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RESEARCH ARTICLE

COMPARATIVE POTENTIAL EFFICACY OF DELTAMETHRIN (PYRETHROID) AND CARBOFURAN (CARBAMATE) ON TOXICITY AND BIOCHEMICAL PARAMETERS IN THE GONADS OF *CHROTOGONUS TRACHYPTERUS* BLANCHARD (ORTHOPTERA: ACRIDIDAE)

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Alkaline phosphatase, ATPase, Carbofuran, Cholesterol, *Chrotogonustrachypterus* ,Deltamethrin, Hypoproteinemia, Protein, Toxicity

Abstract

Potential toxicity and effect on biochemical parameters of Deltamethrin and Carboburan on gonads of *Chrotogonustrachypterus* was investigated. LC_{50} values (24 hrs.) for Deltamethrin 22.069 ppm, 2.498 ppm and forCarbofuran 14.263 ppm, 1.711 ppm on female and male *Chrotogonustrachypterus* respectively. Toxicity of two insecticides were not similar for both sexes but male having higher degree of toxicity than female adult at 24 hrs of LC_{50} values. The effects of sub-lethal doses of Deltamethrin 11.034 ppm, 7.131 ppm; Carbofuran 1.249 ppm, 0.855 ppm on gonads of adult female and male *Chrotogonustrachypterus* were analysed respectively. Investigation of results evaluates the Carbofuran having greater potential toxicity than Deltamethrin. Analysis of biochemical parameters as protein, cholesterol, alkaline phosphatase and ATPase were evaluated at 12, 24 and 48 hrstreatment. Hyperproteinemia ($p<0.001$) exhibited at 12, 24 and 48 hrs after application ofDeltamethrin and Carbofuran in both sexes. The acute toxicity of pyrethroid and carbamate were compared by static exposure on *Chrotogonustrachypterus*. Analysis of LC_{50} value, evaluate that synthetic pyrethroids are less toxic than carbamates. Synthetic pyrethroid and carbamate insecticides have been developed for major uses to control crop pest in agriculture and public health.

Introduction:-

Agriculture relies heavily on the use of pesticides control of insects and other pests. Synthetic pyrethroidandcarbamateinsecticides constitute the most important class of present day pesticides which control of a pest species by affecting its unique biochemical system. The surface grasshopper, *Chrotogonustrachypterus* (Blanchard) (Orthoptera- Acrididae) is a destructive pest of wheat, barley, oil seed crops, maize, jowar, sunhemp, bajra, rice, sorghum, groundnut, pearl millet, cotton, vegetables, indigo, opium, red gram in different parts of the World. Deltamethrin and Carbofuran cause differential fluctuations in biochemical constituents (protein, cholesterol, ATPase and alkaline phosphatase) on gonads of *Chrotogonustrachypterus* which leads to sterility. LC_{50} values of Monocrotophos 36SL and Cypermethrin 25 EC on both the sexes of *Chrotogonustrachypterus* were 353.9 ppm, 151.0 ppm and 33.11 ppm, 16.38 ppm respectively (Shakeet and Bakshi, 2009). Histopathological studies of

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Cypermethrin and Monocrotophos on expose to sublethal doses (16.56 ppm, 8.34 ppm and 176.95 ppm, 75.5 ppm) at 12, 24 and 48 hrs on both sexes of *Chrotogonustrachypterus* Blanchard greatly influence process of spermatogenesis and oogenesis respectively (Shakeet and Bakshi, 2009a, 2009b).

