). Tomato is rich in vitamins (John *et al,* 2010), minerals and lycopene, an excellent antioxidant (Osemwegie *et al.*, 2010) that help to reduce the risk of prostate and breast cancer. The tomato fruit is an indispensable constituent of the daily diet of over 100 million Nigerians. It is used in the preparation

of soups and stews, which are essential complements to the staples based on cereals and root crops. The seeds upon extraction contain 24% oil. The residue is used in livestock feed and fertilizer (Gerald and Frank, 2005). Tomato production has greatly increased in Nigeria because of its high demand and revenue return. Tomato production in Nigeria is essentially restricted due to high temperature, humidity and pest attacks (Erinle, 1989; Umeh *et al*., 2002).

The usefulness and popularity of tomato is recognized both at national and international levels. Unfortunately, the production of this important crop is hampered by a number of pests and diseases, a vector of a number of tomato viral diseases, root-knot nematode and leaf beetles (NRI, 1996, Umeh *et al.*, 2002). The whitefly is of particular importance because apart from sucking sap from tomato plants and reducing plant vigour, it also transmits viral diseases, resulting in drastic reduction in yield. The use of chemical pesticides in the management of crop pests cannot be ruled out; it would not be wise to depend entirely on them as the solution to all pest problems. There is a need to find cost-effective and environmentally friendly management options. The use of plant materials with insecticidal properties is one of such options and this fact necessitates the present investigation.

The objectives of this study, were to evaluate ginger rhizome against the whitefly, *(Bemisia tabaci* Genn) on tomato; and to determine the minimum effective dosage of ginger extract.

MATERIALS AND METHODS

The study was conducted in two different locations; namely the Institute for Agricultural Research Irrigation site and Crop Protection Department student Teaching plot Faculty of Agriculture, Ahmadu Bello University, Zaria.

Nursery beds were prepared in front of the student Teaching Plot of the Crop Protection Department. Tomato variety sown was a hybrid Roma VF. The seeds were drilled in rows 20cm apart on 1m × 1.5m bed and then covered lightly with soil in order not to expose or displace the seeds. After this, 20 g of Carbofuran (Furadan®) was applied on each bed, which was later covered with dry grass to protect emerging seedlings (mulch) before watering. Carbofuran was applied as prophylactics for termite control, since termites are usually attracted by dry grasses. After complete emergence of the seedlings, the mulch was removed to enable adequate sunlight unto the seedlings. A week later, 35g of fertilizer (NPK 15:15:15) was sprinkled on the beds to enhance seedling development. Hand weeding and watering continued until when the seedlings were due for transplanting after three weeks.

The experiment consisted of 12 plots ginger extracts which was replicated four times and was laid out in a Randomized Complete Block Design. The plots measured 1.3m x 3m with a 1m guard row between plots .The tomato seedlings were removed from the nursery bed at the age of three weeks and were transplanted unto the field plots in the 4th week of age 35g. Fertilizer (NPK 15:15:15) was applied in band and covered in small trench of about 2 – 3cm round the tomato plants two weeks after transplanting.

Ginger was air dried, for two weeks, crushed with pestle and mortar and ground into powder. Each powder was sieved through 75mm mesh. One hundred and fifty grammes of ginger power was separately soaked in one liter of water and stirred to mix thoroughly. The soaked extracts was left to stand overnight prior to the application on the field. Before spraying, soaked extracts was filtered with muslin cloth and put into labelled plastic bags, ready for the field.

Sampling Method

At early fruiting stage**,** when tomato has fully established (60 days after transplanting), adult whiteflies were sampled on a per plant basis (Mabbel, 1980). On each plot six plants were sampled randomly, the bell jar was placed over each selected plant, which was then tapped and the adults fly up and settle on the inside of the bell jar, where they can be counted (Rangarade *et al.,* 1980). The sizes of the bell jars were always changed to accompany the growth pattern of the crops. The insect counts were undertaken in the early mornings between 7.30 - 8.30 a.m. because, with increase in temperature, the population of insects tends to decrease on the crop.

The treatments consisted of 15% aqueous solution of ginger extract at the first stage of the trial while the insecticide *(cypermethrin + dimethoate)* at the rate of 5 ml/litre of water and the untreated control. There were 12 plots with a plot size of 3m × 1.5m each; treatments were laid out in a randomized complete block

design (RCBD). Six hundred grammes of ginger extract dissolved in four liters of water were sprayed to cover four plots, with a knapsack sprayer. A screen was used to prevent drift from one plot to another or from one adjacent area to another in addition to guard-row between rows. Two sprays were applied in each dry season with the first spray made in the 60^{th} day after planting and the second a week later. Insect samplings were carried out a day before and a day after each spray. Data collected were subjected to analysis of variance (ANOVA) and means were separated using least significant difference (LSD).

RESULTS

Result of the trial conducted to determine the efficacy of ginger for the control of whitefly populations on tomato are presented in the Tables.1and 2 below. The result revealed in table 1 and 2 showed that, there was no significant differences ($p>0.05$) between 150gm/litre of ginger rhizome extract as compare with the control. Ginger rhizome extract show high efficacy at the rate of 150 gm/litre in the control of whitefly population on tomato in 2011 and 2012 dry season.

Table 1: Effect of aqueous extracts of ginger and Sherpa plus 280EC (*Cyper methrin + dimethoate*) on the population of whitefly on tomato 2010/2011

Treatment	Mean number of whitefly per plant			
	First spray		Second spray	
Aqueous extracts	24 HRS Before Spray	24 HRS After Spray	24 HRS Before Spray	24 HRS After Spray
Ginger rhizome	39.7	12.0	138.0	12.0
Sherpa plus (280 EC)	35.0	0.5	125.0	0.5
Untreated control	40.0	41.6	141.0	145.6
LSD (5%)	14,3	11.3	87.5	48.7
P<0,05	NS	**	NS	**

HRS=hours, B=before spray, A=after spray.
NS=not significant, **=highly significant.

