INTRODUCTION
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The domesticated silkworm, *Bombyx mori* (L.) has been the target of intensive scientific studies on various aspects because of their moderate body size and convenient to deal with. The silkworm, *Bombyx mori* (L.) (Bombycidae: Lepidoptera) is a holometabolous insect. In about 50 days it completes its life cycle of four different metamorphosing phases: egg, larva, pupa and adult. The food selection of this insect is narrow, almost limited to mulberry leaves.

The mulberry leaves which form the main food of the larvae of silkworm are often infested by various insect pests affecting the quality and quantity of mulberry leaf yield which in turn affects the economy of sericulture industry (Kushikannan, 1920; Tsujita, 1951; Hara, 1956; Kawan, 1963; Kawan et al., 1967; Kawan, 1968; Rangaswamy et al., 1972; Kuribayashi, 1967; Nakamuta and Sato, 1977; Kariappa et al., 1978; Castagnoli, 1980; Hondo, 1981; Mathur, 1981; Lugaresi, 1982; Ikeda et al., 1981; Mouloudis et al., 1982; Emori and Sugiyama, 1982).
Bulger (1932), Tsujita (1951), Sato (1957), Kuwana (1962), Sugiyama and Emori (1980a, b) and Troitskaya et al., (1983) reported that eradication of mulberry pests by pesticides like DDVP, Sumithion, Metasystox, Dimecron, Ferodon, Aldrex, Parathion, DDT, BHC, Pyrethrum incidently affected the non-target organisms like silkworms on which they feed. This lead the above workers to investigate on the effect of pesticides on silkworm larvae.

Kuwana et al (1967, 1968a), Kashi (1971) and Watanabe (1978) observed that the silkworm larvae were highly sensitive to pesticides when compared to insect pests. Silkworm larvae when treated with toxic chemicals, Watanabe (1978) noticed that they started showing slight excitement, swinging of the anterior half of the body, usually followed by vomiting of the digestive juice, lying on the side, shortening of the body due to the loss of the digestive juice, muscle contraction, paralysis and eventually death.

According to Hoskins et al (1956) and Kuwana et al (1967, 1968a) silkworm larvae showed much higher regression coefficient than the housefly, Musca domestica, German cockroach, Blatella germanica and mosquito, Aedes taeniorhynchus in the toxicity test studies. The above
investigations indicate that the silkworm population is highly homogeneous as regards sensitivity to toxicants. The factors which affect the susceptibility of the silkworm larvae to toxicants are age, sex and temperature (Watanabe, 1978). The sensitivity of silkworm larvae to insecticides has been exploited in toxicity studies as they are in many ways an ideal bioassay materials (Kashi, 1971; Tesima, 1978).

Watanabe (1978) found that 80% of the pesticide applied topically to the 5th instar larvae passed through the integument into the body cavity within 48 hrs after treatment. He also observed that the organophosphorus insecticides affected the integument, silk gland, ganglia and midgut. The metabolic fate of DDT has been studied in the silkworm by Watanabe (1978) in which the absorption, distribution, metabolism and excretion of $^{14}$C-ring-labelled $p$, $p'$ - DDT were demonstrated.

The effect of carbaryl (1-naphthyl-$N$-methylcarbamate:Sevin), has been widely studied on silkworm larvae by Sugiyama et al (1971, 1972) and Treitskaya et al (1983) who reported that it was highly toxic to the larvae causing 100% mortality. Investigations on the metabolic fate of $^{14}$C-carbaryl
in silkworm was also done by the former authors (1971, 1972). It was found that $^{14}_C$-carbaryl administered orally to larvae was quickly distributed in all tissues and was largely converted into different types of metabolites which are less toxic than carbaryl. The authors suggested that the recovery from toxic symptoms found in the silkworm larvae might be due to rapid transformation of carbaryl within the body to less toxic metabolites.

The inhibitory effect of the IGR-512 was investigated by Rawash et al. (1977) on the silkworm larvae; it was reported that there was an inverse correlation between IGR dosage and both larval blood protein and blood lipid concentration. The feeding activity of the silkworm was also seriously inhibited when mulberry leaves were dipped in 100 ppm chloridimeform hydrochloride solution (Nakamuta and Sato, 1977).

Watanabe and Takano (1966), Kuvana et al. (1966a), Gamo and Hirobe (1977), Kuribayashi (1980) and Yamanoi (1980) recorded the effect of pesticides on silkworm reproduction. According to Kuribayashi (1981a,b) the administration of sublethal pesticide doses of parathion, fenitrothion, malathion, disulfoton, carbaryl, DDT, BMC, Chloridimeform and organo-phosphorus fungicides to silkworm larvae resulted in marked
reproductive abnormalities like decrease in the total number of eggs laid, an increase in the number of non-fertilized eggs, the death of embryos in the early developmental stage, the inability of embryos, developed to the stage just before hatching, to hatch; and the death of newly hatched individuals.

