CHAPTER VII

CONCLUSION AND RECOMMENDATIONS

The hazardous effect of fungicides on the human and animal health is increasing day by day. The residues left in crops enter the human and animal body after being eaten and causes many metabolic disorders and other complications. The present investigation aims to reveal the possible toxicity of mancozeb with respect to haematological, biochemical, enzymological and immunological changes in albino mice. On the basis of the above results obtained from the present study, the following conclusion can be drawn:

Mancozeb was found to be toxic in nature at low dose of 4.156 mg/kg/ body weight in Swiss albino mice during the 30 days consecutive exposure period. The selected high dose of mancozeb for the present study at 6.650 mg/kg/ body weight was found to be more toxic in nature at weight in Swiss albino mice during the 30 days consecutive exposure period. Similar toxicological alterations in both groups were seen with more severity in the high dose group.

During the therapeutic doses remarkable change was seen in the mice and laudable recovery was demonstrated. The treatment with Aloe vera at 400 mg/kg/ body weight showed highly effective improvement during both Simultaneous and Recovery (after withdrawal of MCZ) treatment with much better improvement during the latter. Thus, it could be used safely as a drug of choice during fungicidal intoxication with no untoward side effects.

The treatment with Ocimum sanctum at 250 mg/kg/ body weight showed appreciable improvement during both Simultaneous and Recovery (after withdrawal of MCZ) treatment with much better improvement during the latter. However, in certain cases both the groups had worthy recovery from the burden of the toxicant. Hence, it was also found effective during the 30 days consecutive treatment period against mancozeb.

Highly significant alterations were found in haemoglobin, RBC, WBC and ESR content in blood during the haematological assays. During the present study
significant reduction in haemoglobin and RBC content as compared to control was observed in the mancozeb intoxicated groups. This reduction in haemoglobin value may be due to excessive protein utilisation and breakdown of haemoglobin, anaemia, erythropoietin deficiency from kidney disease, nutritional deficiencies, etc. The decreased RBC count might be due to the excessive cell destruction or decreased cell proliferation.

Significant increase in the haemoglobin value and RBC count were seen during herbal treatment with A. vera and O. sanctum suggesting positive role of the drugs in combating the haematological disorder by increasing erythropoiesis and protecting the haematopoietic system. The Recovery group of A. vera (Gr VIII) demonstrated better results than Recovery group of O. sanctum as well as both the Simultaneous groups on day 30. Probably, the dose was effective against the afterwithdrawal of the low dose of mancozeb administered and was able to bring recovery from the damage done by mancozeb. The treatment with O. sanctum and A. vera in the mice exposed to high dose of mancozeb showed no significant improvement. This suggests that the treatment dose was not effective in removing the burden of the toxicant.

Again, highly significant alterations were found in WBC and ESR content in blood during the haematological assay. During the present study significant increase in WBC count and ESR content as compared to control was observed in the mancozeb intoxicated groups. WBC increase may be due to the increase in the host immune response, both cellular and humoral defence of the body. The leucocytosis possibly attributed to an increase in leukocyte mobilization observed in present study indicates enhancement of the immune system to protect the mice against infection that might have been caused by chemical and also secondary infections, which may be contracted after the weakening condition of the mice. The ESR increases as there was conditions of tissue breakdown, entry of foreign proteins, increased rouleaux formation as well as increase in cholesterol.

Significant decrease in the WBC count which returned to that of the control value on day 30 in the treated groups of A. vera and O. sanctum were seen during herbal treatment suggesting positive role of the drugs in combating the levels of blood cell count and other indices. Significant relative decrease of TLC and ESR
was seen in Gr VIII which neared to that of the control value and showed better improvement as compared to the other treated groups with the control. Better results were obtained in the recovery group of *Aloe vera* (Gr VIII) than *Ocimum sanctum*. Probably, the dose was effective against the afterwithdrawal of the low dose of mancozeb administered and was able to bring recovery from the damage done by mancozeb. The herbal treatment however in the mice exposed to high dose of mancozeb showed no significant improvement. This suggests that the treatment dose was not effective in removing the burden of the toxicant. **Since there is not much information available on the effect of *Aloe vera* and *Ocimum sanctum* with regards to ESR status against mancozeb induced albino mice, hence this study gives us significant insight in this aspect.**

Highly significant reductions were found in total serum protein and blood glucose content in blood during the biochemical assay as compared to control was observed in the mancozeb intoxicated groups. This might be due to an acceleration of protein catabolism during mancozeb intoxication, reduced feeding, acute and chronic infections during toxic effects, disturbance in various metabolic activities and normal physiology of mice, alterations in the content of proteins of carbohydrate, energy and amino acid metabolism. The glucose reduction may also possibly be due to low thyroxine level caused by impaired thyroid function. In the present study similar results were also evident in histopathological and histochemical analysis of kidney and liver. Similarly, highly significant increase was found in the cholesterol content in serum during biochemical assays during intoxication with mancozeb at low dose in Swiss albino mice during the 30 days consecutive exposure period. More severity was observed during intoxication with high dose of mancozeb in Swiss albino mice. This might be due to increased synthesis and accumulation of cholesterol in the liver, kidney and testis and impaired biliary function or increased lipogenesis probably due to acceleration of acetyl-CoA.

