Diversity of Natural Enemies in Organic Cauliflower, *Brassica oleracea* var. Botrytis Applied with Biopesticides from Plant Extracts

Leah C. Tuan*

*College of Agriculture, Fisheries and Agricultural Resources, University of Eastern Philippines, University Town, Northern Samar
Email: leahtuanc@gmail.com

**Abstract**—Selected botanicals used as foliar biopesticide as a sustainable approach on insect pest management for cauliflower production was studied for three months at the University Demo Farm, University of Eastern Philippines, Main Campus, University Town, Catarman, Northern Samar to determine their effect on the incidence of natural enemies on cauliflower.

Presence of natural enemies at the experimental area was not significantly influenced by the introduction of the biopesticide. Abnormalities in the environmental condition during the conduct of the experiment was the major contributory factor to its effectiveness. Yet, repellant and antifeedant properties of the biopesticide must have prevented the establishment of pest species. The prevalence of natural enemies and other arthropods in the area is a clear indicator of a clean and safe environment.

**Keywords**—Biofertilizer, Biopesticides, Bio-resources, and Natural enemies.

I. **INTRODUCTION**

Utilization of bio resources is a means to meet sustainable agriculture requirements. Plant extracts have long been used to control insects. Botanicals are noted to have broad-spectrum activity, relatively specific in their mode of action and also easy to process and use.

In the recent years, reports revealed that several vegetable farmers have already shunned themselves from adopting the conventional means of pest control. Many of them have shared good testimonies and successful stories about growing crops the organic way.

Among the tried and tested organic farming practices by seasoned farmers are: use of fermented plant juices as soil drench to supply nitrogen to young plants, thorough and patient preparation of the field with organic fertilizer, and use of herbal-based pesticides (Rodriguez, 2012; Samonte, 2012; Samonte, 2013).

Farmers have proven that shifting from conventional to natural farming is economically viable and ecologically sound; that organic farming has not just enabled them to save production cost but more so has restore the natural fertility of the soil, save and promote healthier environment favorable for natural enemies and most of all produce chemical-free food on their table.

This study tried to assess the incidence of natural enemies in organically grown cauliflower in Northern Samar.

II. **METHODOLOGY**

The study was conducted in pot experiment under protected culture at the University Demo Farm, University of Eastern Philippines, Main Campus University Town, Northern Samar. It was laid out in a Randomized Complete Block Design (RCBD) with 4 treatments (T1-Control, T2-Biopesticide, T3-Biofertilizer+Biopesticide) in three replications.

**Research Procedure**

A kilogram of chopped fresh leaves of Akapulko and guava (combined in equal amount, 1:1 ratio) was added with 1,000 ml of ground water and a kilo of brown sugar. The mixture was kept in a jar and allowed to ferment in a dark and dry place for seven days then strained; fermented foliar biopesticide was mixed with fresh extract of 100g ground hot pepper (*siling labuyo*) and was allowed to stand for at least 6 hours then was ready for use.

Daily scouting to monitor presence natural enemies in the cauliflower field experimental area was done through visual observation above the ground parts of cauliflower plants. Plants were visited from 600 am to 9:00 am since insects come out at this time to feed. Data were recorded in observation sheets. Species richness and evenness index was computed to assess the diversity of...
natural enemies in the experimental area using Simpson's index, $D_s = \frac{1-\Sigma(n_i-1)}{(N(N-1))}$ where $D_s = \text{Simpson's index of diversity}; N = \text{total number of individuals of all species}; n_i = \text{total number of the species i}$.

Care and management practices on cauliflower production were followed throughout the duration of the experiment. Weeding and earthing up was regularly done to prevent food competition, exposure of the shallow roots and formation of soil crust on surface.

III. RESULTS AND DISCUSSION

Incidence of Natural Enemies

The presence of a sizable number of different species natural enemies in the experimental area is evident of a conducive, clean and safe environment. Non utilization of toxic and harmful chemicals allows them to hover in the area. Prevalence of these beneficial creatures in the experimental area was observed in all the growth stages of the crop, Table 1. Natural enemies present in the field was dominated by different species of spiders.

| Class/Order | Life  stage of the insect | Plant parts located |
|-------------|--------------------------|---------------------|
| Diptera     | Adult                    | Leaves, soil        |
| Hymenoptera| Adult                    | Leaves              |
| Orthoptera  | Adult, nymph, egg        | Leaves              |
| Odonata     | Adult                    | Leaves              |
| Homoptera   | Adult                    | Leaves              |
| Opiliones   | Adult                    | Leaves              |
| Aranaeae    | Adult, nymph             | Leaves, stem, web   |
| Reptilian   | Adult                    | Leaves              |
| Neuroptera  | Adult                    | Leaves              |

Other organisms recorded were several species of Dipterans (blowfly, housefly, Tabanus fly, green fly and orange fly), daddy longlegs (Opiliones), lacewing (Neuroptera), black ants (Hymenoptera), mite (Acari) and green lizard (Reptilian). Existence of these organisms in cauliflower field is indicative of species diversity. Bio resources and carabao manure utilization of must have contributed to the species richness.

