

Integrating Innovative Eco-Friendly Pest Management Strategies for Controlling *Plutella Xylostella*-A Notorious Pest of *Brassica Oleraceae* Var. *Botrytis*

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Abstract:

Cauliflower (*Brassica Oleraceae* Var. *Botrytis*) Is One Of The Most Important Winter Vegetable In India. Out Of Total 5335447 Ha Of Land Under Vegetables Cultivation, Cauliflower Occupies Nearly 4.4 Per Cent Area During The Year 1998-99. The Diamondback Moth, *Plutella Xylostella* L. (Lepidoptera: Plutellidae) Is The Most Destructive Pest Of Brassicaceae.

Vegetable Growers By And Large Depend On Chemical Pesticides To Counter The Problem Of Insect Pests. It Accounts For 13-14 Per Cent Of Total Pesticides Consumption, As Against 2.6 Per Cent Of Cropped Area. Central Aravalli Region Is One Of The Most Important Areas Of Rajasthan From Vegetable Production Point Of View. A Study Conducted To Monitor Pesticide Residues In Vegetables, Of Central Aravalli Region Showed That Maximum Samples Of Cauliflower (51.85%) Found Contaminated Followed By Brinjal (50%), Tomato (46.43%), Cabbage (28.20%) And Potato (23.53%). The Indiscriminate Use Of Pesticides Has Led To Severe Ecological Consequences Like Destruction Of Natural Enemy Fauna, Effect On Non Target Organisms, Residues In Consumable Products Including Water And Ultimately Resistance To The Pesticides, To Which We Solely Rely. Several Studies Have Shown That The Use Of Insecticides Is Not A Sustainable Pest Management Option For Farmers, As It Is Fraught With Problems Such As The Improper Handling Of Insecticides, Increased Cost Of Insecticides, Reduced Control Efficacy And Contamination Of The Farming Environment. Increased Awareness Among The End Users And Concerns About The Deteriorating Ecological Situations Among The Eco-Campaigners Has Surged The Researchers To Develop An Integrated Eco-Friendly Pest Management Strategy For Controlling *Plutella Xylostella*.

Biopesticides Could Play An Important Role In IPM Strategy, Developed To Encounter Pest Threat. Microbial Pesticides, Botanical Pesticides, Biochemical Pesticides (Sex Pheromone Traps) And Introduction Of Natural Enemies Such As *Cotesia Plutellae*, *Daidromus Collaris*, *Diadegma Semiclausam* Could Play A Crucial Role In Successfully Combating *Plutella Xylostella* Threat But In Eco-Friendly Way.

Keywords: *Plutella Xylostella*, Microbial Pesticides, Biopesticide.

INTRODUCTION:

Agriculture And Agriculture Allied Sectors Contribute Nearly 22 Per Cent Of Grossdomestic Product (GDP) Of India, While About 65 -70 Per Cent Of Population Depends On Agriculture For Livelihood [1]. India Is The Largest Producer Of Cauliflower In The World. Cauliflower (*Brassica Oleraceae* Var. *Botrytis*) Is One Of The Most Important Winter Vegetable In India. Out Of Total 5335447 Ha Of Land Under Vegetables Cultivation, Cauliflower Occupies Nearly 4.4 Per Cent Area During The Year 1998-99 [2]. The Edible Part Of Cauliflower Is Known As Curd, Which Consists Of A Shoot System With

Short Internodes, Branches Apices And Bracts. Diamondback Moth, *Plutella Xylostella* L. (Lepidoptera: Plutellidae) Is Recorded As The Major Pest Of The Family Cruciferae [3]. It Presents One Of The Greatest Threats To Crucifer Production In Many Parts Of The World, Sometimes Causing More Than 90% Crop Loss [4].

Vegetable Growers By And Large Depend On Chemical Pesticides To Counter The Problem Of Insect Pests. It Accounts For 13-14 Per Cent Of Total Pesticides Consumption, As Against 2.6 Per Cent Of Cropped Area. Central Aravalli Region Is One Of The Most Important Areas Of Rajasthan From Vegetable Production Point Of View. A Study Conducted To Monitor Pesticide Residues In Vegetables, Of Central Aravalli Region Showed That Maximum Samples Of Cauliflower (51.85%) Found Contaminated Followed By Brinjal (50%), Tomato (46.43%), (32%), Cabbage (28.20%) And Potato (23.53%) [5].

The Indiscriminate Use Of Pesticides Has Led To Severe Ecological Consequences Like Destruction Of Natural Enemy Fauna, Effect On Non Target Organisms, Residues In Consumable Products Including Water And Ultimately Resistance To The Pesticides, To Which We Solely Rely. *Plutella Xylostella* Has Shown A Formidable Capacity To Evolve Resistance To Pesticides [6] And Has Become Notorious For Being The First Pest To Evolve Resistance To D.D.T. And More Recently To *Bacillus Thuringiensis* Formulation [7].

Several Studies Have Shown That The Use Of Insecticides Is Not A Sustainable Pest Management Option For Farmers, As It Is Fraught With Problems Such As The Improper Handling Of Insecticides, Increased Cost Of Insecticides, Reduced Control Efficacy And Contamination Of The Farming Environment [8]. Improper Handling And Unsafe Spraying Of The Agrochemicals Cause High Risk Of Health Hazards [9]. Centre For Science And Environment (CSE) Reported That Pesticide Exposure Causes Acute Poisoning, Cancer And Neurological Impairment, Reproductive And Developmental Problems [10]. In India 76% Of The Pesticide Used Is Insecticide, As Against 44% Globally [11]. The Use Of Herbicides And Fungicides Is Correspondingly Less Heavy.