Significant increase in the total serum protein, blood glucose and cholesterol content in blood were seen during herbal treatment with *A. vera* and *O. sanctum* suggesting positive role of the drugs in combating the biochemical disorder by its anti-oxidative stress property which helps in maintaining good health and in
preventing the chances of the other biochemical diseases. The recovery group of *A. vera* (Gr VIII) demonstrated highest curative properties than recovery group of *O. sanctum* as well as both the Simultaneous groups on day 30 where the depletion of glucose and increase of cholesterol was improving and nearing that of the control. In case of total protein content Gr VIII and X showed better recovery towards that of the control on day 30. The treatment with *O. sanctum* and *A. vera* in the mice exposed to high dose of mancozeb showed no significant improvement. This suggests that the treatment dose was effective in removing the burden of the toxicant at low dose of mancozeb.

The enzymological assays also exhibited significant increase in the SGPT and SGOT content in serum during intoxication with mancozeb at low dose and high dose of mancozeb in Swiss albino mice during the 30 days consecutive exposure period, with more severity in the high dose group. This may be due to increased transamination for rapid breakdown of carbohydrates and proteins to compensate the increased energy crisis resulting from mancozeb intoxication possibly indicating liver damage, hepatic necrosis, infectious and toxic hepatitis, nephrotoxicity and permeability alterations.

The therapeutic doses with *A. vera* and *O. sanctum* showed highly effective improvement during both Simultaneous and Recovery (after withdrawal of MCZ) treatment with much better improvement in the latter during the 30 days consecutive treatment period against mancozeb. Significant decrease of SGPT and SGOT values were seen in Gr VIII towards that of the control. Thus, the treatment was best obtained in Recovery groups than the Simultaneous groups. The treatment with *O. sanctum* and *Aloe vera* in the mice exposed to high dose of mancozeb showed no highly significant improvement suggesting low capacity of the herbal drugs in removing the burden of the toxicant.

Highly significant alterations were found in polymorphocytes, lymphocytes, eosinophils, albumin (only day 30), A/G ratio (only day 15 and 30), ITH and DTH reactions while significant differences were seen in monocytes, globulin (only on day 7) and A/G ratio (only day 7 and 21) during immunological assays in blood and serum while intoxicating with mancozeb at low dose and high dose of mancozeb in
Swiss albino mice during the 30 days consecutive exposure period, with more severity in the high dose group.

In the present study, the counts of polymorphocytes and eosinophils were found to significantly increase in the intoxicated group. This may be to cope up with the condition the body imparts resistance to kill the foreign bodies. Significant decline in these parameters were seen during herbal treatment suggesting positive role of the drugs in fighting the toxicated condition. A significant decline was also noticed in lymphocytes and monocytes count in the intoxicated groups suggesting the receding capacity of the body i.e. cell mediated immunity to fight the intoxicated condition. Also significant decline was observed in serum protein during the intoxication with mancozeb which caused decrease in albumin thereby increasing the globulin content. It may be due to increase in the antibodies to fight the condition. The ITH and DTH reactions induced by mancozeb were found to significantly increase in the intoxicated group. The increased ITH reactions during intoxication suggests role of IgE in the body to fight the foreign body while the increased DTH reactions show role of cellular immunity. **Not much information is available regarding immunological studies with respect to A. vera and O. sanctum in mancozeb treated mice.**

When the intoxicated mice were treated with the therapeutic doses, it exhibited effective improvement in the mice with laudable recovery. The treatment with A. vera showed highly effective improvement during both Simultaneous and Recovery (afterwithdrawal of MCZ) treatment with much better improvement during the latter. The treatment with O. sanctum showed appreciable improvement during both Simultaneous and Recovery (afterwithdrawal of MCZ) treatment with much better improvement during the latter. However, in certain cases both the groups had worthy recovery from the burden of the toxicant during the 30 days consecutive treatment period against mancozeb. The treatment with O. sanctum and A. vera in the mice exposed to high dose of mancozeb showed no significant improvement. **This suggests that the treatment dose of O. sanctum and A. vera were effective in enhancing immune response both the cellular and humoral immune system and hence was effective in removing the burden of the**
toxicant. They exhibited immunomodulatory role in the current study and were able to significantly reduce the enhanced reactions of the body.

The therapeutic doses produced remarkable change in the mancozeb intoxicated mice and laudable recovery was demonstrated. The treatment with *A. vera* and *O. sanctum* showed highly effective improvement during both Simultaneous and Recovery (after withdrawal of MCZ) treatment with much better improvement during the latter and much better in the *Aloe vera* group Gr VIII. Thus, it could be used safely as a drug of choice during fungicidal intoxication with no untoward side effects. However, in certain cases both the groups had worthy recovery from the burden of the toxicant. This suggests that the treatment dose effective in removing the burden of the toxicant. The results shall be helpful in the field of chemotherapy as herbal treatment has fewer side effects and pronounced effective results were also seen.

The results of the present study could be concluded that *Aloe vera* and *Ocimum sanctum* (ayurvedic drugs) are very good antidote for pesticidal intoxication. Better results were evident in the *Aloe vera* group when administered in albino mice after withdrawing the toxicant.
RECOMMENDATIONS OR SUGGESTIONS

- The present study entitled "Studies on herbal protection against mancozeb (ethylene bis dithio carbamate group) induced toxicity in albino mice" is of great significance in the field of public health to reduce the side effects generated by the pesticide used.
- The results of the present study will aid in the field of chemotherapy and therapeutics.
- It will help in generating cost effective treatment with low side effects.
- The treatments can be made available among the mass with easy availability especially among farmers and villagers who are mostly prone to such pesticidal effects.
- Thus, the drugs can be used in prophylaxis of mancozeb intoxication. The study also suggests the use of herbal drugs for curative as well as preventive purposes.
- It could be used safely as a drug of choice during fungicidal intoxication with no untoward side effects with pronounced effective results.
- The results of the present study with further confirmatory trials shall be helpful in the field of chemotherapy as herbal treatment has fewer side effects and pronounced effective results are also seen.