Effect of the Bio Pesticide on the Incidence of Natural Enemies

The effect of the bio pesticide on the natural enemies (NE) was significantly different among the treatments. This finding means that bio pesticides contain substances with insecticidal property, however, is less toxic than synthetic pesticides, hence, categorized as an eco-friendly alternative in pest management.

Effect of the Bio Pesticide on the Incidence of Natural Enemies

Table.1: Natural enemies, other arthropods and vertebrates observed during the different growth stages of cauliflower in UEP, Catarman, Northern Samar, Philippines.

Table.1: Natural enemies, other arthropods and vertebrates observed during the different growth stages of cauliflower in UEP, Catarman, Northern Samar, Philippines.

| Crop developmental stage | Name of insect | Class/Order | Life  stage of the insect | Plant parts located |
|--------------------------|----------------|-------------|--------------------------|---------------------|
| Transplanting to plant establishment | Flies | Diptera | Adult | Leaves, soil |
| Vegetative stage | Wasp | Hymenoptera | Adult | Leaves |
| Praying Mantis | Orthoptera | Adult, nymph, egg | Leaves |
| Dragon fly & damselfly fly | Odonata | Adult | Leaves |
| Lacewing | Homoptera | Adult | leaves |
| Daddy longlegs | Opiliones | Adult | Leaves |
| Spider | Aranaeae | Adult, nymph | Leaves, stem, web |
| Curd initiation and development stage | Wasp | Hymenoptera | Adult | Leaves |
| Flies (different species) | Diptera | Adult | Leaves |
| Spider (different species) | Aranaeae | Adult, nymph | Leaves, stem, web |
| Green lizard | Reptilian | Adult, egg | Soil |

Other organisms recorded were several species of Dipterans (blowfly, housefly, Tabanus fly, green fly and orange fly), daddy longlegs (Opiliones), lacewing (Neuroptera), black ants (Hymenoptera), mite (Acari) and green lizard (Reptilian). Existence of these organisms in cauliflower field is indicative of species diversity. Bio resources and carabao manure utilization of must have contributed to the species richness.

IV. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Foliar biopesticide from fermented plant extracts did not show significant effect on the natural enemies on cauliflower plants. The use of bio pesticide from botanicals (akapulko, guava and hot pepper) had a positive influence on the incidence/diversity of natural enemies of cauliflower, a welcome strategy to promote and realize a clean and safe environment.

Based on the results of the study, the following recommendations are made:

1. Advocate adoption of bio resources in the farm to combat hazardous effects of using conventional farm inputs.
2. Perform experiment on improvement of the preparation and processing of the bio pesticide to increase its potency and effectiveness.
3. Conduct further verification studies on dosage and manner of application of the bio pesticides.
4. Perform the same study during the dry months to confirm efficacy and effectiveness of the bio pesticides and the incidence of natural enemies.

ACKNOWLEDGEMENT

The researcher wish to express her profound thanks to the University of Eastern Philippines (UEP) administration and the Commission on Higher Education (CHED) for the material and financial support that leads in the realization of this experiment. To the University Research and Development Services staff, and field workers who assisted the researchers throughout the duration of the experimentation.