Keeping In View The Problems Encountered By The Use Of Chemical Insecticides Here The Possible Ecosafe And Innovative Pest Management Tactics Is Been Reviewed. The Proposed Eco-Safe Management Strategy For Combating *Plutella Xylostella* Threat Is As Follows:

1. Intercropping:

Intercropped Crucifers Had A Significantly Fewer Number Of *Plutella* Larvae And Pupae As Compared To The Unsprayed Monocrops Of Kale Or Cabbage Plots. A Similar Case Was Also Reported When Cabbage Was Intercrop.D With Other Plant Species [12]. Tomato, When Intercropped With Cabbage Reduced DBM-Egg Laying [13 &14]. Cabbage Intercropped With Garlic, Sunflower, Mustard Also Showed Significant Results.

2. Application Of Botanical Pesticides:

Insecticides Of Plant Origin Have Been In Use For Long Time. Approx. 1800 Plant Species Have Been Reported To Possess Pest Control Properties [15] And 88 Of These Reported To Be Active Against *Plutella Xylostella* . Neem Based Insecticides Have Been Used In Many Parts Of The World For The Management Of *Plutella Xylostella* And Other Pests On Cabbage[16] And Are Generally Effective With Significant Lethal And Antifeedant Effects Accompanied By A Significant Reduction In Food Consumption [17]. A Researcher Suggested Neem Extract As A Better Pest Control Agent And Increase The Mortality Of *Plutella Xylostella* Larva [18]. Plant Extracts Of *Calotropis Procera*, *Melia Azadirach*, *Jatropha*, *Datura* Etc Also Showed Larvicidal Properties. Several Botanical Pesticides Are Available In

The Market, Which Are Eco Safe As Well As Effective. Farmers Should Be Encouraged To Use These Bio-Pesticides.

3. Introducing Synergistic Rationale:

It Is Reported By Many Researchers That Combining Of Plant Extracts Enhance The Bio-Efficacy Of The Bio-Pesticides As Compared To Individual Plant [19]. The Prolongation In Larval Developmental Periods And Subsequent Loss In Pupal Weight And Malformed Larval Pupal Intermediaries Was Observed In *Spodoptera Litura* Larvae Fed With Crude Extracts Of Neem + Mahua + Jatropha [20]. A Low Ovicidal Action Was Observed In All The Neem Formulations [21]. Significant Larval Mortality Of DBM Was Observed When Treated With Neem Seed Extracts+ Calotropis Leaf Extracts In A Leaf Dip Bioassay.

4. Microbial Pesticides:

Microbial Pesticides Based On The Soil-Borne Bacterium *Bacillus Thuringiensis* (Bt) Are Among The Most Widely Used Groups Of Biopesticides. Formulations Based On Bt Subsp. Kurstaki And Bt Subsp. Aizawai Have Been Found To Be Effective Against Several Lepidopteran Pests Either Alone Or In Combination With Other Biopesticides Or Biocontrol Agents On Vegetables. B. Thuringiensis-Based Biopesticides And Parasitoids Of Diamondback Moth Act Synergistically To Suppress Major Lepidopteran Pests On Vegetable Brassicas In Tropical Asia. It Was Found That With The Adoption Of Bt , D. Semiclausum Established In Several Countries And Exerted More Than 70% Parasitism On Diamondback Moth [22].

6. Role Of Parasitoids :

Role Of Natural Enemies For Controlling DBM Should Be Encouraged. *Cotesia. Plutellae* Is The Predominant Larval Parasitoid Of DBM In Almost All The Tracts Of India. It Exhibits Clear Density Dependent Relationship With High Level Of Parasitism Ranging From 46.9% In Bangalore, 77.1% In Gujarat [23] And 83.7% In Tamil Nadu [24]. In India, Field Evaluation Is Done Only To *D.Semiclausum* And *C. Plutellae* Under The AVRDC (Asian Vegetable Research Development Centre) –IIHR Bangalore) – TNAU IPM Programme In Western Ghat Region Of Tamil Nadu. More Strategy Has To Be Developed To Increase The Role Of Other Parasitoids Like *D.Collaris* And Others.

CONCLUSIONS:

Biopesticides Could Play An Important Role In IPM Strategy, Developed To Encounter Pest Threat. Microbial Pesticides, Botanical Pesticides And Introduction Of Natural Enemies Such As *Cotesia Plutellae*, *Daidromus Collaris*, *Diadegma Semiclausum* Could Play A Crucial Role In Successfully Combating *Plutella Xylostella* Threat But In An Eco-Friendly Way. Inter-Cropping, Sex Pheromone Traps Also Have Their Importance In Environment-Friendly Farming. Entomopathogenic Viruses, Especially Nucleopolyhedrovirus (NPV) And Granulovirus (GV), Also Are Known To Be Effective Against Various Insect Pests On Vegetables. It Can Also Be A Good IPM Tool And Need Further Investigation. The Synergistic Rationale For Using Combination Of Various Botanical Pesticides Is Again A Welcoming Strategy To Increase Efficacy Of Biopesticide.

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