

## DIMETHOATE TOXICITY : A HAEMATOLOGICAL AND BIOCHEMICAL APPROACH IN SWISS ALBINO MICE AND REMEDIAL EFFECTS OF LEAF EXTRACT OF *ZIZYPHUS NUMMULARIA*

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### ABSTRACT

Pesticides are used for destroying, repelling or mitigating any pest not to affect human health. These are grouped under the basis of target organisms, eg - Algicide for Algae, Avicide for Birds, Bactericide for Bacteria, Fungicide for Fungi, Insecticide for Insects, Nematicide for Nematodes, Rodenticide for Rodents, Virucide for Viruse etc. Dimethoate is the organophosphate is used extensively in horticulture. The purpose of the research work is to deal with the effect of leaf extract of *Zizyphus nummularia* on the haematological and Biochemical parameters of dimethoate treated albino mice. Animals were divided into two group of two different ages (70 days and 105 days) and each group again divided into three group of albino mice. G1A- (Control group of 70 days aged mice), G2A-[Dimethoate (30 mg/kg.bw) day<sup>-1</sup>] 70 days aged mice, G3A [Dimethoate (30 mg/kg.bw) day<sup>-1</sup> and 60 min after *Zizyphus nummularia* leaf extract (250 mg/kg.bw day<sup>-1</sup>)] 70 days aged mice, and G1B- (Control group of 105 days aged mice), G2B-[Dimethoate (30 mg/kg.bw) day<sup>-1</sup>] 105 days aged mice, G3B [Dimethoate (30 mg/kg.bw) day<sup>-1</sup> and 60 min after *Zizyphus nummularia* leaf extract (250 mg/kg.bw day<sup>-1</sup>)] 105 days aged mice. Dimethoate administration significantly altered the Haemoglobin(Hb), Erythrocyte Sedimentation Rate(ESR), Red Blood Cells (RBC conut), Lactate dehydrogenase (LDH) and Adenosine Triphosphatase (ATPase) and co- administration of leaf extract of *Zizyphus nummularia* showed the protective effects on these parameters.

**KEY WORDS :** Rodenticide, Horticulture, Dimethoate , Haematological and biochemical parameters.

### INTRODUCTION

Food production and disease control are the most important challenges facing humanity, that deserved special attention. The reduced yield and Harvest losses are due to pest, by transmitting the diseases, they are threatening human and live stock health. Due to this reason many research efforts are considered for controlling the pest and insect by using pesticides. India is the second largest manufacturer of pesticides in Asia after China while twelfth globally. Dimethoate is very toxic to non target animals such as bees, birds and other aquatic organisms. It may harm to other wildlife and

livestock, exposure with dimethoate may interfere with hormone system so it is an endocrine disrupter. The common effect of organophosphate (dimethoate) insecticide on serotonergic system which is responsible for high level of anxiety in female rats (Slotkin *et al.*, 2006) and it is responsible for the alteration in nicotinic receptors function and in neuropathy target respectively (Andreadis *et al.*, 2014). *Zizyphus nummularia* is a multipurpose species, having edible fruits (ber), leaves for forage, branches are used for fencing, its wood is used as fuel and it is a folk medicinal plant of tribes to cure different diseases like allergy, eczema, scabies and pyorrhea (Prajapati *et al.*, 2019).

## MATERIAL AND METHODS

Healthy albino mice of (age group 70 days and 105 & days of  $52.65 \pm 2.41$  and  $61.09 \pm 2.89$  grams weight respectively) were taken for experimental study. Animals were kept in laboratory condition. Treatment schedule was continued for 30 days and animals were grouped as -G1A- (Control group of 70 days aged mice), G2A- [Dimethoate (30 mg/kg.bw) day<sup>-1</sup>] 70 days aged mice, G3A [Dimethoate (30 mg/kg.bw) day<sup>-1</sup> and 60 min after *Zizyphus nummularia* leaf extract (250 mg/kg.bw day<sup>-1</sup>)] 70 days aged mice, and G1B- (Control group of 105 days aged mice), G2B- [Dimethoate (30 mg/kg.bw) day<sup>-1</sup>] 105 days aged mice, G3B [Dimethoate (30 mg/kg.bw) day<sup>-1</sup> and 60 min after *Zizyphus nummularia* leaf extract (250 mg/kg.bw day<sup>-1</sup>)] 105 days aged mice. Oral Dose of Dimethoate were 1/5 of LD 50. LD 50 is 150 mg/kg bw (WHO 2001). Oral dose of leaf extracts of *Zizyphus nummularia* 250 mg/kg bw (Rajasekaran 2013) was given to Dimethoate treated mice.

