International Journal of Plant & Soil Science
3(12): 1581-1589, 2014; Article no. IJPSS.2014.12.008
ISSN: 2320-7035

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Effect of *Milletia ichthyochtona* Drake Solution on Cabbage Production Components

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Authors' contributions

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

Article Information

DOI: 10.9734/IJPSS/2014/11057
Editor(s):
(1) Sunday Obalum, Department of Soil Science, University of Nigeria, Nigeria.
(2) Anonymous Editor.
(3) Bin Gao, Dept. of Agricultural & Biological Engineering, University of Florida, USA.
Reviewers:
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Peer review History: http://www.sciencedomain.org/review-history.php?iid=620&id=24&aid=5889

Original Research Article

Received 25th April 2014
Accepted 4th July 2014
Published 25th August 2014

ABSTRACT

The study was performed to evaluate the efficiency of *Milletia ichthyochtona* Drake solution on control of insect pests in cabbage crop. *Milletia ichthyochtona* Drake solution, Soap 0.1% was sprayed at 15, 35 and 45 days after transplanting. The effect of all treatments on cabbage growth was measured. The leaf number, head diameter, head weight and quality of cabbage vegetable were recorded. The efficiency of *Milletia ichthyochtona* Drake solution, Soap 0.1% on cabbage insect pests was measured. Results showed that sprayed with *Milletia ichthyochtona* Drake solution, Soap 0.1% was

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markedly reduced the number of days required for the cabbage growth. Moreover, sprayed with *Milletia ichthyochtona* Drake solution greatly enhanced the leaf number, head diameter, head weight, and quality of cabbage. Furthermore, sprayed *Milletia ichthyochtona* Drake solution have positive effects on pest reduction, and improve growth, yield and quality of cabbage vegetable.

Keywords: Cabbage; Milletia ichthyochtona Drake; diamondback moth; cutworm; flea beetle; growth; quality.

1. INTRODUCTION

The vegetables are high yielding and provide nutritional security, more employment, more cash and foreign exchange [1]. Cabbage (*Brassica oleracea* L.), a member of cruciferae and a useful vegetable, belongs to the genus *Brassica*. Cabbage and is related to turnips, cauliflowers and brussels sprout [2]. The food and Agricultural Organisation [3] has identified cabbage as one of the top twenty vegetables and an important source of food globally. It has been domesticated and used for human consumption since the earliest antiquity [4], and now cabbage is one of the most popular vegetable being grown globally in more than 90 countries [5]. Globally, cabbage (*Brassica oleracea* var. *capita*) is grown on 3.1 million ha and cauliflower (*B. oleracea* var. *botrytis*) and broccoli (*B. oleracea* var. *italica*) on 983.000 ha (estimate excludes Chinese cabbage, *Brassica campestris*) [6]. Cabbage crop is much preferred by the growers because of assured yield and transportable capacity [5]. Cabbage is a rich source of vitamin A and C, folic acid and potassium [7]. The green outer leaves of cabbage are richer in vitamin A, calcium and iron than the white inner leaves. Headed cabbage are usually consumed as a cooked vegetable, or eaten fresh as an ingredient of coleslaws and mixed salads.

Millettia ichthyochtona Drake Trees about 10–15 m tall. Branchlets flexuous, with longitudinal ridges, glabrous. Buds rounded; scales 6–8, broadly ovate. Leaves 5–9-foliolate, rachis 12–17 cm; leaflet blades subalternate, obliquely ovate, 5–8 × 1.5–2.5 cm, papery, base cuneate and asymmetric, apex acuminate. Pseudoracemes axillary, main axis often repeatedly branched, with white crisped trichomes. Pedicel 1–1.5 cm, slender. Flowers 1.5 cm. Calyx 5–6 mm; teeth triangular. Corolla white; standard broadly ovate, without basal calluses. Stamen monadelphous. Ovary stipitate, glabrous, with 2 ovules. Legume falcate-oblanceolate, 11–14 × 2–3 cm, flat, thinly woody, smooth, apex shortly beaked. Seeds 1 or 2 per legume, pale brown, ellipsoid, 1.3 × 1 cm, flat, shiny; hilum white [8].