Deltamethrin belongs to the most commonly used pesticides worldwide. Pyrethroids are divided by characteristic into type I and type II. Both types of toxicity cause neurological symptoms and reduce reproductive potential. Pyrethroids are synthetic analogues of the natural pyrethrins, extracts of the ornamental *Chrysantemumcinerariaefolium*and its related species. Deltamethrin [(s) α-cyano-3phenoxy benzy1-(R)-cis-3-(2, 2-dibromoviny1)-2-2-dimethy1-cyclopropane carboxylate] a synthetic pyrethroid type Ï. It is highly effective against a broad spectrum of insects with potent insecticidal properties (Manna *et al*., 2006). Pyrethroid caused alterations in biochemistry, hematology and reproduction (Yousef*et al*., 2006, El-Demerdesh, 2004) and that kills insects oncontact and through digestion. Synthetic pyrethroids are less persistent and less toxic to mammals and birds (Sayeed*et al*., 2003), they are highly toxic to a number of non-target organisms such as bees, freshwater fish and insects even at very low concentrations (Oudou*et al*., 2004), for this reason, these are extremely used in agriculture and foresty. LC_{50}ofDeltamethrin on female and male adults of *Chrotogonustrachypterus* were 22.069 ppm and 14.263 ppm respectively. Earlier observation on Fenvalerate and Chlorpyrifos toxicity on*Chrotogonustrachypterus* were 105.1 ppm, 85.52 ppm and 606.1 ppm, 349.9 ppm respectively (Jangir and Bakshi, 2011).

Carbofuran (2,3-dihydro-2,2-dimethylbenzofuran- 7-yl methylcarbamate) or Furadan is an anticholinesterase carbamate commonly used as an insecticide, nematicide and acaricide in agricultural practice throughout the world. Carbofuran is highly toxic by inhalation and ingestion and moderately toxic by dermal absorption. As with other carbamate compounds, carbofuran's cholinesterase-inhibiting effect isshort-term and reversible. Carbofuran has a potential to cause damage to the reproductive system and to health by prolong exposure (Nasir Aziz, 2008). LC_{50} of Carbofuran on female and male adults of *Chrotogonustrachypterus* were 2.498 ppm and 1.711 ppm respectively. Carbofuran has decreased the contents of carbohydrates and total protein in testicular tissue (Wael M. Al- Amound, 2012). The aim to conduct the present studywas to determine the potential toxicity and biochemical alteration in gonads of *Chrotogonustrachypterus*after exposure of insecticides: Deltamethrin, Carbofuran, Cypermethrin, Fenvalerate, Chlorpyrifos and Monocrotophos.

Material and Methods:-

Insecticides:-

Carbofuran and Deltamethrin will be selected for study these were purchased from RathoreBeezBhandar,SabziMandi, LalKothi, Jaipur, India.

Rearing of *Chrotogonustrachypterus*:-

Chrotogonustrachypterus were collected from the fields(RajasthanUniversity ground), low crop ground, bare soil and grass or the waste land. The collected insects were conditioned in the laboratory. Rearing was done at room temperature ranging from 27 to 37°C in summer months and rainy days. During winter, temperature range from 27 to 32°C was maintained in the cages. The rearing was carried out at room humidity 35 to 65 per cent.

Mode of Application:-

Chrotogonustrachypterus were treated by dipping method because of the smaller size and hopping behaviour of the insect. About 5 ml solution of a sub-lethal concentration of the Deltamethrin and Carbofuran was taken in a small crucible, cleared and sterilized. A grasshopper held dorsally at the thoracic region by forceps was just dipped in the insecticide contained in the crucible.

Observations were recorded on the basis of insect's mortality at 24hrs. The results obtained were subjected to Quantal Response Assay. The LC_{50} of Deltamethrin and Carbofuran against *Chrotogonustrachypterus* were obtained by using the following formula -

$$\text{Log } LC_{50} = \text{Log } X_o + \frac{0.50 - P_o}{P_+ - P_o} \Delta$$

Where Xo be the highest dose that gives a reaction, Po < 0.50, $P_+ > 0.50$ and Δ = dose step (Ipsen*et al*., 1970).

Determination of Sub-lethal Dose of Deltamethrin and Carbofuranagainst*Chrotogonustrachypterus:-*
The LC_{50}values of Deltamethrin and Carbofuran against female and male *C. trachypterus* were 22.069 ppm, 14.263 ppm and 2.498 ppm, 1.711ppm respectively. In continuation of above results the sub-lethal dose of Deltamethrin and Carbofuran on female and male adults of *C. trachypterus* was 11.034 ppm, 7.31 ppm and 1.24 ppm, 0.855 ppm respectively when applied by the dipping method. The effects were observed after 12, 24 and 48 h intervals and compared with control.

