CHAPTER 1

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From the prehistoric days insect pests have been man's most serious enemy. Many of the species of insects affect the health of man, damage agriculture, horticulture and forest products. As such insect control is imperative. Insect control in its broadest sense implies everything that makes life hard for insects, tends to kill them and prevent their increase or spread. Several methods employed for insect control include the use of chemicals, biological control, culture practices, mechanical devices, draining and filling (Davidson, 1966; Nath and Sharma, 1977) and the legislative methods (Davidson, 1966). The chemicals for insect control are classified in various ways. A common method is to group them according to their type of action e.g. stomach poison, and contact poisons (insecticides), fumigants, attractants, repellants and chemosterilants (Davidson, 1966).
Use of aziridine compounds to combat insect pests is the recent trend in insect control. Such compounds may be alkylating agents such as Apholate, Tepa, Metepa, Thiopepa etc. or non-alkylating agents such as Hempa and Hemel (Borkovec, 1966; Davidson, 1974). The fact that chemicals could produce genetic changes in the same way as radiation was not discovered until the early years of the Second World War when Auerbach and Robson (1947 a,b) found that mustard gas could produce mutation in *Drosophila* as well as affect fertility. Independently, Rapport (1947) discovered that ethyleneimine was also mutagenic, and its from analogues of this compound aziridine that most of the modern insect chemosterilants are derived. Since 1960 interest in the potential of chemosterilant as practical insect control agents increased rapidly and within a few years numerous chemosterilants were identified. Foremost among them are aziridine and their derivatives (LaBrecque, 1961; Knipling, 1962; Chamberlain, 1962; Crystal, 1963; Borkovec, 1966). They have been suggested as an alternative method of sterilization where X-ray irradiation has been proved to damaging the species (Klassen et al., 1968). A large number of such chemicals affecting fertility now exist and act in different ways (Borkovec, 1968). However, according to Lachance (1967) all chemicals that induce dominant lethal mutations are chemosterilants but not all chemosterilants can produce dominant lethal mutations or any kind of mutation.

Any chemical compound affecting fertility may be called a chemosterilant. Campion (1972) and Davidson (1974) divided
the chemosterilants as antimetabolities, alkylating agents, organometals and JH analogues. According to Davidson (1974) most of the dominant lethal producing chemicals are alkylating agents i.e. substances producing carbonium (−CH₂) ions which in living tissues combine with some of the nucleic acids and proteins of the cell. This upsets the genetic code and leads to point mutation and chromosome breakage (Fahmy and Fahmy, 1964). The alkylating agents known so far are tepa (tri-(1-aziridinyl) phosphineoxide), mete-a (Tris (2-methyl-(1-aziridinyl) phosphineoxide), Apholata (2,2,4,4,6,6 hexakis (1-aziridinyl) −2,2,4,4,6,6 hexahydro, 1,3,5,2,4,6 tri-azatriphosphorine), tretamine, melamine etc. and non alkylating agents are hempa (hexamethyl phosphoramido) and hemel.

Most widely used method of insect control is through insecticides. Insecticides can be divided into the following groups according to the nature of their penetration into the insect organism such as stomach poisons, contact poisons, systemic poisons and fumigants etc.

As the term suggests, it applies to all poisons which act through the stomach. When chemical are ingested by the pests, chemical reactions in the digestive tract may set free secondary compounds which are more poisonous and distribute them throughout the body. Some of the important stomach poisons are BHC, DDT, Lead arsenate, Calcium arsenate, Methoxychlor, Paris green, Sodium fluoride, Cryolite, Fluosilicate, certain Phosphate, etc. Some important contact poisons are BHC, DDT, Nicotine
preparations, Lime sulphur, Chlordane, Dieldrin, Methoxychlor, Pyrethrum, Oil emulsions, Rotenone, Thiocyanate, TEPP, Aldrin, Melathion, and Toxophene etc. which act by direct penetration through body wall.

Certain insecticides are transmitted to the insects into the gaseous state. Some fumigants are liquid nicotine, naphthalene, hydrocyanic acid, carbondisulphide etc. (Sree Ramulu, 1985).

However, use of insecticides has some drawbacks like the potential health hazards of insecticidal residue, the possible hazard to fish, wild life, live-stock and the development of insect resistance or tolerance to the insecticides. According to Brown (1971) and Brown and Pal (1971) about 130 species of arthropods of agricultural and veterinary importance have shown resistance to insecticides and 102 species of medical importance, most of which are insects. Davies et al. (1958) and Georghiou (1971) also are of the same view. According to Davidson (1974), insecticides are still important for control of insects, but of more concern is their cost and the organization required for their efficient application. According to Davidson (1974) problems created by the use of insecticides have induced the idea of genetically manipulated insects to control insect population i.e. genetic control of insect.

Thus, an obvious alternative of controlling population by increasing the death rate usually attain by insecticides, is the decreasing the birth rate which can be achieved by hampering
the reproductive potential of an insect. Exposure to ionizing radiation or to certain chemicals are ways of deliberately sterilizing insects and this is known as genetic or autocidal control (Davidson, 1974; Pal and Whitten, 1974). The advantage of the control of insects through sterilization over the control through killing of insects is explained by Knipling (1955, 1960, 1962) who made the first study of the characteristics of population decline after the release of irradiated males. Knipling (1960) hypothesized that male sterility had greater impact in reducing insect population than mortality i.e. the dynamics of a sterile male than by a killed counterpart. This hypothesis led to the sterile male technique of insect control (Knipling, 1967). The potential role of sterility in insect control has been discussed thoroughly by Borkovec (1966, 1975) and Campion (1972).

Chemosterilants offer a number of advantages over irradiation sterilization. They are relatively cheap and do not require expensive apparatus for their application. They can be applied in different ways viz. orally, topically, by injection, by spraying, dipping or fumigation or by exposure of the insect to treated surfaces. One enormous potential advantage of chemosterilants is the possibility of their use in the field to sterilize wild populations (Davidson, 1974). The great disadvantage of alkylating agents is that their sterilizing and mutagenic effects extend to higher animals, including the man and that some of them at least are carcinogenic and even phytotoxic.
(Campion, 1972). Attempts to find safer chemosterilants have resulted in the discovery of non alkylating analogues of tepa and tretamine, viz. hempa (hexamethyl phosphoramide or tris (dimethylamino) phosphineoxide) and hemel (hexa-methyl-melamine).

In the present study, effects of chemosterilants apholate an alkylating and hempa the non alkylating chemosterilant has been seen on the cuticle, haemocyte and Alimentary canal of *Poseiloceras pictus* Fabr. a secondary pest of Maize, Pappya, Brinzel and Tomato. The study will help us to understand that what are the other side effects of chemosterilants on the other tissues of insects when such chemosterilants are used for the control of insect pest and other pest animals. With a view to understand that what actually happens to cuticle, haemocyte and alimentary canal of insects when they are treated with chemosterilants, a histopathological observations on cuticle and different parts of alimentary canal viz. pharynx, oesophagus, gizzard, gastric caeca, stomach (fore part), stomach (mid part), stomach (hind part) and rectum was done. Effect on haemocytes was studied by means of differential haemocytes counting and total haemocytes counting etc.