Millettia tetraptera Trees, 15–26 m tall. Branchlets grayish yellow, rough, yellowish tomentose, glabrescent. Leaves 7–11(or 13)-foliolate; rachis 15–30 cm, including petiole 2–3 cm; stipels absent; leaflet blades elliptic-obovate, 8–13 × 2.5–3.5 cm, papery, abaxially yellow tomentose, base rounded to subcordate, apex obtuse, acute, or retuse. Pseudoracemes axillary at top of branchlets; rachis nodes with clusters of 2–5 flowers. Pedicel ca. 7 mm. Flowers 0.9–1.1 cm. Calyx 2–2.5 mm; teeth shortly triangular. Corolla lilac; standard broadly orbicular, basally thickened and emarginate. Stamens monadelphous. Ovary villous, with 4 ovules. Legume linear to oblong, 15–27 × 3–3.5 cm, flat, base tapering; stipe ca. 2 cm; both sutures with 2 ca. 1 cm wide woody wings perpendicular to them. Seeds 1 or 2 per legume, black, orbicular, ca. 1 cm in diameter [8].

The crop is grown worldwide under 3 Mha. The chief constraints in the production of cabbage is pest complex right from germination till harvest. The most important pest species

of these and other brassica crops is the diamondback moth (*Plutella xylostella* L.) [9], *Plutella xylostella (*Linnaeus), cabbage *white butterfly*, *Pieris rapae* L. (*Lepidoptera: Pieridae*), *cluster caterpillars*, *Spodoptera litura F.* (*Lepidoptera: Noctuidae*), beet armyworm, *Spodoptera exigua* Hübner (*Lepidoptera: Noctuidae*), the green peach aphid*, Myzus persicae* Sulzer (*Hemiptera: Aphididae*), the turnip aphid *Lipaphis erysimi* Kaltenbach (*Hemiptera: Aphididae*) [10]. The intensified production of cabbage has led to a common problem of high pest infestation, with one of the most important insect pest being the diamondback moth*, Plutella xylostella*. It is the greatest threat to crucifer production in many part of the world, sometimes causing more than 90% crop loss [7]. Moreover, *Brassica* crops are of particular importance in peri-urban environments and high farm gate prices have led to the frequent overuse of insecticides. The situation is most acute in the sub-tropics and tropics, where farmers often grow crops continuously and apply mixtures of insecticides on a weekly or sub-weekly basis. Insect parasitoids are active in fields despite the heavy use of chemical insecticides in the crop systems over the years. Overuse of pesticides has led to resistance [11,12], crop residue problems, environmental contamination and destruction of indigenous natural enemies. The frequent application of mixtures of pesticides also has a considerable impact on the profit margins of growers.

However, biological control represents more sustainable alternatives to chemical control of cabbage insect pest; they are urgently required and are potentially more economic. A number of *Bt* and *NPV* products were reported to have high efficacy in killing the target pests with no side effects on the beneficials [13,14]. Additionally the information about response of cabbage vegetable by application of *Milletia ichthyochtona* Drake solution to control cabbage insect pests is so far lacking. The present study was carried out to evaluate the effect of *Milletia ichthyochtona* Drake solution to resistance insect pests and cabbage growth under field condition.

2. MATERIALS AND METHODS

2.1 Plant Materials and Treatment Design

The experiment was carried out in Thai Nguyen University of Agriculture and Forestry, Vietnam from 2009 to 2010 in winter-spring. There are three treatments in the experiment included: T1 (control treatment without application of biology control), T2 (Soap 0.1%) and T3 (*Milletia ichthyochtona* Drake+ soap 0.1%). The experiment was design in Randomized Complete Block Design (RCBD) with three replicated. The cultivar used was KKcross and was transplanted at 40 × 50 cm spacing. Each plot consisted of one hundred and five plants. The *Milletia ichthyochtona* Drake solution was made by combination between water and seed of *Milletia ichthyochtona* Drake. The 1.0 kg seed of *Milletia ichthyochtona* Drake was cut into small piece, then put 1.0 little water, and soaked in water 24 hours (in this time about 1-2 hours the solution was shake to mix the seed and water). After 24 hours, get 0.1 little of *Milletia ichthyochtona* Drake solution, and then bring 0.1 little solution plus 1.0 little water, plus 1.0 gram soap. They was shake to mix the solution, after finish we can spray on the vegetable. The *Milletia ichthyochtona* Drake was sprayed at 15, 35 and 45 days after transplanting in the afternoon with a truck-mounted motorized sprayed until dripoff.