Bio-chemical Estimation:-
1. **Estimation of Protein:** Total protein was estimated by the Lowry *et al*., (1951) procedure. The absorbance was read at 640 nm against blank. The activity was expressed in mg/g of the wet tissue.
2. **Estimation of Cholesterol:** Total cholesterol was determined by the method described by Zlatki*et al.,* (1953). Cholesterol has unsaturated bonds and phenanthrene ring structure. The absorbance was read at 540 nm against blank. The activity was expressed in mg/g of wet tissue.
3. **Estimation of Alkaline Phosphatase:** Alkaline phosphatase was estimated by the method after Fiske and Subba-row (1925) for the determination of phosphate liberated with modification including the incubation procedure of Bodansky (1932, 1933) using alkaline buffer. The phosphatase activity is the difference between the inorganic phosphate content of the incubated and control samples and is expressed in terms of Bodansky unit corresponding to the liberation of inorganic phosphorus from the tissue in mg pi/g/h.
4. **Estimation of Adenosine Triphosphatase(ATPase):** For quantitative analysis of the activity of ATPase, the method given by Sickevitz and Potter (1953) was followed. Tissues were homogenized in sucrose. Disodium salt of ATP was used as substrate. The activity was measured in term of inorganic phosphorus liberated from the tissue as for the acid and alkaline phosphatases. The absorbance was read at 640 nm.

Statistical Analysis:-
The results obtained were expressed as mean±S.E. The statistical analysis by use ofStudent's t parametric test was performed to determine significant differences. The significance levels were expressed in 'P' values as
NS = Non significant
P<0.05 = Significant
P<0.01 = More significant
P<0.001 = highly significant

Results and Discussion:-

Toxicity Results:-
Results of the bioassay of Deltamethrin and Carbofuran tested against the female and male adults of *Chrotogonustrachypterus*were summarized in table 1.

Effect of Deltamethrinon female adults: Insects mortality at 400, 800, 1100, 1200, 1300 ppm concentration were 3.57, 14.29, 41.18, 76.47 and 100% at 24 hrs respectively **(**Table 1).LC_{50} value for female adults at 24 hrswas found to be 22.069 ppm with confidence limits of 24.06 and 7.81 (Table - 2, fig -1).

Effect of Deltamethrinon male adults: Insects mortality at 200, 400, 550, 600 and 750 ppm concentration were 10, 44.44, 71.43, 88.46 and 96.97% at 24 hrs respectively **(**Table 1).LC_{50}value for male adults at 24 hrs was found to be 14.263 ppm with 95% confidence limits of 17.16and 11.84 (Table -2, fig -2).

Effect of Carbofuranon female adults: Insects mortality at 0.4, 0.1, 0.12, 0.16 and 0.2 ppm concentration were 3.13, 8.33, 23.53, 66.67 and 95% at 24 hrs respectively **(**Table 1).LC_{50}value for female adults at 24 hrs wasfound to be 2.498 ppm with confidence limits of 3.11 and 2.00 (Table - 2, fig -3).

Effect ofCarbofuran on male adults: Insects mortality at 0.2, 0.5, 0.6, 0.8 and 0.1 ppm concentration were 3.45, 9.52, 33.33, 81.25 and 95.65% at 24 hrs respectively **(**Table 1).LC_{50}value for female adults at 24 hrswasfound to be 1.711 ppm with confidence limits of 1.93 and 1.62 (Table - 2, fig -4).

Effect of Deltamethrin on biochemical parameters:-
1. Protein
Male: -A highly significant (P<0.001) increase was recorded in protein level of male insects after 12, 24 and 48 hrs of treatment (Table 3, Fig. 5).

Female: - Protein level highly significant increase (P<0.001) at 12, 24 and 48 hrsin females (Table 3, Fig. 5).

2. Cholesterol

Male: - There was a highly significant (P<0.001) increase in cholesterol level at 12 and 48hrs of the treatment which was followed by highly significant (P<0.001) decrease at 24 hrs (Table 3, Fig 6).

