CHAPTER - I

INTRODUCTION
It is well acknowledged fact that pesticides are one of the most important components of modern agricultural technology. If handled properly, these are boon for the society but their indiscriminate and injudicious use can prove bane for mankind. Discovery of toxic properties of DDT during Second World War opened an era for second generation pesticides which mainly include organic synthetic toxicants belonging to different chemical groups. To start with, it was organochlorine insecticide group constituting DDT, BHC, aldrin, dieldrin, chlordane, heptachlor, endosulfan, etc, which were introduced during forties and fifties. Along with organo-chlorine group, the other potential chemical groups exploited for developing pesticidal compounds were organophosphates and carbamates. It was in mid-seventies that synthetic pyrethroids came in the field, the use of which is becoming popular now for controlling insect-pests complex of a variety of crops, in India. Recently about 1,000 chemicals available in different formulations are being used all-over the world both for agriculture and public health purposes.

Among all categories of pesticides, the insecticides, being more hazardous, are potential source of contamination of environment as compared to herbicides, fungicides, etc. Moreover, the use of latter has been comparatively less in
India as compared to advanced countries. Out of different groups of insecticides, the organochlorine compounds are more stable chemicals and persist in the environment, i.e. soil, water, agricultural commodities, etc. for fairly long time. It is more so in temperate conditions. It has been reported that the DDT residues have been so highly wide-spread in the environment that even if its use is banned now, it will take 200 years for its complete dissipation.

It is worth while to have a look on pesticidal scene before discussing the behaviour of these xenobiotics in Indian conditions (Table 1).

Table 1. Pesticides scene

<table>
<thead>
<tr>
<th>World</th>
<th>Total no. of agrochemicals being used</th>
<th>= 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consumption in developed countries</td>
<td>= 80% of total world production</td>
</tr>
<tr>
<td></td>
<td>Consumption in developing countries</td>
<td>= 20%</td>
</tr>
<tr>
<td></td>
<td>Among developing countries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brazil has the largest share</td>
<td>= 7%</td>
</tr>
<tr>
<td></td>
<td>India and Mexico each account for</td>
<td>= 2%</td>
</tr>
<tr>
<td>India</td>
<td>Total pesticides registered</td>
<td>= 126</td>
</tr>
<tr>
<td></td>
<td>Largely used</td>
<td>= 69</td>
</tr>
<tr>
<td></td>
<td>Manufactured indigenously</td>
<td>= 57</td>
</tr>
</tbody>
</table>
Pesticide Usage Pattern in India

In 1954-55 about 4,000 metric tonnes of technical grade of pesticides were used in India which rose to about 70,000 in 1985-86 and it is estimated that by the end of 7th five year plan, our consumption will be 92,000 metric tonnes and by the end of 20th century the figure will reach about 1.5 lakh tonnes (Table 2). However, our consumption of pesticides on the basis of per unit area is very low in comparison to the developed countries of the world. For example, our consumption is only about 327 g per hectare as compared to 1600 g in USA, 2000 g in UK and 10,000 g in Japan.

In 1950, only 0.5 million hectare area was covered with pesticide umbrella which rose to 30-100 million hectares in 1980 and 160 million hectares in 1985-86. Although many new agro-chemicals have entered the field, yet, in India, DDT, BHC and malathion constitute more than 50% of the total pesticidal consumption.

Dietary Intake of Pesticide Residues

The total diet studies carried out in India by Singh (1982) show that mean values for DDT and BHC have been 238 and 124, respectively, for vegetarian and 224 and 133 for non-vegetarians whereas maximum values are much higher than
Table 2. Pesticides consumption in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption (M. tons.)</th>
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<tbody>
<tr>
<td>1954-55</td>
<td>4000</td>
</tr>
<tr>
<td>1978-79</td>
<td>58980</td>
</tr>
<tr>
<td>1983-84</td>
<td>62000</td>
</tr>
<tr>
<td>1984-85</td>
<td>66000</td>
</tr>
<tr>
<td>1985-86</td>
<td>70000</td>
</tr>
<tr>
<td>1986-87</td>
<td>76000</td>
</tr>
<tr>
<td>1987-88</td>
<td>80000</td>
</tr>
<tr>
<td>1988-89</td>
<td>92000</td>
</tr>
<tr>
<td>2000-2001</td>
<td>144000</td>
</tr>
</tbody>
</table>
the acceptable daily intake levels of these toxicants. Considering the contamination of various food items with DDT and HCH, this estimate appears to be on the lower side. Daily intake of DDT and BHC of an average Indian has been quite high when compared with the people of agriculturally advanced countries and their higher pesticidal consumption per unit area.