2.2 Data Collection

Twenty plants per plot were selected randomly for taking observation regarding growth, and quality, time of pre-head initiation, time of head formation, and time of head maturity were

recorded. Numbers of leaves per plant were obtained by counting each green and functional leaf that existed on the plant at each sampling. Head diameter was measured across the widest part of head. Average head weight was determined by weighing of cabbage vegetable at harvest. The efficiency of *Milletia ichthyochtona* Drake on cabbage insect pests was measured by method of [15].

Henderson-Tilton's formula

$$\text{Corrected\%} = \left(1 - \frac{\text{n in Co before treatment} * \text{n in T after treatment}}{\text{n in CO after treatment} * \text{n in T before treatment}}\right) * 100$$

Where n= insect population, T=treated, Co=Control

In heads of cabbage vegetable ascorbic acid, known as vitamin C, was measured by classical titration method using 2,6-di-chlorophenol indophenol solution in mg/100g sample [16].

2.3 Statistical Analysis

The data obtained from the study were analyzed using SAS 9.1 statistical software for different cultivars are used in the experiment. The least significant difference was calculated following a significance at $p \leq 0.05$.

3. RESULTS AND DISCUSSION

3.1 Effect of *Milletia ichthyochtona* Drake Solution on Period Growth of Cabbage Vegetable

Growth is function of various vegetative characters put together namely, height of plant, number of leaves, plant spread, no of secondary head, days to central head formation, days to secondary head formation, head size and harvest duration. From the results obtained in Table 1 revealed that the time of cabbage growth was significantly different among treatment. The minimum period of pre-head initiation was found in mid winter-spring, later winter spring with value of 24.00, 24.04 days after transplanting, respectively by sprayed *Milletia ichthyochtona* Drake+ soap 0.1%, followed by Soap 0,1% sprayed, whereas the maximum period of pre-head initiation was recorded in untreated control. For the period of head formation, there were significant differences among treatments concerning it (Table 1). In which, the control treatment was found to have the highest value of 43,56, 42,69 and 41,86 days after transplanting in early winter-spring, mid winter –spring and later winter-spring, respectively, whereas the period of head formation was hastened due to application of *Milletia ichthyochtona* Drake+ soap 0.1%. Moreover, the earliest harvestings were obtained by sprayed *Milletia ichthyochtona* Drake+ soap 0.1% with value of 90,63,90,28 and 90,09 in early winter-spring, mid winter spring and late winter-spring, respectively (Table 1). It seem that application of *Milletia ichthyochtona* Drake+ soap 0.1% treatment reduced the number of days required for the initiation of pre-head. This has also resulted in the earliness in the formation head and maturity of head.

3.2 Effect of *Milletia ichthyochtona* Drake Solution on Quality Parameters of Cabbage Vegetable

3.2.1 Number of leaf per plant

The results summarized in Table 2 showed that, the application of *Milletia ichthyochtona* Drake+ soap 0.1% had significant different effects on number of leaf per plant. In which, the highest value was found in mid winter spring by sprayed *Milletia ichthyochtona* Drake+ soap 0.1%, followed by in late winter spring, early winter spring with value of 29.85, 29.15 and 27.72 number of leaf per plant, respectively as compared to untreated control.

3.2.2 Head diameter and head weight

As can be seen from Table 2, the treatment that sprayed with *Milletia ichthyochtona* Drake+ soap 0.1% produced the maximum head diameter 74.54 cm, 72.67 cm and 69.23 cm in mid winter spring, late winter spring and early winter spring, respectively, whereas the control treatment produced the least of head diameter in all treatment. It can be seem that the head diameter of cabbage was significantly influenced ($p \leq 0.05$) by application of *Milletia ichthyochtona* Drake+ soap 0.1%

For the head weight, data in Table 2 showed that there was significant head weight among treatments. In mid winter spring, application of *Milletia ichthyochtona* Drake+ soap 0.1% resulted the greatest head weight (2.04 kg), followed by application of Soap 0.1% with value of 1.0 kg, where as the lowest head weight (0.9kg) was obtained for untreated control. It is also clear from the results that application of *Milletia ichthyochtona* Drake+ soap 0.1% showed the higher head weight as compared to untreated control. This result was achieved in the late winter spring and early spring, respectively with the significantly difference at ($p \leq 0.05$). It can be seem that application of *Milletia ichthyochtona* Drake+ soap 0.1% greatly improve some parameter and quality of Cabbage vegetable compared to control treatment.