Female: - Highly Significant (P<0.001) decrease was recorded at 24hrsin cholesterol levelwhile at 12 and 24 hrshighly significant (P<0.001) raised (Table 3, Fig. 6).

3. Alkaline Phosphatase

Male: - A significant decrease in alkaline phosphatase activity was recorded 48 hrs after treatment, but slightly significant increase (P<0.01) after 24 hrsand highly significant (P<0.001) increase 12 hrsofthetreatment (Table 3, Fig. 7).

Female: - A non-significant increase in alkaline phosphatase level at 24 hrs while at 12 and 48 hrs significantly declined (Table 3, Fig. 7).

4. ATPase

Male: - ATPase level highly significant (P<0.001) increased 12, 24 and 48 hrs. (Table 3, Fig. 8)

Female: - ATPase analysis of result in females recorded similar as in males but at 24 hrsslightly fluctuation was occurred (Table 3, Fig. 8).

Effect of Carbofuran on biochemical parameters:-

1. Protein

Male: - A highly significantly increase (P<0.001) in protein level was recorded at 12, 24 and 48 hrs (Table-4, fig-9).

Female: - There was a highly significant (P<0.001) increase was recorded in treated females at 12, 24, 48hrs similar as in males(Table-4, fig-9).

2. Cholesterol

Male: - Increase in cholesterol level was highly significant (P<0.001) at 12 and 48 hrsof the treatment and slightly decrease at 24 hrs in cholesterol level (Table-4, fig- 10).

Female: -Continuously highly significant (P<0.001) increase in cholesterol level at 12, 24 and 48 hrs were recorded (Table-4, fig-10).

3. Alkaline phosphatase

Male: - A highly significant (P<0.001) increase in alkaline phosphatase was recorded at 24hrs of the treatment. Thereafter a highly significant (P<0.001) decrease in the activity of alkaline phosphatase was recorded at 12 and 48 hrs after the treatment (Table-4, fig-11).

Female: - There was a highly significant (P<0.001) increase in the activity of alkaline phosphatase at 24 hrsand decrease the level of alkaline phosphatase on 12 and 48 hrs(Table-4, fig-11).

4. ATPase

Male: - A continuous increase of ATPase level which was highly significant (P<0.001) at 12,24 and 48 hrsafterthe treatment (Table-4, fig-12).

Female: - Experimental result analysis similar as in males (Table-4, fig-12).

Treatment with Deltamethrin and Carbofuran were found potentially effective, quantitative estimation of biochemical parameters viz. Protein, Cholesterol, Alkaline phosphatase and ATPase in the gonads of *Chrotogonustrachypterus.*

Table1:-Effect of various concentrations of Deltamethrin and Carbofuran on female and male adults of *Chrotogonustrachypterus*at 24hrs

Treated Insecticides	Sex	No. of Insects	Dose (ppm)	Dead	Survived	Survived at this & greater dose Sg	Died at this & Smaller Dose Ds	Sg + Ds	Percentage
Deltamethrim (Pyrethroid)	F	10	400	1	9	27	1	28	3.57
	F	10	800	2	8	18	3	21	14.29
	F	10	1100	4	6	10	7	17	41.18
	F	10	1200	6	4	4	13	17	76.47
	F	10	1300	10	0	0	23	23	100.00
	M	10	200	2	8	18	2	20	10.00
	M	10	400	6	4	10	8	18	44.44
	M	10	550	7	3	6	15	21	71.43
	M	10	600	8	2	3	23	26	88.46
	M	10	750	9	1	1	32	33	96.97
Cabofuran	F	10	0.4	1	9	31	1	32	3.13
	F	10	0.1	1	9	22	2	24	8.33
	F	10	0.12	2	8	13	4	17	23.53
	F	10	0.16	6	4	5	10	15	66.67
	F	10	0.2	9	1	1	19	20	95.00
	M	10	0.2	1	9	28	1	29	3.45
	M	10	0.5	1	9	19	2	21	9.52
	M	10	0.6	3	7	10	5	15	33.33
	M	10	0.8	8	2	3	13	16	81.25
	M	10	0.1	9	1	1	22	23	95.65

