SUMMARY

Introduction

After invention of DDT, the trend in chemical control of crop pest has been increased, and this had accelerated the decline in bio-diversity in agricultural landscape Several ecologists in India and abroad have highlighted the importance of agricultural ecosystem for birds. The avian species that are dependent directly or indirectly on agricultural area for food are treated with pesticide. Organochlorine pesticides and their related compounds have been detected in significant amount in the environment and in human body tissues (Edwards 1976). The decline in the bird' s population reflects changes in invertebrates and plant species they survived on. The significant negative correlation between DDE residues in the egg and eggshell thickness is well documented in various species of birds. The objective of the present study is to report the concentration of organochlorine (HCH and DDT) contaminants in tissue, eggs and its impact on breeding success of the avian species.

The study carried out in Kheda district, situated in the central part of Gujarat. Whole district is under Culturable Command Area of Mahi Right Bank Canal Project for irrigation. The total cultivated area of the district is 6,58,495 hectare. Paddy (*Oryza sativa*) crop area of the district is 20.24 per cent of total paddy area of the state. Agriculture in the study area is dependent on canal irrigation. Total annual rainfall during study period was 557.97 mm in 1998, 648.97mm in 1999 and 431.70 mm in 2000.

CHAPTER 1: PROCESS DOCUMENTATION RESEARCH ON PATTERN OF PESTICIDE USE

The utilization of various inputs for crop production mainly depends on our national policies and strategies for agricultural development and farmer' s background in term of economic, psychological and social characteristics. With the promotion of new agricultural input i.e. seeds of high yielding varieties, the use of chemical fertilizer and pesticides had increased. The higher pesticide use was only for few crop which were cultivated for exports i.e. cotton and rice.

To find out the correlation between amount of pesticides used and awareness amongst the farmers the study was carried out in Kheda district of Gujarat, to know the individuals farmer' s background, knowledge, socio-economic status, attitude towards the adoption of IPM on magnitude of pesticides used by him for pest control. The variables considered in the study (i.e. Age, Education, Social participation, Extension contact, Size of land holding, Area under paddy crop, Scientific orientation, Awareness about IPM and Adoption of IPM) were selected on the basis of extensive review of literature on the subject, and to quantify its relations with pesticide use.

The study indicates that the pesticide utilization was much higher by the group of farmers having middle level of education and age. Also the farmers having membership in one or more organization utilized higher amount of pesticides. Because of their membership in various organizations, they were able to arrange for required finance for the agricultural inputs, whereas farmers having high level of knowledge do not prefer overuse of pesticide. The results indicate that pesticide utilization was negatively related with scientific orientation and the knowledge of the farmers.

The correlation between selected variables and extent of adoption of IPM indicates that the education, social participation, area under paddy crop and productivity, scientific orientation and awareness about IPM

were significantly and positively correlated with the extent of adoption of IPM strategy.

CHAPTER 2: SELECTION OF KEY SECEIS TO ASSESS THE IMPACT OF ORGANOCHLORINE PESTICIDES

The agricultural landscape provides habitat for wide variety of bird species, utilizing the crop and surrounding environment in different ways. Hence, the proper selection of key species for assessing pesticide residues in the environment and its impact on the biota can result in assessment of the species most sensitive to the pesticides and ecologically most susceptible to the exposure. The bird species available in study area were evaluated against the EPA criteria and the most sensitive species were found to be Cattle Egret and Black-throated Weaver bird. In addition to EPA criteria, for the selection of key species Cattle Egret and Black-throated Weaver bird also fulfill the criteria given by Moore (1966) for selecting the indicator species for determining the impact of organochlorine residues on wildlife. Both selected species are widely distributed, relatively abundant and easy to capture. They are also residential and sedentary in nature, which is beneficial for assessing the impact of organochlorine pesticides to the local problems.

CHAPTER 3: FOOD HABIT OF SELECTED BIRD SPECIES

The birds are potentially excellent agents of natural pest control Present study was carried out to evaluate the food habit of selected key species. Cattle Egret and Black-throated Weaver Bird which depend on agriculture for their food and form the important component of agricultural ecosystem. A total of 245 regurgitated food samples were collected from the nestling of Cattle Egret from colonies distributed in Kheda district during June to August 1999. The insects were predominant in the cattle egret nestling diet by frequency, biomass and occurrence than the other classes except the biomass of the amphibians. Total 5747 items of 66 different species belonging to 41 different families recovered from the diet. Out of which, 3785 were harmful, 1192 were beneficial, 72 neutral and 698 remained unconfirmed in their role in the environment. The study clearly indicates that 65.86 % of organisms in the food (Mainly the insects) are harmful organisms that are being consumed by the Cattle egrets.

The diet of the Black-throated Weaver Bird chiefly consists of plant material. The animal matter was found to be less important during the study period. It is evident from the studies that both Cattle Egret and Black-throated Weaver Bird are largely dependent on the agricultural ecosystem for feeding. Consequently, the large-scale cultivation of paddy crops has forced them to depend on the particular crop and also preference for agricultural pest as a component of Cattle Egret diet, which makes natural benefit to agricultural ecosystem. But at the same time there is high risk for exposure of these bird species to pesticides, all the more because of the pesticide residues higher in pest species, those have developed high level of resistance to many groups of pesticide due to repeated spraying. So the dose to which this avifauna will be exposed gets magnified (biomagnifications) and they are at the risk of high toxicity of pesticides, which might perish these birds and affects the agricultural ecosystems and their food web.

