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Effect of TobaccoConcentration (*Tobaccumrestica*) to Protect Cabbage Aphid (*Brevicornyebrassicae*) on Cabbage crop (*brassica oleracea*)

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The study was carried out on the effectiveness of tobacco plant leaf extract and tested at various concentrations on three cabbage varieties and compare with the chemical insecticides (diaznone) to manage cabbage aphid on cabbage varieties. The experiment was conducted on farmer field under irrigation and the crude extract of tobacco leave were extracted with distil water and five treatment were tested:2.5g, 5g, 7.5g, crude leaf extracted, diaznone 60%EC and untreated control. The varieties were Thomas, Copenhagen and local cabbage. Split plot design was used with three replication that put varieties on the main plot and tobacco extract concentration on the sub- plot. Application of the treatment nicotine and diaznone 60% was done following the established economic threshold level (ETL). The result showed that crude extract nicotine concentration significantly affected aphid numbers. There was also interaction between variety and nicotine concentration. Cabbage variety of Thomas was the best of all varieties considered in the study and crude extracted nicotine 7.5g gave the best result that it may be taken as preliminary recommendation and more than one spray may be advised because the potency of the botanical decline with time.

Keywords: Botanical: Nicotine concentration: Diaznone 60% EC: Variety.

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INTRODUCTION

Cabbage (*Brassica oleracea: Brassicaceae*) is a cool season crop and the optimum temperature for cabbage production is 15 to 20°C. Cabbage does not grow well above 25°C. It grows well on mineral, sand and muck soils. Cabbage is a good source of beta-carotene, vitamin C and fibers and it is rich like magnesium, Calcium, potassium, carbohydrate, phosphorous and other nutrient which are essential for human health (USFDA, 2006).The Food and Agriculture Organization of the United Nations reported that total world production of all brassicas for calendar was 68,584,199 metric tons (FAO, 2011). Ethiopian agriculture sector is predominantly important for the economy of the country which contributes about 50% to the total GDP and 90% of the earning export. Cabbage, both head and kale, are the most important vegetable crop in Ethiopia as other vegetable crops (CSA, 2011). In Ethiopia, vegetable crops make significant contribution to household and also to the national economy (Fikadu and Dandena, 2006).

Cabbage aphid is one of the important key pests that

affect the quality and market value of cabbage in Ethiopia (Birhanu, *et al.,* 2011).Cabbage aphids develop resistance to increased application of insecticides more quickly and strongly than any other insects (Clark and Yamaguchi, 2002). According to (Raworth, 1984) cabbage aphid produced 40.7 nymphs per female. Vegetative stage of Indian mustard has produced four instars and a life span of 37.25 to 42.25 days for cabbage aphid on (Kashayp and Sharma, 1994). The cabbage aphid is more significant and destructive pest (Basavaraju *et a*l., 1995). Mustard aphid is another important aphid pest of brassica (Aslam, 2005). Aphids contribute up to 70-80% of yield losses caused by insect pests and elsewhere they are reported to have caused as much as 35-75% yield and 6% oil content reduction (Shoaib, 2003).

Nicotine is the toxicant or the active principle which is derived from tobacco leaves and the active insecticides from tobacco. In the present experiment, botanical insecticide (tobacco leaf extract) was used at different concentration. Therefore, the primary goal of this study was to test the efficacy of different nicotine concentrations on three cabbage varieties for the control of cabbage aphid species in Awi zone, Amhara Region, Ethiopia. To best of my knowledge, limited research work is available on effectiveness on tobacco extraction to cabbage aphids in Ethiopia. Thus, this research was given the answer to evaluate the effect of tobacco concentration against cabbage aphids on cabbage varieties and to investigate the interaction effect of tobacco crude extract and different cabbage cultivars on cabbage aphids as well as to determine the appropriate dose of tobacco crude extract concentration against cabbage aphids.

Materials and Methods

Land Preparation

Experiment site selection was carried out that was not crucifereae family in previous year to avoid soil born disease and other factors which might have negative influence on the experiment. The trail site was cleared and made ready to plough with ox and the experiment area was ploughed repeatly until the soil was made fine on September 16 2013-october 15 2013. The cabbage seedling was planted in seed bed and transplanted to the trail (experimental site)

Preparation of Plant Extracts

In this study, mature local tobacco (*Tobacco rustica*) leaves were collected in Fagita Lekoma, around Chaginie (guangua) district and the collected leaves were washed, cleaned, spread, aerated and dried under shade to reduce chemical volatility. The dried leaves were, finely ground to make the extraction easy with traditional crush material. Ground leaves of each measurable tobacco powder of 2.5 g, 5 g and 7.5 g were mixed with 100ml of water to made tobacco concentration and stay as mixture for 24 h to release its toxicity. Named as stock solution 2.5%, 5% and 7.5% and the mixed material was filtered with cheese cloth after 24 h and then 2.5mg of soap was added to increase stickiness of the extraction on to cabbage leaves.