What has not been established is, whether these residues can cause any long-term hazards. The argument whether they act as carcinogens at the level commonly occurring, still rages, but presently there are no instances of confirmed deaths other than accidental or suicidal causes (Kothpal, 1988).

WHAT NEED TO BE DONE

The answer to pesticide contamination in the environment is not banning of pesticides. Some areas warrant our attention and research, which are as follows:

1. Regular monitoring of environment and planning pest control measures accordingly.
2. Use of safer and less persistent pesticides.
3. Treating, controlling or removing pesticide residues from commodities, production animals, soil, air and water.
4. Disposal of pesticide waste in a manner least detrimental to environment.
5. Establishment of effective regulatory and legislative programmes.


**HUMAN POISONING BY PESTICIDES**

Pesticides account for small but significant fraction of acute human poisoning. There have been a number of outbreaks of accidental poisoning by pesticides and deserve special mention. Many of the recognized outbreaks have occurred in countries that make no orderly collection of mortality data. The main sources of epidemics of accidental poisoning of pesticides have been the contamination of food by pesticide formulations during transport or storage and the use of pesticide treated grain as food. The accidental poisoning to the human beings occurred in December 1984 when leakage in the Union Carbide Plant at Bhopal took thousands of human lives and the reason for this tragedy was methyl isocyanamide, which is a raw product for manufacturing the carbammat pesticide. The epidemics have been reported in several countries of the world, for example, India, Columbia, Iraq, U.S.A., Guatemala, Turkey, Japan and Singapore. In Japan deaths of several people have been reported after eating bread made from contaminated flour. Another outbreak in Singapore may also be worth mentioning where many people died but source of contamination was never discovered.
Even acute human poisoning after improper application of pesticides directly to food or feed is reported (Edson, 1957), an episode involving toxaphene is typical where the insecticide was sprayed on collards, a kind of leafy vegetables. After 3 days the leaves were gathered and cooked with the result, four of seven members of the family became sick. In another incidence in California, eleven persons became sick after eating mustard green sprayed with unusually high doses of nicotine sulfate. Even cases of occupational poisoning by dieldrin in Venezuela, Ecuador, Nigeria, India, Indonesia, Kenya and Tanganyiaka have been reported (Hayes, 1975). Besides the reported poisonings through accidents, or through ignorance or by occupational poisoning, suicidal and homicidal poisoning have also been reported from time to time. For this purpose many of the inorganic pesticides have been used but arsenic remained a favourite for centuries.

The U.S. National Centre for Health Statistics has thus shown that there is a continuous decline of deaths from accidental poisoning for both children and adults because the incidence of death was lower in 1977, (3374) as compared to 1975 (4694), and 1976 (4161). Recently, Govaerts (1977) has indicated that pesticides account for 4.4% of the total poisoning cases in the world and 0.3% account for attempted suicide (Gupta and Salunkhe, 1985).

Since, in India the use of pesticides is increasing day
by day for the better developed crops and vegetables and for
the destruction of pests, it becomes worth while to investi-
gate the impact and effect of some commonly used pesticides
on mammals. As such it was decided to see the effect of some
pesticides on Rattus rattus, albino. The project awarded by
Bureau of Police Research and Development, Ministry of Home
Affair, New Delhi to study the toxicology of mammals, investi-
gations in this laboratory are being done under the super-
vision of my guide Dr. Y.N. Tahai under whose supervision
Dr. A.K. Baronia reported toxicological effects of some pesti-
cides on the brain with pituitary, gonads, kidney, blood and
adrenal gland of Rattus rattus albino. The remaining tissues
were assigned by my supervisor to me, so that a complete story
regarding this study can be investigated and reported for human
welfare.

In present investigations, histopathological changes
induced by DDT, BHC, malathion and carbaryl on the alimentary
canal, its associated glands and spleen of Rattus rattus albino,
has been done with special reference to oesophagus, stomach,
small intestine, rectum, pancreas, liver and spleen. By re-
viewing the literature it was discovered that very little work
has been done in this field. As such the present investigation
was undertaken to do, this so far neglected work.

The importance of the work lies in the fact that the
alimentary canal, its associated glands and spleen comprise
an important vital organs of mammals and any damage done to them will effect the general physiology of the mammal which in due course will not be a normal individual. In addition to histopathological changes induced by these pesticides qualitative detection of residues in oesophagus, stomach, small intestine, rectum, pancreas, liver and spleen has also been done by the method of thin layer chromatography, to confirm the presence of pesticides and their metabolites in the tissues studied for histopathological studies.

The present investigation will give an information about the damage done to the alimentary canal, its associated glands and spleen on one hand and accumulation of pesticides on the other hand in the tissues studied.