INTRODUCTION
1. INTRODUCTION

Many insect species are in direct competition with human beings. Due to vastness of their numbers and their devastating efficiency they pose a great threat to increased agricultural production and well being of mankind. They not only compete for food but also cause nuisance and transmit many serious diseases like Malaria, Filariasis, Encephalitis, Onchocerciasis, Leishmaniasis and Trypanosomiasis. These afflictions persist in millions of people and many more millions continue to be at the risk of acquiring infection. Without continued vigilance against insect pests, man faces world famine and disease. Even with our present efforts in crop protection and disease control more than half of our fellow men are hungry and sick most of the time (Ware, 1978).

The need to reduce and if possible to eliminate altogether the ravages of these insect pests and vectors has attracted the attention of scientists, technologists, national governments and International agencies for many decades. Early efforts to control arthropod pests and disease vectors relied primarily on the application of insecticides. Thus, evolution of insecticides essentially began with readily available botanicals such as nicotine, pyrethrum, rotenone, derris, etc. The process continued with materials like arsenicals and petroleum oils since 9th century onwards, rapidly followed by the era of fumigants, inorganics and petroleum products collectively
classified as first generation pesticides. The first synthetic organic insecticides that appeared for public use were dinitro compounds and thiocyanates. Perhaps the most significant discovery leading to the proliferation of new synthetic insecticides was that of DDT synthesized by Zeidler in 1874 and insecticidal properties first discovered by Muller in 1939. After second world war the immediate and exciting success of synthetic insecticides in controlling malaria and other insect borne diseases resulted in synthesis of steady stream of second generation pesticides, exemplified by DDT and other chlorinated hydrocarbons, organophosphates, carbamates and synthetic pyrethroids. The decades of 1940's and 1960's were characterized by major discoveries in the use of chemicals that secured public's health and food crops which later created problems of other kind.

Rachel Carson, in her book "Silent Spring" in 1962, highlighted the excessive and indiscriminate pesticide application leading to environmental contamination, disastrous ecological damage and development of resistance by target population. Most of the conventional synthetic insecticides, being broad spectrum in activity, disrupt natural regulatory mechanisms like (i) prey-predator relationship (ii) density dependent factors. As a result resilience of insect population within a short span of time was noticed. Therefore, a more rational, specific and balanced alternative approach was sought which can be biologically active,
ecologically compatible, environmentally safe and economically cheaper. The biological approach is one such method which includes the entomopathogenic micro-organisms, parasites and predators. However, parasites and predators are slow acting and sometimes fail to intercept epidemic outbreaks and vulnerable to environmental vagaries. Therefore, use of chemicals which act instantaneously in such situations is unavoidable. Alternative chemicals which tend to be more compatible with biologicals include Insect Growth Regulators (IGRs) and pheromones, the novel alternatives called "Third generation pesticides" (Williams, 1967). IGRs received great deal of attention only in the past two decades. The term encompasses a relatively new group of chemical compounds that can alter growth and development in insects. Their effect observed on embryonic and larval development, on metamorphosis, on reproduction in both males and females, on behaviour, and on several forms of diapause provided much opportunity for agriculture scientists to develop control strategies based upon insect hormones and hormone analogues (Slama et al., 1974). They include ecdysone (moulting hormone), juvenile hormone (JH), JH mimic, JH analog (JHA) and their broader synonyms, juvenoids and juvegens. Recently another group of compounds belonging to benzoylphenylureas known as chitin synthesis inhibitors have been registered with Environmental Protection Agency. The term IGR is sometimes used in a restricted sense to mean insect juvenile hormone but usually all compounds that regulate insect growth and development come under this category (WHO, 1985).
To date, there are only two IGRs registered for commercial use, \textit{methoprene} (Altosid), a juvenoid and \textit{difenbuzuron} (Dimilin), a chitin synthesis inhibitor, that widely differ in their mode of action. JH and JHA instead of being directly toxic to target organism disrupt the metamorphosis resulting in adult intermediates which die without gaining reproductive competence. Chitin synthesis inhibitors interfere with the chitin biosynthesis and its deposition during ecdysis resulting in insect mortality due to cuticular malformation.

Even though novel alternatives were effective their use was limited to restricted habitats. It was realized that single method of control will not be effective in all situations. Consequently there was a need for integrated approach which led to the advent of \textit{Integrated Pest Management} (IPM) techniques for the effective suppression of pest population. The concept of IPM is not a new one, but it has come to achieve a range of different meanings, since the term was first coined. In its simplest form it is accepted as being a control strategy in which a variety of biological, chemical and cultural control measures are combined to give stable long-term pest control. The three component parts of the defined pest management programme include maximizing natural control, monitoring the concentration of pests and natural control factors in a given area, and selecting the appropriate techniques to suppress the pest only when necessary (Lucas, 1978). Since IGRs are specific and do not interrupt the natural regulatory mechanisms, they have become one
of the integral parts of IPM programme.

It is important to realize that in IPM strategy, pest is not the function of species but the density. Consequently the objective of the IPM is not to eradicate a species but to limit their population density to a level that is acceptable as determined by economic factors and environmental concerns. This could be achieved by sustained control pressures which are compatible with natural regulating mechanisms. IGRs, being specific, selective and less prone to resistance development, are free from the drawbacks.

IGRs, the novel insect control agents, are now used extensively to regulate the population of common vectors of insect borne diseases. Examination of the past experience reported earlier draw attention to the fact that almost all of the work falls into two discrete areas. At one end of the spectrum there are many studies describing the efficacy of these IGRs in laboratory and field trials, at the other end biochemists investigate the mode of action, metabolism, degradation and toxicology of IGRs at the molecular level. There is, however, marked lack of information between these two areas. It is not known what biological process (eg. feeding, metamorphosis, reproduction) in target insects is affected. Such information is of interest not only because they help to link the findings by biochemists to field work but because they also enable the interpretation of how IGRs in small doses can disrupt development
of insect vectors and interfere with disease transmission.

Therefore, the present study was undertaken to investigate the bioefficacy and sublethal effects of a new IGR, OMS 3031(XRD-473), on the biology and behavior of vector mosquitoes *Culex quinquefasciatus*, *Aedes aegypti* and *Anopheles stephensi* and its effect on non-target fauna which are important to the decision making processes in Integrated Pest Management programmes in near future. This study may help to predict and guide the development of IGRs with more advantages and higher potency within the legal confines as other insecticides in the coming years.