Treatments and Experimental Design

Totally, Five tobacco concentration treatments were tested: 2.5 g, 5 g, 7.5 g, crude leaf extract ,diaznone 60% E.C and an untreated control and also there were cabbage varieties that used in the research. These varieties were: Thomas, Copenhagen, and local cabbage. The varieties were selected based on Melikassa Research Center information that is Copenhagen was susceptible, Thomas variety resistance and local cabbage as a standard check. Split plot design was used with three replications by putts varieties on the main plots and extract concentrations in the sub-plot. Plot size was 1.5 m × 3 m with 1 m path between plots and 1.5 m between replications**.** The cabbage seedling were transplanted from bed to experimental site when the seedling had six leave stage on November 02,2013 and the experimental site had five rows per plot, five plants per row in space at 60-cm apart between row and 30 cm between plants in total area of 392m^2. The treatments were placed randomly within each block selecting system and 250kg/ha DAP and 125kg/ha urea were applied.

Treatment Application

There were three crude nicotine extract concentrations applied based on the concentration and diaznone 60% EC sprayed as a standard check. The treatments were applied on November10, 2013 in the morning (the day was cloud) by using knapsack sprayer when the plants were at 6-8 true leaf stage. Application was done following the established economic threshold level (ETL) of 2% infestation by 5 or more aphids (Saskatchewan Agriculture, 2012).

Data Collected and Analysis

Aphid numbers were recorded on a random sample at the middle of nine plants from the three central rows after

spray nicotine. Sampling was carried out four times after application, i.e., at 24 h, 48 h, 72 h and one week after spray and the cabbage yield was recorded at harvest. Factorial ANOVA (JMP 5.0.1 2003 SAS institute) was used to analyze effect of cabbage variety, nicotine concentration, and their interaction on aphid abundance and cabbage yield. Means were separated using LSD Range test at α=0.05.

Repeated Measure Analysis of Variance

Because aphid data were taken from each plot four times, i.e., at 24 h,48 h,72 h and one week after spray, we had to use repeated measure analysis of variance to determine variation in aphid numbers among the different sampling times. In that case, the two factors, i.e., cabbage variety and nicotine concentration, were considered as a fixed effects and time of sampling as random effect. Sphericity test was conducted to choose either univariate or multivariate analysis of the four sampling dates (times).

RESULT AND DISCUSSION

Nicotine concentrations difference significantly influenced the number of aphids and the interaction effect in between cabbage variety and tobacco concentration was significant but the result that had obtained from diaznone treated treatment had showed good result on aphid reduction in number compare with tobacco concentration. The aphid population was increase in number from one week after spray in all varieties and applied concentration. Aphid protection with 7.5g tobacco concentration plus Thomas variety had scored good result relatively compare the other interaction .Thomas cabbage variety had recorded less number of aphids relatively with other cabbage varieties. The study indicated that tobacco concentrate application was decreased within time after applied.

The effect of crude extracts nicotine concentration and cabbage varieties on cabbage aphid

The analysis revealed significant interactions between tobacco concentration and the cabbage varieties. Aphid abundance significantly varied between nicotine concentrations regardless of when the data were recorded after spray (Table 1). These result was agreed on tobacco extract effectively control aphid population (Sohail, et al., 2012). In all tobacco concentrate applied condition, the local variety carried more aphids per plant than the other varieties that treated with the same concentration. In general, aphid numbers declined as nicotine concentrations increased in the following order: untreated, 2.5 g, 5 g, 7.5 g and diazinone. This result is inline that frequency of aphid feeding and the mortality rate of botanical insecticides were concentration-dependent (Isman, 2000). Cabbage feeding potential of aphid is reduce as the botanical insecticide concentration increase.

The tobacco concentration at 2.5 g, and 5g did not significantly vary in aphid number in all cabbage varieties. Likewise, rates 5 and 7.5g did not significantly vary but there was a significant difference in between 2.5g and 7.5 g tobacco concentration on the cabbage varieties. This result had agreed that susceptible cabbage varieties had showed low ability to reduce or mitigate cabbage aphid and resistance cabbage cultivar was reduced aphid populations and damage (Munthali, 2009). Generally as tobacco concentration increase, the protection ability became increase but the treatment that treated with diaznone had showed high protection ability relatively on tobacco concentration in all varieties.

Effect of Time on Crude Extract Nicotine and Cabbage Varieties on Cabbage Aphid Numbers

The efficacy percentage of nicotine concentration in aphid mortality increased within concentration increased and related with date of data recorded. The efficacy percentage aphid mortality at 2.5g; 24hrs , 48hrs, 72hrs and one week were 28.3%, 43.3%, 50% and 33.3% respectively. The efficacy percentage at 5g was also 36.6% at 24hrs, 64.43% at 48hrs, 70.0% at 72hrs and 53.33% at one week. These was inline the idea of Tobacco concentration 5 per cent was the most effective and recorded 62.73 per cent aphid mortality (Patel and Sangekar, 2012).The efficacy percentage at 7.5g 59.37% at 24hrs,71.57 at 48hrs, 76.5% at 72hrs and 53.3 at one week. Under tobacco concentrate application, the highest efficacy was observed at 7.5g concentrate but the protection ability reduced after one week. The result is agreed that tobacco leaves are useful in the control of aphids (Nayar et al., 1990). The highest efficacy was observed with diazinon treated, which was 80.83% at 24hrs, 85% at48hrs and 72hrs and 100% at one week. These result showed, that crude extract nicotine concentration had decreased after one week but diazinon60%E.C was progressively increased the percentage of aphid mortality. The efficacy percentage also increased as nicotine concentrations increased at extend of time except at one week (Table 2).

