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BIO CONTROL AND ITS ROLE IN SERICULTURE: A REVIEW PAPER

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ABSTRACT

Mulberry silkworm, Bombyx mori L. the living biological factory of silk, and the backbone of sericulture industry becomes victim of various pests and pathogens. Mulberry is attacked by a number of insect pests, parasites, predators and pathogens around the year which not only affect the leaf quality but also responsible for poor yield. According to an estimate, the pests and disease cause about 25% loss in foliage production of mulberry, besides deteriorating the nutritive value of leaves. Realizing the drawback of chemical measures of pest and pathogen control the usage of bio control agents has received maximum attention for the control of sericulture pests and pathogens. The insect populations are naturally affected by a wide variety of environmental factors, both biotic and abiotic. The action of these factors is often termed natural control. One aspect of natural control is biological control, which involves the use of some beneficial living organisms for control other harmful living organisms. The present review focuses on the role of bio control agents in silkworm and mulberry pest and pathogens.

Keywords*: *Bio-control agents, Silkworm, pests, mulberry, Botanicals.

I. INTRODUCTION

Sericulture is an agro based cottage industry, having tremendous employment potential and providing direct and indirect employment through on - farm as well as off- farm activities. The silkworm (*Bombyx mori* L.*)* being a monophagous insect derives complete nutrient supply including water required for its growth from the mulberry leaves. Mulberry which belongs to genus *Morus* comprising of 68 species (Datta, 2000), is a perennial woody plant which after proper establishment can come to full yielding capability during the second year and last for over 17 years without any significant deterioration in leaf yield (Kumaresan et al.,1994).

II. WHAT IS BIO-CONTROL

Bio-control is the action of the parasitoids, predators and pathogens against target Pathogens and pests to keep their populations below the level of economic damage by keeping environment harmonized. Bio control is an environmentally sound and effective means of reducing or mitigating pests and pest effects through the use of natural enemies. Bio-control is economic method. The term biological control was first used in the index of

economic entomology in 1930. The bio-control can be applied for the pests of agriculture, forest, medical, household etc.

III. NEED OF BIO-CONTROL

Chemical control pose serious unwanted problems like air, soil and water pollution , health hazards, killing of beneficial insects, secondary pest out- break , pest resurgence , pest – resistance etc. Therefore, biological control serves as a potential weapon in avoiding these problems. Manipulation of native natural enemies which bring about the reduction in pest population is a desirable method of controlling insect pest in sericulture (Thangavelu and Singh 1991; Singh et al., 1992). As compared to chemical control we are spreading very less amount on biological control in India. DeBach (1964) reported that during (1923-1953), California industry saved 115 million dollars by spending only 4-5 million dollars on biological control.

IV. BIO-CONTROL IN SERICULTURE

The bio control of the pest in sericulture is much more effective, selective and safe for humanity (Singh et al., 1992; 1993 and 1994). Mulberry is the only food plant for the silkworm, *Bombyx mori* L. which is an economically important insect for sericulture industry. Mulberry is reported to be attacked by more than 200 species of insects belonging to various orders. According to an estimate, the pests and diseases cause about 25% loss in foliage production of mulberry (Gupta et al. 2000). Pest management with special reference to biological consideration is one of the best solutions for pest management in sericulture. For this we have to think over the regulation of biotic agents in the field, because biotic agents possess tremendous potential for keeping the population of harmful insects below the damaging level. The micro–organisms that adversely affect the target pathogens growing in association with them are termed as *antagonists*. The mechanism of actions of an antagonist is called *antagonism*. In biological control of plant diseases, the antagonists are called *biological control or bio-control agents,* which have the potential to interfere in the life processes of plant pathogens. The efficacy of bio control agent is dependent on ecological factors. In Mulberry, the first evidence of bio-control of diseases has been reported long back in 1935 when Adam and Pugsley observed a yellow bacterium, isolated from mulberry leaves itself, inhibited the infection of bacterial leaf blight in mulberry caused *by Pseudomonas mori.* Various bio-control agents used against different pathogens and pests of sericulture include use of Ladybird beetles against mealy bugs[1]. Although several species of lady bird beetles occur in mulberry gardens. *Cryptolaemus montrouzieri* and *Scymnus coccivora* are found to be effective against pink mealy bugs. It is recommended to release 250 *Cryptolaemus montrouzieri* or 500 *Scymnus coccivora* beetles/acre/year in 2 split doses at an interval of 6 months. There are about 150 species of *Trichogramma* worldwide that differ greatly in host preference, searching behavior and tolerance to environmental conditions. Release *Trichogramma chilonis* egg parasitoids @ 4 tricho-cards/acre/crops (from July to February). Tear each card into small pieces and staple on the underside of mulberry leaves at random, covering the entire garden. Release of *Trichogramma chilonis* @1 lakh adults/acre in 4 split doses and *Tetrastichus howardii* @1 lakh adults /acre against leaf roller of mulberry. Release of *Trichogramma chilonis* @ 1lakh adults/acre against Bihar hairy caterpillar and