Table 2:- LC_{50} values of Carbofuran and Deltamethrin for both sexes of *Chrotogonustrachypterus* at 24 hrs

Treated Insecticide	Sex	LC_{50}	95 % Confidence limit	
			Upper Limit	Lower limit
Carbofuran	Female	2.498	3.112	2.004
	Male	1.711	1.932	1.623
Deltamethrin	Female	22.06	24.06	7.81
	Male	14.26	17.16	11.84

Table 3:- Biochemical alterations of Deltmethrin on gonads of *Chrotogonustrachypterus* (Blanchard) in control and treated groups.

Parameter	Sex	Group	Time in hrs. after treatment		
			12	24	48
Protien (mg./g.)	**Male**	**Control**	61.13 ± 0.5189	58.46 ± 0.7261	62.1 ± 1.5977
		Treated	74.44 ± 0.6739***	81.88 ± 0.9165***	100.15 ± 0.4739***
	Female	**Control**	43.53 ± 1.1951	54.22 ± 0.4453	61.3 ± 0.5258
		Treated	53.34 ± 0.6478**	64.48 ± 1.8014**	76.64 ± 0.2577***
Cholesterol (mg./g.)	**Male**	**Control**	10.47 ± 0.2738	10.2 ± 0.4618	11.36 ± 0.1677
		Treated	21.06 ± 0.085***	18.18 ± 0.0272***	25.7 ± 0.3381***
	Female	**Control**	8.34 ± 0.1963	9.36 ± 0.1853	9.03 ± 0.0957
		Treated	19.64 ± 0.1399***	17.3 ± 0.2477***	23.41 ± 0.0969***
Alkaline Phosphatase (mgpi/gm./hrs.)	**Male**	**Control**	4.23 ± 0.055	4.16 ± 0.0408	3.08 ± 0.0386
		Treated	2.16 ± 0.0708***	2.94 ± 0.1905**	1.74 ± 0.3139*
	Female	**Control**	3.79 ± 0.2046	3.01 ± 0.1603	3.2 ± 0.0944
		Treated	1.58 ± 0.1905**	3.02 ± 0.4289NS	0.38 ± 0.2578***
ATPase (mgpi/gm./hrs.)	**Male**	**Control**	41.85 ± 0.7159	41.41 ± 0.245	42.16 ± 0.0196
		Treated	72.1 ± 0.4903***	121.46 ± 0.5195***	147.08 ± 0.072***
	Female	**Control**	42.17 ± 0.4769	45.62 ± 0.2851	46.4 ± 0.5076
		Treated	81.96 ± 0.417***	81.47 ± 0.6351***	151.51 ± 0.2944***

Each value represent - Mean±S.E. Significance level – Control vs. Treated NS = Non significant
*P<0.05 = Significant **P<0.01 = More significant ***P<0.001 = Highly significant

Table 4:- Biochemical alterations of Carbofuran on gonads of *Chrotogonustrachypterus* (Blanchard) in control and treated groups.