According to repeated measure data analysis aphid abundance significantly varied between cabbages varieties regardless of when the data were recorded except the 24h after spray (Table 3). The local variety

Table1. Effect of nicotine concentrations and cabbage varieties on cabbage aphid reduction on cabbage varieties

Concentration	Mean aphid /plot		
	Local	Copenhagen	Thomas
Untreated check	7.3a	6.3b	5.9b
2.5 g	3.3c	3.3c	2.8cde
5 g	3.1cd	2.5cdef	2.1efg
7.5 g	2.3defg	1.9fg	1.6g
Diaznon 60% EC	0.6h	0.6h	0.5h

Means followed by same letter(s) are not significantly different according to Tukey HSD ($p<0.05$)

Table 2. Efficacies of different crude extract nicotine concentration on aphid mortality different dates.

Treatments	Mortality Rate (%) after application			
	24 hrs	48 hrs	72 hrs	a week
2.5g	28.33 (32.16)c	43.3 (41.15)b	50.00 (45.00)b	33.33 (35.26)c
5.0g	36.67 (37.27)bc	64.43 (53.39)a	70.00 (56.79)ab	53.33 (46.91)bc
7.5g	59.37 (50.40)ab	71.57 (57.78)a	76.50 (61.00)a	72.70 (58.5)ab
Diazinon 60%E.C	80.83 (64.03)a	85.00 (67.21)a	85.00 (67.21)a	100.00 (90.00)a
Control	0.00 (0.00)d	0.00 (0.00)c	0.00 (0.00)c	0.00 (0.00)d
MSE	12.10	10.89	11.2	14.58
CV (%)	29.49	20.59	19.91	28.11

Table 3. Effect of varieties on aphid dynamics at different time of count

Time after spray	Cabbage variety		
	Local	Copenhagen	Thomas
24 hrs	3.3a	3.2a	2.9a
48 hrs	3.0a	2.7ab	2.3b
72hrs	2.9a	2.5b	2.2b
a week	3.9a	3.3a	2.9b

Means followed by the same letter in rows are not significantly difference from each other according to Tukey honestly significance different test at $\alpha=0.05$.

carried more aphids than other varieties per plant. The result in line with studied in Ethiopia, the study conducted at Bridge to Israel Children Village Farm in Gonder stated that 70-80% of the cabbage plants were severely infested by these aphids (Gebrelibanos et al., 2011). There was significant difference in between local variety and Thomas variety in all time of spray with aphid population except at 24 h (Table 3). There was, nevertheless, a sign of difference in aphid count between times of data collection after spray on the variety Copenhagen. Generally, the local variety was more susceptible to the aphids than the other two varieties, especially Thomas and relatively more aphids were counted one week after infestation than other times (table 3). This was also reported that natural insecticide products, have no persistent detrimental effects on the environment as they rapidly degrade to harmless- substances (Digilioet al., 2008).).

Effect of Nicotine Concentration and Varieties on Cabbage Yield

The yield of variety was directly related with concentration and genetic variability of cabbage variety that is Thomas variety treated with 7.5g of nicotine concentration gave a good yield within the other but the local variety had low yield that treated in all tobacco concentration and from other varieties. This idea is agreed cabbage aphid plays a prominent role in reducing the yield ranging from 50 to 80% (Ellis and Singh, 1993.In all three varieties, as the concentration increased, the yield also increased in size and the local variety had no a good yield compared with the other varieties that treated with equal crude extract nicotine concentration. It had the same idea that estimated annual damage caused by these pests on average is about 30% in USA and 50% or more in Turkey (Roberson, 1999). Copenhagen the second which was effective that increased the yield with

the interaction of treatment compare to local variety. The aphid population was increased at one week data collection in all varieties and concentrations. These was agreed with the idea of Nicotine is highly breaks down within 48 hours but tobacco plant extract spray used cabbage aphid control (Mary L, et al., 2011).

CONCLUSION

Cabbage plants treated with nicotine or the insecticide carried less aphid numbers than untreated (control) ones but its potency became decrease with time due to easy degradable problem. That means nicotine has proved to be a potent botanical pesticide and has a potential to replace synthetic pesticides such as pirimicarb for aphid control and Cabbage varieties also varied in aphid numbers but it needed repeat application. When the concentration increased, the number of aphid population on all varieties was decreased however; the concentration of 7.5 g and Thomas variety cabbage interaction had good result compare with the other. Cabbage yield increased with increasing nicotine concentration and also there was difference in yield between the varieties.

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