REFERENCES

[1] Abdelrahim SI, Almagboul AZ, Omer MEA, Elegami. 2002. Antimicrobial activity of Psidiumguajava L. Fitosferapia, 73 (7-8): 713-715
[2] Agrinfoinfo©2015.Cultivation of Cauliflower. Retrieved November 21, 2016, from http://Agrinfoinfo/?page=topic&superid=2&topicid=916
[3] Antonious, G.F., J.E. Meyer, J.A. Rogers, and Y.H. Hu. 2007. “Growing hot pepper for cabbage looper, Trichopulsiani (Hubner) and spider mite, Tetranychusurticae (Koch)Control". Journal of Environmental Science and Health Part A 41(8): 559-567
[4] Antonious, G.F., J.E. Meyer, and J.C. Snyder. 2006. “Toxicity and repellency of hot pepper extracts to spider mite, Tetranychusurticae Koch. Journal of Environmental Science and Health Part B B 42(5): 559-567
[5] Baby Joseph, 2011. “Review on Nutritional, Medicinal and Pharmacological Properties of Guava (Psidiumguajava Linn.)”. International Journal of Pharma and Bio Sciences. 2(1): 53-69
[6] Battcock, M. and Sue Azam-Ali. 1998. “Fermented fruits and vegetables. A global perspective...". FAO.Agricultural Services Bulletin No. 134. Food and Agriculture Organization of the United Nations Rome
[7] Capewell, Martin. Undated. The Benefits of Foliar Feeding. Retrieved February 22, 2017, from https://www.agriculture.solutions.com/resources
[8] Dawn. 2007. Production technology of cauliflower. Retrieved November 21, 2016, from http://www.dawn.com/news/226775/production-technology-of-cauliflower
[9] DOST. 1998. Madre de cacao. Department of Science and Trade. Manila, Philippines
[10] Doughari J.H. and B. Okafor, 2007. “Antimicrobial Activity of Sennaalata Linn.". East and Central African J. Pharm. Sci., 10. 17-21
[11] Fritz V.A., C.J. Rosen, M.A. Grabowski, W.D. Hutchison, R. L. Becker, C.B.S. Tong, J.A. Wright and T.T. Nennich. 2017. Growing broccoli, cabbage and cauliflower in Minnesota. Retrieved March 4, 2017, from http://www.extension.umn.edu/garden/yard-garden/vegetables/ growing-broccoli-cabbage-and-cauliflower-minnesota/index.html
[12] Gomez, A.G. and A.A. Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd Ed., IRRI, UPLB Laguna Philippines
[13] Hidetoshi A and G. Danrio. 2002. “Isolation of antimicrobial compounds from guava (Psidiumguajava Linn.) and their structural elucidation”. Biosci. Biotechnol. Biochem. 66. Pp. 1727-1730
[14] Jairp, P, Khoohaswan, Y. Wongkrajang, P. Peungvicha, P. Suriyawong, MLS Saraya, O. Ruangsomboon. 1999. “Anticough and antimicrobial activities of Psidiumguajava Linn. leaf extract”. Journal of Ethnopharmacology. 67 (2): 203-212
[15] Koike, S.T., Michael Cahn, Marita Cantwell, Steve Fennimore, Michelle Lestrange, Eric Natwick, Richard F.Smith, EtaferahuTakele. 2009. Cauliflower production in California. Retrieved November 21, 2016, from http://anrcatalog.ucdavis.edu/pdf/7219.
[16] Lichtenberg, E., &Zilberman, D. 1984. The econometrics of pesticide use: Why specification matters. Paper presented at the American Agricultural Economics Association annual meetings, Ithaca, NY
[17] Ma.Publico Z. December 2008. “Young Ilocano Farmers Talk About Their Techniques". Agriculture. 13(12): 22-25
[18] PCARRD. 1999. Broccoli and Cauliflower Production Guide. Information Bulletin No. 148. Los Banos 4030 Laguna
[19] Perez R., M. Gutierres, S. Mitchell and R.V. Solis. 2008. “Psidiumguajava: A review of its traditional uses, phytochemistry and pharmacology”. J. Ethnopharmacol. 117: 1-27
[20] Pottner, D.J. 2012. Abundant Gardening. Retrieved November 27, 2016, from http://www.wvu.edu/~agexen/hortcult/homegard/caul.pdf
[21] Rodriguez A.A. 2010. “Penaranda’s lone cauliflower grower”. Agriculture Monthly. 14 (5):52-53
[22] Rodriguez A.A. 2010. “Brassicas are the veggies to eat”. Agriculture Magazine. 14 (12):10-15
[23] Rodriguez A.A. 2010. “Growing brassicas in lowland farms”. Agriculture Magazine. 14 (12):16-19
[24] Rodriguez A.A. 2012. “Sariaya, Quezon organic farmer succeeds with cauliflower”. Agriculture Monthly. 16, (1):44
[25] Rodriguez A.A. 2012. “Organic pigs & veggies for livelihood in Oriental Mindoro’s District". Agriculture Monthly. 16(4):14-15
[26] Rodriguez A.A. 2013. “Small Ilocos Sur Towns are big cauliflower producers”. Agriculture Monthly. 17(3):50-51
[27] Samonte P. 2011. “Organic farm inputs replace inorganic fertilizers and pesticides in Bulacan”. Agriculture Monthly. 15(12):18-19
[28] Sarian ZB. May 2007. “Lowland cauliflower produces big head”. Agriculture Magazine. 11(5):4-5

[29] Shoemaker, J.S. and Tesky, B.F. 1955. Practical Horticulture. New York, John Wiley and Son, Inc.

[30] Slideshare.2016. “Growth Formula of Crops” Retrieved January 22, 2017, from https://www.slideshare.net/humanxuno81/growth-formulaofcrops

[31] Tiwari, K.N. undated. Cauliflower. Retrieved December 2, 2016, from http://www.ncpahindia.com/cauliflower.php

[32] Tuan, 2002. Personal Communication. Project Leader, UEP PATSARRD Project

[33] Turnock, W.J. 2015. Insect Pests. Retrieved November 27, 2016, from www.thecanadianencyclopedia.ca/en/article/insect-pests/

[34] Zilberman, David and Eunice Kim.Zilberman& Kim. 2011. The lessons of fermentation for the new bio-economy. AgBioForum, © AgBioForum. University of California, Berkeley. 14(3): 97-103

[35] Zilberman, D., Ameden, H., Quim, M. (2007). “The impact of agricultural biotechnology on yields, risks, and biodiversity in low-income countries”. Journal of Development Studies, 43: 63-78