bell moth of mulberry. Use of antagonistic micro organisms like *Trichoderma harzianum +Trichoderma viride* in combination with effective micro organisms for their bio control potential against *Fusarium spp*. of mulberry causing root rot disease. (N.Dhahira Beevi and S.M.H. Qadri 2010)[2]. The antifungal activity of the extract of root epidermis of mulberry (*Morus alba* L.) in–vitro against *Rosellinia necatrix* (mulberry root rot) and many other phytogenic fungi have been reported by Shirata and Takshashi. *Tetrastichus howardi and Trichogramma chilonis* are used against leaf webber. Release of pupal parasitoid ,*Tetrastichus howardi @* 20,000/ac. Release of egg parasitoid, *Trichogramma chilonis @* 2 cc/ac. For the biological control of nursery diseases of mulberry, various species and isolates of *Trichoderma, Gliocladium* and other microbes have been evaluated for their antagonistic activities against the causal pathogens *(Botryodiplodia theobromae, Phoma spp. and Fusarium solani). Verticillium chlamydosporium* has also shown its potential against *Meloidogyne arenaria* causing disease in mulberry[3].*Trichoderma harzianum, T. viride, Pseudomonas maltophila, Clasdosporium cladosporioides, Curvularia lunata, Corynebacterium sp., Staphylococcus sp.* and *Streptomyces sp.* have been evaluated for their antagonistic potential against *C. moricola* pathogen of leaf spot disease of mulberry. (Siddaramaiah et al., 1978)[4]. Yellow ladybird beetles, *Illeis cincta Fab.* and *I .indica Timb.* have been reported as biological control agents of powdery mildew fungus of mulberry[5]. The fresh extracts of *Azadirachta indica* was found most effective in controlling powdery mildew of mulberry followed by C*hromolaena odorata* and *Allium sativum* (Gangerwal et al., 2000). *Trichoderma harzianum, T.viride and Gliocladium virens* are reported to be antagonistic to *A. alternata* and *F. pallidoroseum* causing fungal leaf blight in mulberry[6]. Ladybird beetles, *Menochilus sexmaculatus and Scymnus coccivora, Anthocorid orius sp.* and Neuropterans were observed to feed on thrips (major pest of mulberry) in the field and laboratory. *Reduvid* and *pentatomid* predators are observed to feed on both nymphs and adults of jassid (minor pest of mulberry). *Menochilus sexmaculatus* @200 adults/acre, *Cryptolaemus montrouzieri* @300 adults/acre and *Scymus coccivora* @500 adults/acre are released against spiraling whitefly pest of mulberry. Use of predators such as the *green lacewing* and *parasitic encirtid wasps* against scale insect (minor pest of mulberry). Predation by *Eocanthecona furcellata* was observed in the field against cutworm pest of mulberry.