## RESULT AND DISCUSSION

After 30 days of treatment with dimethoate ,a

significant decrease were observed in Hb as found by Lone *et al* in *Rattus rattus* (2013), ESR (Yasin *et al.* found the reduction in the ESR in albino mice due to dimethoate, 2013), RBC (Adeoti *et al* reported that inhalation of dimethoate pesticide by wistar rat decreases the ESR, 2017) and ATPase (same result was found by Samih *et al.*, 2017) while a significant increased was seen in LDH, Hussain *et al.* reported the same result in *Catla catla* and *labeo rohita* fishes (2016) and co-treatment with *Zizyphus nummularia* leaf extract shown ameliorative effects on altered parameters due to dimethoate treatment.

The main reason of reduction in Hb is the liver disease caused by dimethoate which increases the destruction of RBC and create the condition of anemia by haemoglobin deficiency. Liver disease is frequently associated with the hematological abnormalities and common symptom is to become anemic. Due to the damage of liver a deficiency occurs in hapticidin hormone (produced by the liver) and iron homeostasis disturbs that is why a decrease is found in Hb (Gkamprela *et al.*, 2017) Low level of ESR is the sign of being anemic (Hameed *et al.*, 2006). Alteration in hemoglobin level puts oxidative stress and band -3 protein oligomerization occurs, which induce the macrophage-mediated clearance

**Table 1.**

S.No.	Parameters	G1A	G2A	G3A
1	Hb (gm/dl)	11.33 ± 0.007	8.42 ± 0.044	10.00 ± 0.043
2	ESR (mm/h)	41.6 ± 0.548	33.60 ± 0.548	40.00 ± 1
3	RBC (*10 <sup>9</sup> /l)	8.08 ± 0.012	5.77 ± 0.011	7.78 ± 0.130
4	LDH(U/L)	370.00 ± 0.837	431.00 ± 0.837	360 ± 1.48
5	ATPase (U/L)	2.96 ± 0.014	1.08 ± 0.01	2.7 ± 0.10

Mean values are significantly different at p < 0.05

G1A-Control group of 70 days aged mice.

G2A-Dimethoate (30 mg/kg.bw) day<sup>-1</sup> 70 days aged mice.

G3A-Dimethoate (30 mg/kg.bw) day<sup>-1</sup> and 60 min after *Zizyphus nummularia* leaf extract (250 mg/kg.bw day<sup>-1</sup>) 70 days aged mice.

**Table 2.**

S.No.	Parameters	G1B	G2B	G3B
1	Hb (gm/dl)	12.4 ± 0.008	8.54 ± 0.054	11.5 ± 0.164
2	ESR (mm/h)	43.4 ± 0.548	37.8 ± 0.837	42.2 ± 0.447
3	RBC (*10 <sup>9</sup> /l)	10.1 ± 0.548	7.58 ± 0.046	9.76 ± 0.089
4	LDH (U/L)	388 ± 2.07	469 ± 1	388 ± 0.89
5	ATPase (U/L)	3.01 ± 0.007	2.01 ± 0.007	3.01 ± 0.005

Mean values are significantly different at p < 0.05

G1B- Control group of 105 days aged mice.

G2B- Dimethoate (30 mg/kg.bw) day<sup>-1</sup> 105 days aged mice.

G3B- Dimethoate (30 mg/kg.bw) day<sup>-1</sup> and 60 min after *Zizyphus nummularia* leaf extract (250 mg/kg.bw day<sup>-1</sup>) 105 days aged mice.

of altered RBC and reduces the RBC count (Pritini *et al.*, 2019). LDH is a marker of common injuries and disease and increased level is the sign of stressful condition where oxygen deficit condition appears (hypoxia) and anaerobic metabolism increases (Shadegan and Banaee, 2018). ATPase is necessary for neuronal excitability. Inhibition of this enzyme could lead membranar depolarization which leads to the suppression of excitation. Due to oxidative stress membranar lipid peroxidation occurs which damages the membrane in dose dependent manner (Cortes-Iza and Rodriguez, 2018).

Leaf extract of *Zizyphus nummularia* contains many alkaloids like n-octacosanol, quercetin, terpenoid, fatty acid, ethyl alpha-D-glucopyrenoside and vitamin E, which have the antioxidant activity, removes oxidative stress from tissue, while cyclopeptide alkaloid, phytosterol, fatty acid, terpenoid, quercetin and betulinic acid, which have anti-inflammatory action, these alkaloid protect albino mice from the toxic effects of dimethoate.

### CONCLUSION

Regarding the use of pesticide, there should be a legislation at international and national level (Mitra *et al.*, 2011). It is also suggested there should be a comparison between laboratory concentration response data for pest, may indicate how to use pesticide selectively as a part of Insect Pest Management Program (IPM) (Wiles and Jepson, 1992). Due to unique and diverse climatic conditions in India there is a need to avoid extinction of ethno-medicinal heritage, that could be achieved by the involvement of concerned authorities, academia and conservation managers. Ongoing research will focus on characterizing and isolating mechanism of the effect of bioactive compounds leaf extract of *Zizyphus nummularia* on the aspect of pesticide toxicology.

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