CHAPTER 4: ORGANOCHLORINE PESTICIDES IN THE BODY TISSUE OF SELECTED AVIAN KEY SPECIES

The organochlorine pesticide residues in body tissues (brain and deposited fat) of Cattle egret and Black-throated Weaver Bird were analyzed, the result indicates that mean residues of DDT was 0.033 ppm in brain tissue and 20.131 ppm in the deposited fat. In case of Black-throated Weaver Birds, the geometric mean of total DDT detected was 0. 0300 ppm in brain tissue and 14.72 ppm in the deposited fat, The residue of DDE and TDE detected in all the tested samples of both category; brain and deposited fat of both species, except in two brain tissue sample of Black-throated Weaver Birds. But TDE was below the detectable limit in all the tested samples

The geometric mean of total HCH residues detected in the Cattle Egret brain tissue was 0.041ppm and linden was 0.030 ppm. While the geometric mean of total HCH and linden residues detected in the Cattle Egrets deposited fats was 5.08 ppm and 4.97 ppm respectively. In case of Black-throated Weaver Birds, the geometric mean of total HCH and Lindane residues detected was 0.010 ppm and 0.001 ppm in brain tissue while 4.211 ppm and 2.797 ppm in deposited fat respectively. Residue levels of all the compound was lower in Black-throated Weaver Bird compared to the residues obtained from the tissues of Cattle egret irrespective of the tissue type. Because Black-throated Weaver Birds being granivorous was getting low amount of pesticides through grains, whereas the Cattle Egret was subjected to higher core from pesticides target organism or pest and thus biomagnification is more conspicuous in these birds than Black-throated Weaver Birds However, there was a considerable difference in the residues of HCH in deposited fat and brain tissue.

The overall impact of organochlorine compounds in the study area is a matter of concern to the conservationist and environmentalists. Even though, the present residues were below the level that can cause

adverse impact on population The pesticide residues in the body tissue are still found in higher range, which are not causing direct mortality of the species but is indirectly affecting the population.

CHAPTER 5: IMPACT OF ORGANOCHLORINE PESTICIDES RESIDUES ON REPRODUCTION

The Worldwide, experimental and field oriented studies have shown the impact of pesticides on avian population for reproduction success. However, such studies in India remain untouched, even though 40 % of globally threatened animals of India are from avian community. So it was necessary to initiate the study on impact of organochlorine pesticides on reproductive success of which avifauna would help us to formulate strategies and policies for biodiversity conservation. The study was carried out in the agricultural landscape of kheda district during 1999 – 2000, where the impact of organochlorine pesticide residues on avian community was evaluated by taking Cattle Egret as key species of the present study. The mean hatching success was 92.17 %; whereas fledling success was 72.50 % and overall breeding success was 60.16 %. The mean residues level obtained in eggs were 0.92 ppm DDE, 2.38 ppm TDE, 5.79 ppm total DDT, 2.52 ppm HCH and 2.06 ppm Lindane. The residue levels obtained in present study was well below the critical below the critical level which can cause adverse impact on breeding success immediately, but in the long run due to bioaccumulation it is bound to show its impact on population if not controlled.

CHAPTER 6: FFOD HABIT AND PESTICIDES RESIDUES IN BODY TISSUE OF LITTLE CORMORANT: A CASE STUDY

The wetlands are more vulnerable to pesticides hazards than any other ecosystem. Because of its placement in ecosystem, the pesticide applied in one zone may ultimately come into aquatic ecosystem. In India, several wetlands are directly treated by pesticides to control the vector of several diseases i.e Maaria, Filaria. It was important to evaluate the role of wetlands in mitigation of toxic hazards and also to evaluate the impact of pesticides residues on the avifauna depending on the aquatic system. The Little Cormorants was taken as a key species for evaluating pesticides hazards, by studding its nesting population, reproductive success, food habit and residue analysis. The average brood size was 2.3 and overall breeding success was 65.52 %. The dietary composition of the nestlings revealed that fish was the main food item (66 %) followed by crustaceans and insects. The highest pesticide residues obtained in fish were 0.03 ppm DDE, 0.01ppm TDE, 0.04 ppm total DDT, 0.10 ppm HCH and 0.03 ppm Lindane. The concentration of residues in body tissues of Little Cormorants recorded was 0.022 ppm DDE, 0.048-ppm total DDT in brain tissue and in deposited fat 0.030 ppm DDE and 39.73 ppm total DDT. The eggs contained mean organochlorine contaminant were 1.52 ppm DDE and 0.70 total DDT. The biomagnification of organochlorine contaminants through food base was quite clear. However, levels were lower than the crtical level but the higher level of DDE in the eggs could be the main culprit for the egg shell thinning and lower the breeding success. The heronries used by the Little Cormorant in 1999 were 21 %, which decreased to 14 % in 2000, shows some reduction in the population of birds in the study area.