Nesolynx thymus against uzifly is a hymenopteran gregarious ecto – pupal parasitoid. 2 pouches/ 100dfls on 3rd or 4th day of 5th instars in rearing house. (From each pouch about 10,000 to 12,000 parasitoids emerge). *Trichoporia* has also been reported as a potential parasitoid of uzi fly[7]. Mated female oviposits on the uzifly puparia and oviposits for 2-3 days continuously. The parasitoids prefer to parasitize 1-4 days puparia, though it has been reported to develop successfully on the uzi fly puparia which were up to 8 days old. Thangavelu and Singh (1992) reported that *Psix striaticeps , P. lucanatus and Trissoculs sp.* are important egg parasitoids of stink bug, *Canthecona furcellata* an important predator early stage of larvae of Tasar silkworm, causing heavy loss to Indian silk industry. *P. striaticeps* has a density dependent relationship with its host. It has been found capable of attacking 80% of the stink bug eggs within 10 minutes of exposure period, indicating its high searching capacity i.e., the ability to find the hosts when the higher reproductive potential (Singh et al., 1994; 1995; and 1996). *Trichomalopsis apanteloctena*, is a gregarious ecto –pupal parasitoid of uzifly, *B. zebina*. In order to find out the possibility of using this parasitoid in

the biological control of *B. zebina* , the biological characteristics, age specific survival, age specific fecundity, intrinsic rate of population increase and sex ratio under laboratory conditions were reported by Singh and Thangavelu 1995 and 1997. The number of female progeny produced by *T. apanteloctena* was 41.76 and the sex ratio was 1:4.5 in favour of females on the pupae of *B. zebina* and did not vary significantly with maternal age (Singh and Thangavelu, 1999). Each female usually parasitized about 4 hosts (range 1-6) daily until one or two days before death and laid 8-14 eggs on each host (Singh and Thangavelu 1992). Besides this, *Pediobius sp*. an eulophid wasp was found to kill the pupae of *B. zebina* (Singh et al., 1994; Singh and Sinha, 1995). Laboratory studies indicate that all these parasitoids of uzi fly, have tremendous reproductive potential, high searching ability and female based sex ratio. Singh and Thangavelu, (1992, 1994 and 1998) reported that *T. apanteloctena*, *Pediobius and N. thymus are* the potential parasitoids in tasar sericulture, parasitizing 45.32% of uzi fly pupae. Recently, some important parasitoids of gall insect (*Trioza fletcheri minor*) have been screened . They are identified as *Trechnites secundsus* (Encystidae) *and Aprostocetus niger* (Eulophidae) (Singh et al., 1995). The females of *T.secundus and A. niger* developed successfully on the galls of *Terminalia arjuna and Terminalia tomentosa.* It prefers to parasitize 6 days old gall and yielded 80-90 percent adult parasitoids within an average of 10-12 days. For management of diseases in silkworm a good amount of well documented work has been done in the country and abroad with the use of synthetic fungicides and disinfectants. Exploitation of naturally occurring plant materials and avoidance of synthetic chemicals has achieved paramount importance in present day strategy of pest and disease management system in order to avoid environmental pollution and its hazardous effects on humans, animals and plants. In J&K state, white muscardine disease inflicts heavy damage to silkworm population/silk industry year after year and sometimes up to 80-90 per cent cocoon crop loss are registered in severely affected areas. An annual crop loss up to 23.5 per cent has been estimated due to this disease (Anonymous, 2000). Munshi et al., (2002) reported that *Trichoderma viride* and *Chaetomium uridicum* possesses antagonistic potentialities against the pathogen of white muscardine and could be used as bio- control agent for the management of the disease[8]. *Trichoderma viride*, *Trichoderma harzianum* and *Trichoderma spp.* were used against *Beauveria bassiana* and *Metarhizium anisopliae* pathogens of white muscardine and green muscardine disease respectively in silkworm (Banerjee,S. Pal et al., 2016)[9]. Use of fresh plant extract has been top priority during last three decades for the plant disease control. Extract of garlic was found to inhibit growth of *Beauveria bassiana* (Krishna Prasad et al., 1979)[10]. The extracts of garlic, onion, mulberry root, neem was also found effective against *Aspergilosis* of silkworm (Sanyal, 1924: dey, 1980; kaushik and dhiman , 2000). Various botanicals like pudina, tethwan. Costus, walnut, and pambachalan were also found to be effective against *Beauveria bassiana*. Extracts of garlic and datura each at 30 and 50 per cent concentrations and formalin chaff at 0.8 per cent have been found effective against muscardine disease without deleterious effect on commercial characters (Raghavaiah and Jayaramaiah, 1990). Plant products viz., heena leaf, garlic bulb, tomato leaf, mango bark, cotton leaf, turmeric powder, onion, tulsi leaf, neem leaf and ginger at 1.0 , 2.0, 3.0 per cent concentrations were screened against Aspergillus flavus and A. tamari both in –vitro as well as in –vivo for the control of fungal disease (Aspergillosis) in silkworm. Among these heena leaf, garlic and mango bark

