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Effective microorganisms (EM) and Jeevamrutha for sustainable production and pest management in horticulture – A review

Laishram Hemanta, M Jangyukala¹, A Sarkar² and Mutum Preema Devi³

¹ & ²Department of Horticulture, School of Agricultural Sciences and Rural Development, Nagaland University, Nagaland – 797106

³Department of Pomology and Post Harvest Technology, UBKV, Pundibari, Cooch Behar, West Bengal -736165

Corresponding author email: hemanta.horti@gmail.com

Modern farming is associated with the heavy use of chemical fertilizers and pesticides resulting in degradation of soil and environmental pollution. Many scientists working in the field of agriculture have expressed their concern that any more efforts to persist with this chemical farming model will only prove counterproductive and cause irreparable damage to soil health and environment. The indiscriminate use of fertilizers and pesticides immensely harm biological activity of the soil in vast areas rendering it almost lifeless. Pesticides which are not easily degradable have entered the food chain and pose a number of health hazards. These pesticides secrete into soils and groundwater ending up in drinking water. For achieving sustainability, the need of the hour is to reduce or replace with some non-chemical alternatives. Many organic inputs are utilized as substrate media in horticulture like cocopeat, vermicompost, FYM, panchgavya, biofertilizers, livestock waste manures etc. Recently, use of effective microorganisms (EM) and jeevamrutha in agriculture as organic inputs has been gaining momentum and many researchers have reported its usage can improve the quality of soil, plant health, growth and yield. EM is a fermented live mixed culture of 83 bacterial and fungal strains of different species naturally isolated from the soil. The use of EM as an addition to manure or as a spray directly in the field increase the micro-fauna biodiversity of the soil, leading to an improvement in field production. Jeevamrutha is a fermented microbial culture of water, desi cow dung, desi cow urine, jaggery, flour of any pulse and handful of soil from farm which promotes biological activity in the soil and makes the nutrient available to the crop. Though the names are different but both EM and Jeevamrutha have similar mode of action and can be used as an alternative for chemical fertilizers and pesticides in horticultural crops.

Keywords: Effective microorganisms (EM), Jeevamrutha, sustainable production, pest management, horticulture

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Role of indigenous plant products in the sustainable management of major insect pests of cabbage under Imphal valley agroecological situations

K.I. Singh, P.S. Devi and S. M. Haldhar

Department of Entomology, College of Agriculture

Central Agricultural University, Lamphalpat, Imphal-795004(Manipur)

Corresponding author email: singhki_ento@yahoo.com

A field experiment was conducted at the College of Agriculture, Iroishemba, Imphal during Rabi, 2020-21 to study the bio-efficacy of certain aqueous indigenous plant extracts against the Diamond back moth(DBM), *Plutella xylostella* Linnaeus, the Cabbage butterfly(CB), *Pieris brassicae* Linnaeus and the Cabbage aphid (CA), *Brevicoryne brassicae* Linnaeus and their toxic effect on the population of predatory coccinellid beetle, *Coccinella septempunctata* Linnaeus in cabbage crop var. 'Pride of India'. There was moderate incidence of *P. xylostella*, *P. brassicae* and *B. brassicae* in the experimental crop var. 'Pride of India'. The insects maintained mean incidence of 14.42 to 22.80 % leaf damage, 9.51 to 16.14% leaf damage and 37.33 to 77.35 aphids/plant, respectively. Thus, these pests were considered as the regular and major pests of cabbage during the investigation. The results on the efficacy of bio-rational insecticides against *P. xylostella*, *P. brassicae* and *B. brassicae* revealed that all the insecticidal treatments resulted in significantly suppression of both the pests' incidence. The pooled results based on three applications of insecticide indicated that Margosom (Azadirachtin 300



ppm) @ 0.3% spray conc. followed by *Melia azedarach*, extract applied at the spray conc. of 5.0% were quite effective in reducing the population of the insect pest of cabbage with a record of lower mean leaf damage of 6.92 and 7.61 per cent, respectively and did not differ significantly between them. Against *P. brassicae* also Margosom (Azadirachtin 300 ppm) @ 0.3% spray conc. registered significantly the lowest mean leaf damage of 7.65 per cent as against 14.73% in untreated check, closely followed by *Melia azedarach* extract @ 5.0% spray conc.(8.10% LD) and *Artemisia nilagirica* extract @ 5.0% spray conc.(8.37 % LD) which had none significant difference one another. The significantly highest mean leaf damage incidence (12.33% LD) was noticed in the plots treated with aqueous extract of *Solanum conyzoides* when applied @ 5.0% spray conc. Of the aqueous indigenous plant extracts field evaluated against the butterfly, *M. azedarach* proved the most effective treatment in suppression the pest incidence with minimum mean leaf damage. The results on the effectiveness of various insecticidal treatments against *B. brassicae*, further showed that Margosom (Azadirachtin 300 ppm) @ 0.3% conc. also maintained its superiority to other treatments in suppression of the aphid population recording the lowest mean population of 9.43 per plant as against 36.46 aphids/plant in untreated control. It was at par with the mean population recorded in the treatments with *Ageratum conyzoides* (11.97 aphids/plant), *Solanum xanthocarpum* (12.01 aphids/plant), *Mariandra bengalensis* (12.46 aphids/plant) and *Artemisia nilagirica* (12.69 aphids/plant). While, *M. azedarach* extract exhibited its inferior performance in controlling aphid with highest mean population of 14.04 per plant. The plots treated with Margosom (Azadirachtin 300 ppm) recorded maximum cabbage yield of 22.38 t ha⁻¹ follower by *M. azedarach* extract treated plots (19.93 t ha⁻¹) with increase yield over control of 6.50 t ha⁻¹ and 40.93 per cent, and 4.05 t ha⁻¹ and 25.50 per cent, respectively but deferred significantly from each other as per the yield harvested from the plots of these insecticides is concerned. The minimum mean yield (18.00 t ha⁻¹) was obtained from the plots treated with *A. nilagirica* with increase yield of 2.12 t ha⁻¹ and 13.35 per cent over control, but, did not differ significantly from that of rest insecticidal treatments except yield of *Plectralthus ternifolius* extract. However, it is amply clear that all the plant extracts were superior in controlling DBM, CB and CA in comparison to untreated control. The extent of avoidable yield loss due to the incidence of *P. xylostella*, *P. brassica* and *B. brassicae* was estimated to be 29.04 per cent in untreated control which was reduced to 10.95- 19.57 per cent. Minimum being recorded in *M. azedarach* and maximum in *Artemisia nilagirica* extract. Further, the pooled mean data of three observation periods' revealed that among the test insecticides *M. azedarach* @ 5% *A. nilagirica*, *Cinnamomum tamala* and *Aralia armata* each applied at the spray concentration of 5.00%, proved to be the safer extracts to the predatory beetle *C.septempunctata* with their corresponding mean beetle population of 1.56, 1.41, 1.32 and 126 per plant as against 3.27 in untreated control which did not show significant difference from one another. The lowest beetle population (0.79/plant) recorded in the plots treated with Margosom (Azadirachtin 300 ppm) @ 0.30% conc. closely followed by *Solanum xanthocarpum* and *Meriandra bengalensis* extracts @ 5.00% conc. with the mean beetle population of 0.89 and 0.92 per plant, respectively.

Keywords: Cabbage, major insect-pests, indigenous plant, insecticides, efficacy