3.3.3 Vitamin C

The Vitamin C of cabbage vegetable were significantly ($p \leq 0.05$) influenced by application of *Milletia ichthyochtona* Drake+ soap 0.1% in early winter-spring, mid winter spring and late winter spring. Data in Table II indicated that the highest value of Vitamin C 27.91mg/100g in mid winter spring, 26.86mg/100g in late winter spring, and 25.46mg/100g in early winter spring was achieved in *Milletia ichthyochtona* Drake+ soap 0.1% sprayed, while the untreated control gave the lowest value of 24.01 mg/100g, 23.28mg/100g and 22.74mg/100g, respectively.

Table 1. Effect of *Milletia ichthyochtona* Drake solution on the growth of cabbage vegetable*

Treatment	Early winter spring			Mid winter spring			Late winter spring		
	Pre-head period	Head formation period	Head maturity period	Pre-head period	Head formation period	Head maturity period	Pre-head period	Head formation period	Head maturity period
Control	25.14a	43.56a	93.51a	26.06a	42.69a	92.43a	26.13a	41.86a	91.43a
Soap 0,1%	24.33b	43.02ab	91.26b	24.97b	41.58b	91.38b	25.83b	41.05ab	90.94b
Milletia ichthyochtona Drake+ soap 0.1%	24.58b	41.65c	90.63c	24.00c	40.61c	90.28c	24.04c	40.79c	90.09c

** Mean in each column followed by the same letters are not significantly different at p≤ 0.05 according to Duncan's multiple range test*

Table 2. Effect of *Milletia ichthyochtona* Drake solution on parameter and quality of cabbage vegetable*

Treatment	Early winter spring				Mid winter spring				Late winter spring			
	Number of leaf/plant (leaf/plant)	Head diameter (cm)	Head weight (kg)	Vitamin C (mg/100g)	Number of leaf/plant (leaf/plant)	Head diameter (cm)	Head weight (kg)	Vitamin C (mg/100g)	Number of leaf/plant (leaf/plant)	Head diameter (cm)	Head weight (kg)	VitaminC (mg/100g)
Control	24.27c	37.0c	0.75c	22.74c	27.82c	42.41c	0.90c	24.01c	25.53c	38.92c	0.81c	23.28c
Soap 0,1%	25.71b	45.48b	0.83b	23.15b	28.34b	51.90b	1.0b	24.95b	26.56b	47.84b	0.89b	24.71b
Milletia ichthyochtona Drake+ soap0.1%	27.72a	69.23a	1.70a	25.46a	29.85a	74.54a	2.04a	27.91a	29.15a	72.67a	1.83a	26.68a

**Mean in each column followed by the same letters are not significantly different at p≤ 0.05 according to Duncan's multiple range test*

3.4 Effect of *Milletia ichthyochtona* Drake Solution on Control Cabbage Insect Pest

As showed in Table 3, the highest value (78.75%) was obtained with *Milletia ichthyochtona* Drake+ soap 0.1%, followed by Soap 0.1% sprayed with value (3.76%), compared to lowest value of 0.0% was found in untreated control in the case of Diamondback moth after sprayed 5 days, which is in accordance with the findings of [17] who stated the effect of biological control extract from the plant to control insect pest. Moreover, for Cutworm application of *Milletia ichthyochtona* Drake+ soap 0.1% exhibited the maximum efficiency (75.91%), but untreated control gave the lowest value of 0.0%. In the same table data showed that, sprayed *Milletia ichthyochtona* Drake+ soap 0.1% recorded the maximum value of 92.94%, while the minimum value of 0.0% was obtained in untreated control, which was found in the case of *"Flea Beetle"* insect pest (Table 3). It can be seem that sprayed *Milletia ichthyochtona* Drake+ soap 0.1% greatly efficiency in control insect pest cabbage vegetable as compared to untreated control, which is in accordance with the finding of [13,14]. Similar results were reported by [17] who stated the effect of biological control extract from the plant to control insect pest.