inhibited the growth of both Aspergillus spp. at all concentrations tested in culture medium and were also found to be effective in controlling the infection of the disease in silkworms after dusting with these plant products (singh et al., 2002). In addition of mucardine , the leaf extract of psoralea coryleifoia has been found effective against BmNPV infection in silkworm (Sivapraksam and robindra , 1996). Efficacy of *Ocimum sativum* (tulsi) leaf powder , *Azadirachta indica* (neem leaf powder) and *Vitex negundo* (vavila leaf) was studied by kuntamalla and Rao (2004) and have reported that application of neem and tulsi powder at low concentrations reduced the incidence of bacterial flacherie in silkworm and enhanced the economic characters.

V. CONCLUSION

Since bio control agents are ecofriendly, economical, feasible and long–term effective, they hold greater promise for the safer and effective management of diseases and pests in sericulture. Though use of Bio control agents for disease and pest management can not completely help us in replacement of chemical pesticides but can help us to curtail non judicious use of these chemicals.

REFERENCES

[1] Rajadurai ,S. And Thiagarajan , V. (2003). Mulberry sap sucking pests. *Indian silk*,42 (4):5-8.

[2] N.Dhahira Beevi And S.M.H.Qadri .(2010) Biological control of Mulberry root rot diseases (*Fusarium spp.*) with antagonistic micro organisms*; journal of biopesticides* 3(1 special issue) 090-092.

[3] DE LEIJ , F.A.A.M.And KERRY ,B.R. (1991). The Nematophagous fungus *Verticillium chlamydosporium* as a potential biological control agent against *Meloidogyne arenaria*. *Revue de Nematologie*, 14:157-164.

[4] Shivapratp ,H.R; Philip , T. And Sharma, D.D. (1996) . In vitro antagonism of *Trichoderma species* against Mulberry leaf spot pathogen, *Cercospora moricola. Indian j. seric., 35* : 107-110.

[5] Bhattacharjee,S.S; Chakraborty,N.;Kumar, C.A.Sahakundu,A.K.(1994). Control of white powdery mildew, *phyllactinia corylea* (pers) KARST .with the ladybird beetle, *ILLeis indica Timb.* (coccinellidae :coleoptera*). Sericologia*,34 : 485-491.

[6] Latha, J.; Govindaiah And Datta , R.K. (1993) . In vitro toxic effect of culture filtrate of *Trichoderma species* against *Fusarium pallidoroseum* causing leaf blight in Mulberry. *Indian j.seric* ,32 : 121-123.

[7] Ram Kishore And Kumar , P.(1990) Parasitoid of uzi fly *Exorista sorbillans* wiedmann (Diptera: Tachinidae) XII .Biology of *Trichopria sp*. (Hymenptera : Diapriidae).

[8] Nordlund , D.A. (1984) .Biological control with entomophagous insects. *Journal Georgea Entomological society* (2^{nd} supp.) :14-27.

[9] Banerjee, S.,Pal,S.,Mukherjee,S.,Podder, D.,Mukherjee, A.,Nandi,A.,Debnath, P.,Sur,P.K.And Ghosh, S.K.(2016) Cellular abnormalities induced by *Trichoderma spp.* during in vitro interaction and control of white muscardine (*Beauveria bassiana*) and green muscardine (*Metarhizium anisopliae*) diseases of silkworm Bombyx mori *;JBiopest* 9(2):104-112 .

[10] Krishna Prasad, K.S., Siddaramaiah , A.H and Ligaraju , S.(1979).Possible control of muscardine disease of silkworm by using few plant extracts. *Current research* 8(5) : 79-80