Table 2: Effect of aqueous extracts of ginger and Sherpa plus 280EC (*Cypermethrin + dimelhoate*) on the mean population of whitefly on tomato 2011/2012 dry season

Treatment	Mean number of whitefly per plant			
	First spray		Second spray	
Aqueous extracts	24 HRS Before Spray	24 HRS After Spray	24 HRS Before Spray	24 HRS After Spray
Ginger rhizome	38.3	7.2	47.3	12.5
Sherpa plus (280 EC)	36.6	0.5	50.9	3.0
LSD (5%)	40.9	41.3	50.2	50.2
P<0,05	15.1	11.6	12.8	10.1
	NS	**	NS	**

HRS=hours, B=before spray, A=after spray, NS=not significant, **= highly significant.

Table 3: Effects of different concentrations of ginger rhizomes applied to tomatoes plant on the mean population of *B. tabaci* 2011/2012 dry season

Treatment		Mean number of whitefly per plant			
		First spray		Second spray	
Plant Materials	Concentration (g/litre of water)	24 HRS Before Spray	24 HRS After Spray	24 HRS Before Spray	24 HRS After Spray
Ginger rhizome	0	10.44	112.5a	270	285.0a
	2.5	17.30	65.0a	290	232.0a
	50	85.0	50.0b	273	117.5b
	75	112.5	25.0c	285	52.0c
	100	107.5	13.0c	313	12.5c
LSD (5%)		23.2	11.8	78	30.6
P<0,05		NS	**	NS	**

HRS=hours, B=before spray, A=after spray, NS=not significant, **=highly significant

Table 4: Effect of different concentrations *of* ginger rhizomes applied to tomatoes plant on the mean population of *B. tabaci* 2012/2013 dry season

Treatment		Mean number of whitefly per plant			
		First spray		Second spray	
Plant Materials	Concentration (g/litre of water)	24 HRS Before Spray	24 HRS After Spray	24 HRS Before Spray	24 HRS After Spray
Ginger rhizome	0	112.5	120.0a	280.0	209.0a
	2.5	125.5	100.0a	268.0	208.0a
	50	127.5	48.7b	283.0	138.0b
	75	123.0	30.5c	288.0	66.0c
	100	110.0	18.3c	315.0	25.0c
LSD (5%)		50.5	29.1	315.0	147.2
P<0,05		NS	**	NS	**

HRS=hours, B=before spray, A=after spray, NS=not significant, **=highly significant.

In the second stage of the experiment in which varying concentration of ginger extracts were used, (table 3). There were significant differences in efficacy of higher concentrations (75g/l and 100g/l) when compared with the lower concentrations. Higher concentrations were significantly ($p<0.05$) more effective in reducing the population of whitefly than the lower concentration. The effects of the varied concentrations are shown in Tables 3 to 4 below.

From the data, Table 3 and 4, result revealed that as the concentrations of ginger extract increases the insecticidal properties or efficacy in reducing mean population of whitefly in tomato also increases. The efficacy shown at 100g/litre was significantly different from the lower concentrations (25g/litre). There was however, a significant difference between 75g/litre and 50g/litre treatments.

The population of *B. tabaci* fluctuated in a similar pattern in all the plots. The present study has revealed insecticidal potential of the aqueous, ginger rhizome against *B. tabaci* on tomato. At 150g/litre, the aqueous extracts significantly reduced the population densities of *B. tabaci* on tomato plant.

The percentage reduction effect was recorded highest (above 80%) for all the dry season in aqueous extract of ginger rhizome on *B. tabaci*. The gingers (Zingiber officinale) contain prophylactic and therapeutic cadmium detoxification effect (Egwurugwu et al, 2007).

This study shows that the concentrations of aqueous extract increases so there was corresponding reduction in insecticidal capacity on whitefly population. So also in the same manner (Sridhar *et al*, 2002) revealed the insecticidal capacity of ginger on American boll worm, aphids, plant hoppers, thrips, and root nematodes.

The present study therefore has shown that ginger rhizome extract at 100 g/litre present a good potential insecticide against *B. tabaci* population on tomato. Since the efficacy and the varying concentrations were conducted under field condition, these extracts could serve as either alternatives or complements to chemical insecticides and as most integral part of integrated pest management, which are potentially harmful to the users and the environment.

ACKNOWLEDGMENT

Special thanks goes to my colleague Mal. Sadiq, I.A., Dr. Mani, U., Mrs. Badamasi, H.; Mal. Ahmed I. A. and my wife for financial and moral supports from beginning up to the end of the experiment.

REFERENCES

Babalola, D.A; Makinde, Y O; Omonona, B. T; Oyekanmi, M.O. (2010). *Determination of post harvest losses in tomato production a case study of imeko*. Afon Local government Area Ogun State *Acta SATECH*, 3, 14-18.

Egwurugwu, J.N., Ufearo, C.S., Abanobi, O.C., Nwokocha C.R., Duruide, J.O., Adeleye G.S., Ebunlomo A.O., and Onwufuji, O., (2007). *Effects of ginger (Zingiber officinale) on cadmium toxicity.* African Journal of Biotechnology Volume 6 (18): 2072-2082.

Sridhar, S., Saraswathy, H., Vijayalakshmi, K. (2002). Organic Vegetable Gardening. *Centre for Knowledge System*, Chennai.