Kuribayashi (1981a) also reported that the organophosphorus insecticides entered the female body during the larval stage, became residual due to the absence of neutralization or excretion, was transferred to the egg during egg formation, and subsequently inhibited the embryonic cholinesterase activity, resulting in death just prior to hatching or death just after hatching.

Recently a new class of compounds (1-(2,6-disubstituted benzoyl)-3-phenylureas, which specifically inhibit chitin biosynthesis has been reported (Daalen et al 1972; Mulder and Gijswijt, 1973; Post and Vincent, 1973; Wellinga et al 1973). Since then the effect of diflubensuron (N-[(4-Chlorophenyl)amine] Carbonyl] 2,6-difluorobensamide) on blocking the formation or deposition of chitin in insect cuticle has been studied by many workers (see Mussarelli, 1976; see Anderson, 1979; Retnakaran, 1979;

Anderson (1979) in his review reported that the toxic symptoms of this insecticide when given to larvae or nymphs, they usually survive until the next adult and then die during ecdysis due to lack of mechanical strength in new cuticle. The incorporation of labelled glucose or glucosamine into chitin is blocked by diflubensuron (see Mussarelli, 1976; see Anderson, 1979; Mitsui, et al. 1980). Baumler and Salama (1976) recorded an increase in the glucose level in the haemolymph of the larva of Dimilin-treated Porthetria dispar (Dimilin a registered commercial trade mark, containing variable amounts of diflubensuron), concluding that chitin synthesis from sugars is greatly reduced. Deul et al. (1978) observed that no accumulation of N-acetylg glucosamine occurs in the cuticle of Pieris brassicae treated with Dimilin and suggested that it probably blocked the polymerization reaction completely. On the contrary Post et al. (1974) reported
an increase in N-acetylglucosamine level in the cuticle of *Pieris brassicae* treated with DU-1911 and inferred that polycondensing enzyme is not completely blocked.

Histological examination of the cuticle of the Dimilin-treated larvae of many insects revealed that the endocuticular deposition of chitin is disturbed upon ingestion of Dimilin; the newly formed cuticle consists only of epicuticular and exocuticular layers; the endocuticle that formed after treatment was not properly attached to the epidermis and showed globules of apparently coagulated material (Mulder and Gijswijt, 1973; Post and Vincent, 1973; Hunter and Vincent, 1974; Post *et al* 1974; Selama *et al* 1974; Keer, 1977; Peul *et al* 1978; Greenstreet, 1978; Eck, 1979; Gijswijt *et al* 1979; Bena *et al* 1980; Rabinbryndra and Balasubramanian, 1981; Lim and Lee, 1982).

Lipids form a major component of the epicuticle and exocuticle in insects (see Anderson, 1979). Selama *et al* (1976) and Saxena and Kumar (1981) reported that the lipid content is reciprocally correlated with the chitin content and is increased significantly in the cuticle of Dimilin treated insects. Hunter and Vincent (1974), Selama *et al* (1976), Keer (1978) and Saxena and Kumar (1981) observed
that the protein level in the cuticle of treated insects is insignificantly reduced. On the other hand Ishaaya and Casida (1974) reported that the amount of cuticle protein is unaffected which alters the protein : chitin ratio which in its turn probably affects the elasticity and firmness of the endocuticle. This was supported by Mitlin (1980) who reported that in Anthogramous grandis the biosynthesis of DNA was inhibited in the female when treated with Dimilin but neither RNA nor protein synthesis was affected.

Treatment with diflubensuron increases the amount of extractable chitinase activity significantly in fly larvae (Ishaaya and Casida, 1974). It is also observed from the above study that phenoloxidase activity also increased significantly in treated larval cuticle. Paul et al (1978) did not find any effect upon chitinase activity either in vivo or in vitro. They also recorded significant increase in the phenoloxidase activity in the cuticle of the treated larvae of Pieris brassicae.

The effect of Dimilin on reproduction, egg-laying capacity and the viability of eggs in insects has also been reported by many workers (Wright, 1974; Lacey

The foregoing review of literature would indicate that there is no study on the effect of Dimilin on the cuticle of larvae of Bombyx mori (L.) which is a non-target organism despite its great economic importance. Hence it is thought worthwhile to study the effective concentration of Dimilin for the larvae of successive instars of the silkworm in the laboratory, its effect on the structure and chemistry of the larval cuticle, and to assess the reasons for their failure to moult during ecdysis.