Table 3. Effeciency of *Milletia ichthyochtona* Drake solution on control DMB and other insect pest cabbage vegetable*

Treatment	After sprayed 5 days		
	Diamondback moth (%)	Cutworm (%)	Flea Beetle (%)
Control	0.0c	0.0c	0.0c
Soap 0.1%	6.27b	7.88b	3.76b
Milletia ichthyochtona Drake+ soap 0.1%	78.75a	75.91a	92.94a

**Mean in each column followed by the same letters are not significantly different at p≤ 0.05 according to Duncan's multiple range test*

4. CONCLUSION

It can be concluded that the application of *Milletia ichthyochtona* Drake + soap 0.1% greatly reduced the number of days required for the head formation and maturity in cabbage. This results of the study also indicated that the weight of cabbage head was greatly improved by application of *Milletia ichthyochtona* Drake + soap 0.1%. Moreover, sprayed of *Milletia ichthyochtona* Drake + soap 0.1% greatly resistance the effect of cabbage insect pests, and also clearly enhanced the quality in cabbage production. Therefore, we can be concluded that application of *Milletia ichthyochtona* Drake + soap 0.1% would have substantial positive impacts, promoting agricultural productivity and human nutrition without the deleterious environmental and health to meet commercial demands.

ACKNOWLEDGMENTS

The authors thank to our friends for technical help in the fieldwork.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Dhengle RP, Bhosale AM. Effect of plant growth regulators on yield of cabbage (Brassica oleraceae var.capitata). International Journal of Plant Sciences. 2008:3(2):376-378.
2. Jim M, Tony N. Cabbage growing prime fact 90. (Replaces GFACT. H8. 1.27. NSW Department of primary Industries (publ). 2006;1-7.
3. FAO. Traditional Food Plant. Food and Agricultural Organization of the United Nations, Rome, Italy; 1988.
4. Smith M. Report on the expert consultation on procedures for revision of FAO guidelines for predictions of crop water requirement. Rome FAO, 45p. Soil types effects on Growth and dry matter production of spring onion. Journal of Horticultural Sciences and Technology. 1995;77:340-5.
5. Sawant VP, Naik DM, Barkule SR, Bhosale AM, Shinde SB. Effect of foliar application of growth regulators on growth, yield and quality of cabbage cv. GOLDENACRE. The Asian Journal of Horticulture. 2010;5(2):495-497.
6. FAOSTAT. Food and Agriculture Organisation, United Nations. Available: http://faostat. fao.org.2007
7. Badii KB, Adarkwah C, Nboyine JA. Insecticide use in cabbage pest management in Tamale Metropolis of Ghana. Greener Journal of Agricultural Sciences. 2013;3(5):403-411.
8. Zhi W, Pedley L. MILLETTIA Wight & Arnott, Prodr. Fl. Ind. Orient. 263. 1834, nom. Cons. Flora of China. 2010;10:176–181.
9. Talekar NS, Shelton AM. Biology, ecology and management of the diamondback moth. Annual Review of Entomology. 1993;38:275-301.
10. Liu SS, Brough EJ, Norton GA. ACIAR Workshop Report: Integrated pest management in brassica vegetable crops. Cooperative Research Centre for Tropical Pest management, Brisbane, Australia; 1996.
11. Tabashnik BE, Cushing NL, Johnson MW. Diamondback moth (Lepidoptera: Plutellidae) resistance to insecticides in Hawaii USA: Intra-island variation and cross-resistance. Journal of Economie Entomology. 1987;80:1091-1099.
12. Shelton AM, Wyman JA, Cushing NL, Apfelbeck K, Dennehy TJ, Mohr SER, Eigenbrode SD. Insecticide resistance of diamondback moth, Plutella xylostella (Lepidoptera: Plutellidae) in North America. Journal of Economie Entomology. 1993;86:11-19.
13. Shi ZH, Liu SS. Toxicity of insecticides commonly used in vegetable fields to the diamondback moth, Plutella xylostella, and its parasite, Cotesia plutellae. Chinese Journal of Biological Control. 1998;14:53-57 (in Chinese with English summary).
14. Shi ZH, Guo SJ, Lin WC, Liu SS. Evaluation of selective toxicity of five pesticides against Plutella xylostella (Lep: Plutellidae) and their side effects against Cotesia plutellae (Hym: Braconidae). Pest Management Science. 2004;60:1213-1219.
15. Henderson CF, Tilton EW. Tests with acaricides against the brow wheat mite. J. Econ. Entomol. 1955;48:157–161.

16. Miller D. Food chemistry: A laboratory manual. 1st ed. John Wiley and Sons, New York, USA; 1998.
17. Trang ND. Study effect of biological control extract from the plant to control insect pest in North Vietnam. Ph.D Thesis. Institute of Agriculture Science and Technology Viet Nam. 1995;145.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=620&id=24&aid=5889