Parameter	Sex	Group	Time in hrs. after treatment		
			12	24	48
Protien (mg./g.)	**Male**	**Control**	50.24 ± 0.5037	50.18 ± 0.0287	51.34 ± 0.2694
		Treated	58.56 ± 0.2234***	62.56 ± 0.6608***	68.4 ± 0.3103***
	Female	**Control**	50.34 ± 0.5416	50.13 ± 0.0558	52.15 ± 0.0589
		Treated	56.16 ± 0.0752***	58.12 ± 0.0517***	65.24 ± 0.0944***
Cholesterol (mg./g.)	**Male**	**Control**	8.81 ± 0.0027	7.84 ± 0.1362	7.64 ± 0.113
		Treated	17.84 ± 0.0054***	16.21 ± 0.0027***	17.97 ± 0.0276***
	Female	**Control**	6.88 ± 0.026	6.68 ± 0.0876	7.71 ± 0.0844
		Treated	16.21 ± 0.0027***	17.83 ± 0.0136***	17.55 ± 0.0216***
Alkaline Phosphatase (mgpi/gm./hrs.)	**Male**	**Control**	3.1 ± 0.1292	2.91 ± 0.1016	3.19 ± 0.2975
		Treated	0.8 ± 0.2876**	1.85 ± 0.0857**	1.34 ± 0.2103**
	Female	**Control**	4.07 ± 0.0798	3.9 ± 0.0566	3.17 ± 0.0196
		Treated	1.14 ± 0.0288***	1.52 ± 0.0792***	1.03 ± 0.0384***
ATPase (mgpi/gm./hrs.)	**Male**	**Control**	27.25 ± 0.4696	29.76 ± 0.1933	29.85 ± 0.0236
		Treated	60.15 ± 0.0558***	122.04 ± 0.0054***	132.4 ± 0.174***
	Female	**Control**	29.97 ± 0.0249	30.41 ± 0.162	31.17 ± 0.0249
		Treated	59.43 ± 0.1787***	120.48 ± 0.2749***	140.52 ± 0.2655***
Each value represent - Mean±S.E. Significance level – Control vs. Treated NS = Non significant *P<0.05 = Significant **P<0.01 = More significant ***P<0.001 = Highly significant					

Fig. 1:- Effect of Deltamethrin on protein level in gonads of *Chrotogonustrachypterus*

