I- INTRODUCTION

Chemical insecticides have been the backbone of insect pest control since the early 1950s (Dent, 1991) and assumed greater importance in recent years. Among the various methods of insect control, none brings about such prompt and conspicuous relief as that of chemical control. Most studies pertaining to effects of insecticides were concerned with their acute toxicity to insects (Hamilton and Schal, 1990) and emphasis had been on mortality produced rather than on many other effects the chemical may cause (Soderstrom and Lovitt, 1970). Tremendous changes are brought about in the biology of insects exposed to insecticides (Katiyar and Lemonde, 1972). The exposure of insects to insecticides has been shown to cause reduced longevity, fecundity and fertility of survived females as well as immediate mortality. For instance, Hunter et al. (1958, '59) found 32-34% biotic reduction in the longevity, fecundity, fertility and survival of progeny in resistant strain of house flies, *Musca domestica* L., treated with DDT or diazinon. Adkisson and Wellso (1962) reported that adult pink bollworm *Pectinophora gossypiella* lived fewer days and produced fewer eggs, surviving low doses of DDT than untreated control. Ridgway et al. (1965) reported that feeding of small doses of American Cyanimid CL-47031 to boll weevils, *Anthonomus grandis* greatly reduced oviposition.

Until recently, the effects of sublethal doses of insecticides on insects have received comparatively little attention (Hamilton and Schal, 1990). A fair amount of direct but frequently contradictory experimental evidences has been presented showing the effect of sublethal dosages of various insecticides on the biology of insects. Many reports suggest that sublethal doses of insecticides reduce longevity, fecundity and fertility (Moriarty, 1969; Haynes, 1988; Khowaja et al., 1994). Other reports (Georghiou, 1965; Yokoyama and Pritchard, 1984) indicate that sublethal doses had no effect on longevity and egg fertility. Still other investigators found that insects treated with sublethal doses produced more eggs and lived longer than untreated females (Kuenen, 1958; Ball and Su, 1979; Abd-Elghafar and Appel, 1992; Khowaja et al., 1993).
The effects of an insecticide on insects surviving sublethal doses differ from one chemical to another as well as from one species to another (Abo-Elghar et al., 1972). This effect might be extended to the reproductive and survival potential of the filial generations. Numerous workers have evaluated many chemicals as potential insect reproductive inhibitors (Murray and Bickley, 1964). For instance Speyer (1924), Kalandaze (1927) and Friederich and Steiner (1930) found that the lepidopterous larvae poisoned with arsenicals developed into partial or complete sterile adults. Kissan and Hays (1966) also found triphenyltin acetate and triphenyltin chloride as potential reproductive inhibitors. Similarly, Ansari and Khan (1977) observed a very significant reduction both in fecundity and fertility of the adults Dysdercus cingulatus following the application of 35 mg/sq. inch triphenyltin acetate. Styezynska et al. (1969) noted that organophosphate insecticides trichlorfon and ronnel, reduced the fertility of housefly eggs. Exposure to carbamate or organophosphate insecticides caused gravid female German cockroaches to drop their oothecae prematurely, resulting in decrease hatch (Hamon and Ross 1987, '88). These observations by different authors on biological effects of insecticides belonging to different chemical groups offered a stimulus to further probe the biological effects of some new (modern) organophosphate and carbamate insecticides on hemipterous (Hemimetabola) and lepidopterous (Holometabola) insects which are also different in food habits.

Therefore, in the present investigation, the effects of sublethal concentrations of acephate, ethion, dichlorvos (organophosphates) and furadan, carbaryl, aminocarb (carbamates) were studied with particular reference to their effects on mortality, moulting, longevity, fecundity and fertility of Dysdercus cingulatus F. (Hemiptera: Pyrrhocoridae) and Diacrisia obliqua (Lepidoptera: Arctiidae). The red cotton bug, D. cingulatus is an important pest of cotton in Uttar Pradesh, Bihar, Madhya Pradesh, Bombay, Madras and Punjab (Sohi, 1964), it also feeds on vegetables, sorghum, ragi, oil seeds, small millets, sugar cane, peddy, guinea grass, jute, sunn hemp, beet root, potato and sweet potato (Mathur, 1962), other malvaceous plants, wheat, maize, bajra and certain other agricultural and fibre crops and medicinal plants of economic value. Both the nymphs and adults feed gregariously on leaves and bolls of cotton plants. The yellow excreta of the bug stain the lint and spoil its quality. The Bihar hairy or
jute hairy caterpillar, *Diacrisia obliqua* Walker (Lepidoptera:Arctiidae) which is presently known as *Spilosoma obliqua* is a versatile, widely distributed polyphagous pest reported practically from all over India specially from Bihar, Madhya Pradesh, Uttar Pradesh and Punjab causing damage to a large number of cultivated (such as sesame, mash, mung, linseed, mustard, some vegetables etc.) as well as non-cultivated plant species (Fletcher, 1922; Sevastopulo, 1940; Mathur 1962; Dutt, 1964; Pandey *et al.*, 1968; Kabir and Khan, 1969; Gargav and Katiyar, 1971; Viswanath and Gowda, 1975; Deshmukh *et al.*, 1976; Bhattacharya and Rathor, 1977). The host range of this insect pest is still increasing. Beside India, this pest has been reported from Myanmar, Bangladesh, Pakistan and Sri Lanka. It is a sporadic but serious pest which causes almost complete devastation of entire fields whenever it appears in an epidemic form. Several outbreaks of this insect have been reported during recent past (Anonymous, 1969; Prasad and Chand, 1980a). Nowadays this has assumed the status of major pest in the priority list of pests which need attention to develop a safer management programme (Singh and Bhattacharya, 1994).

Further to correlate the sterility and infecundity by the present chemicals (organophosphates and carbamates), anatomical and histological observations were also made on gonads of the treated (affected) and untreated (control) adults.

It is further expected that the application of sublethal concentrations of the present insecticides on one hand may throw light on their comparative effectiveness in causing mortality, moulting disorder, reproductive inhibition and pathological effects on gonads and on the other hand the prospects of pollution by these selected insecticides as well as toxic hazards to non-target organisms may be reduced, yet the net results will be in the favour of agricultural economy.