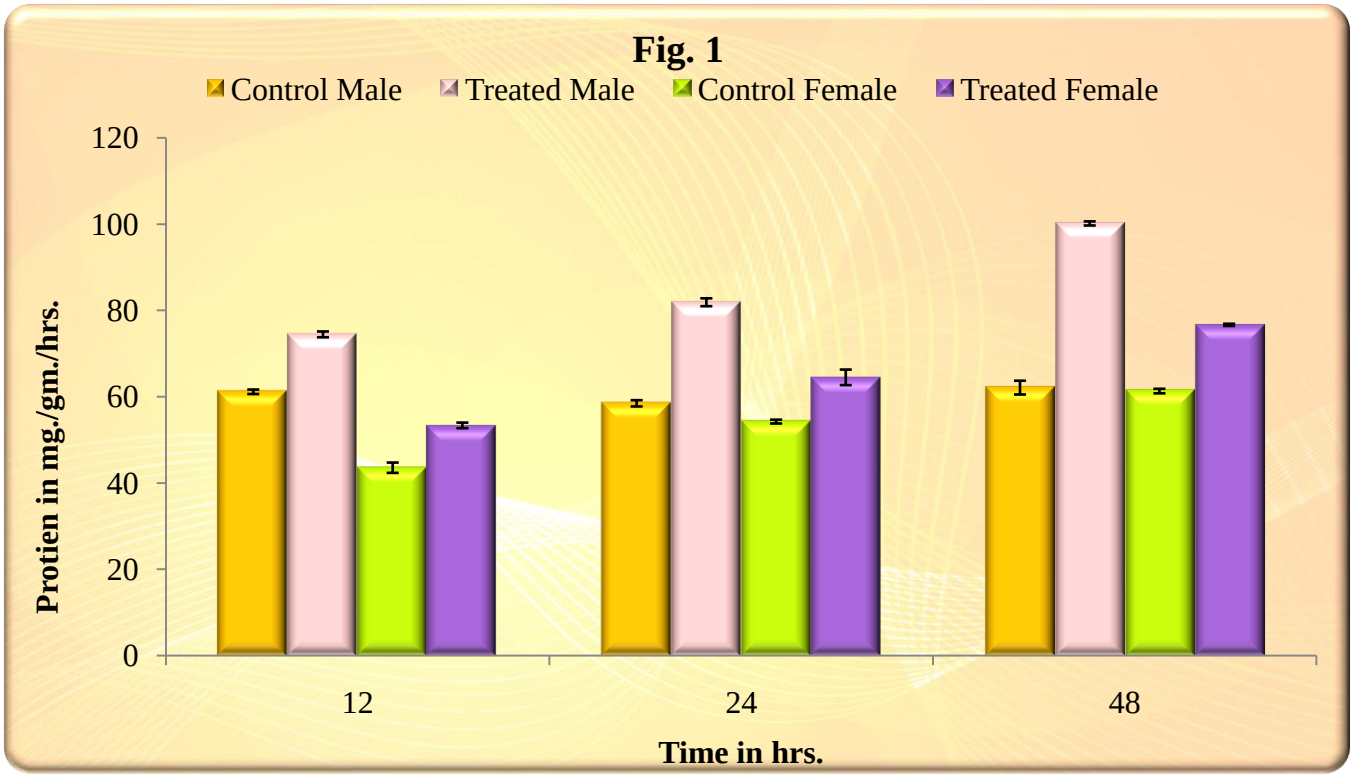


Fig. 2:-Effect of Deltamethrin on Cholesterol level in gonads of *Chrotogonustrachypterus.*

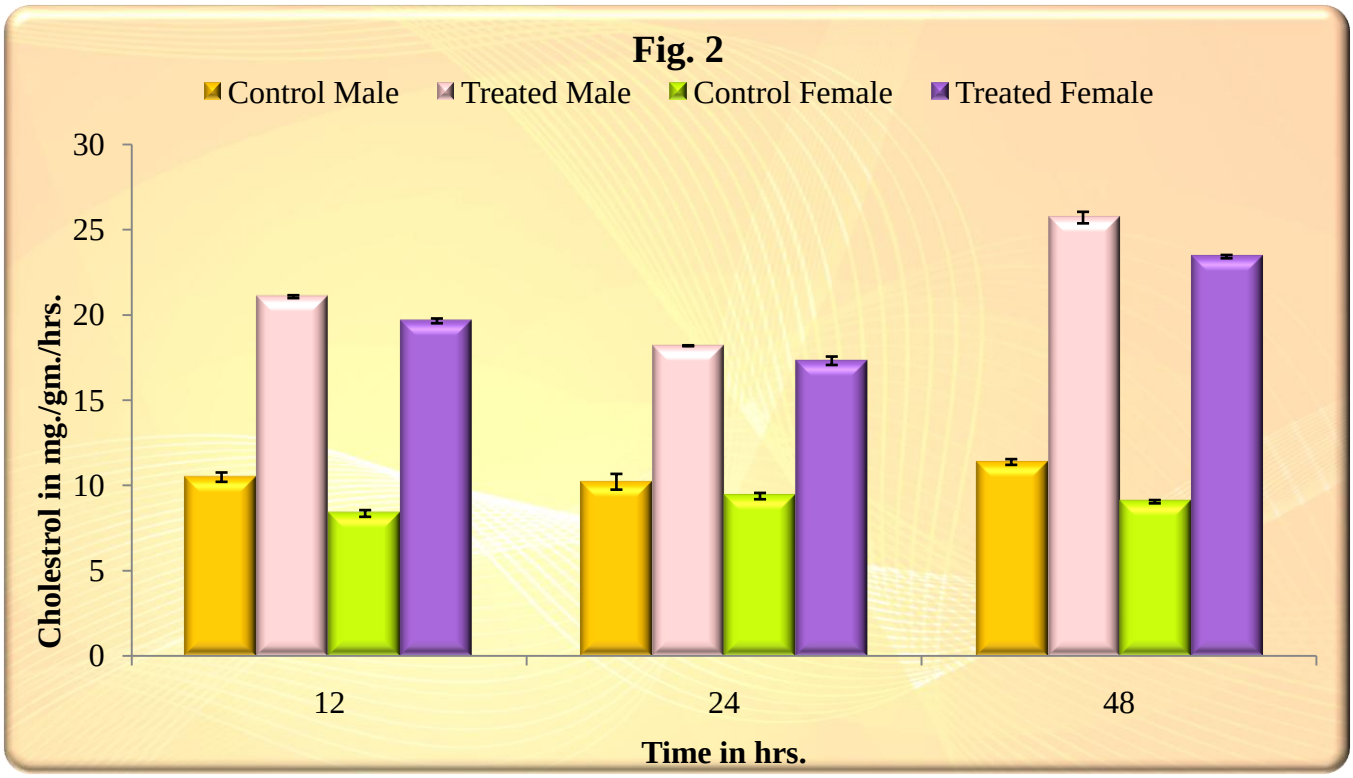


Fig. 3:-Effect of Deltamethrin on Alkaline Phosphatase level in gonads of *Chrotogonustrachypterus.*

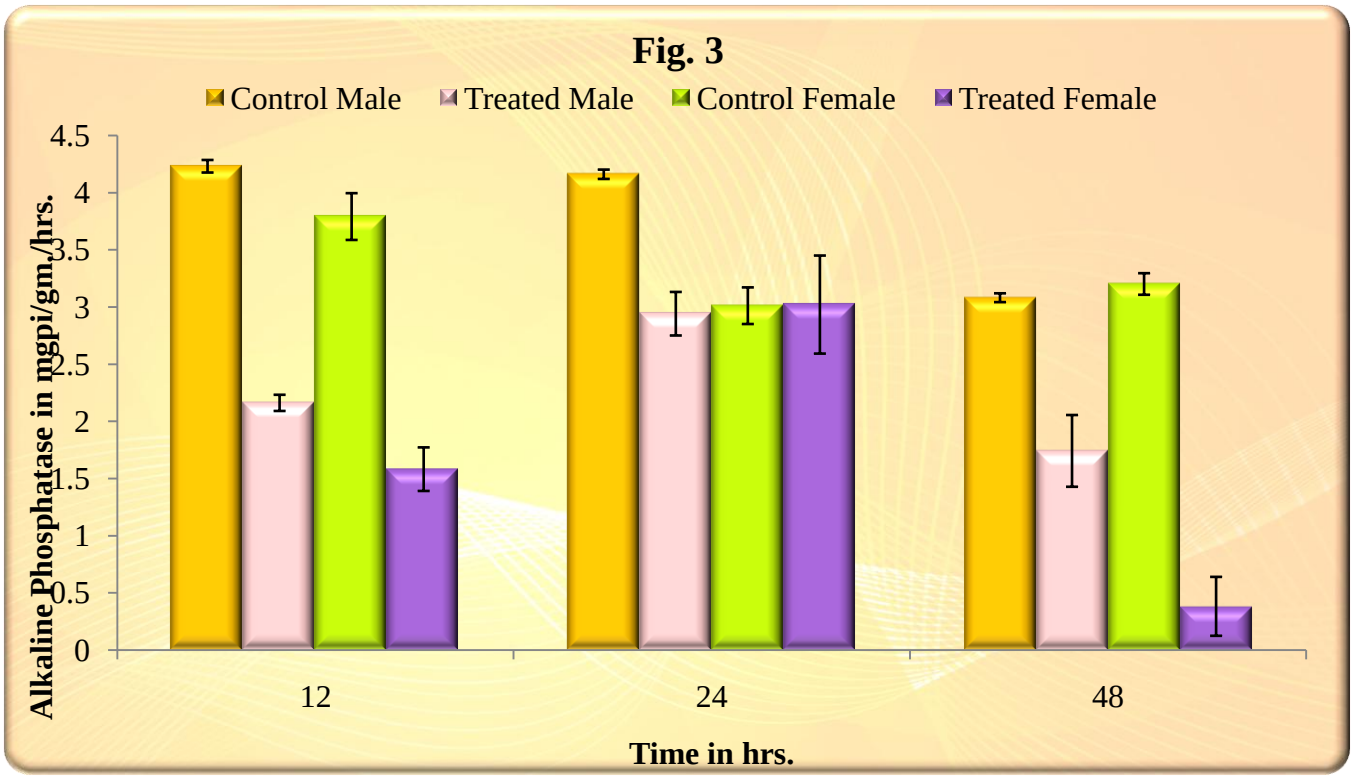


Fig. 4:-Effect of Deltamethrin on ATPase level in gonads of *Chrotogonustrachypterus*

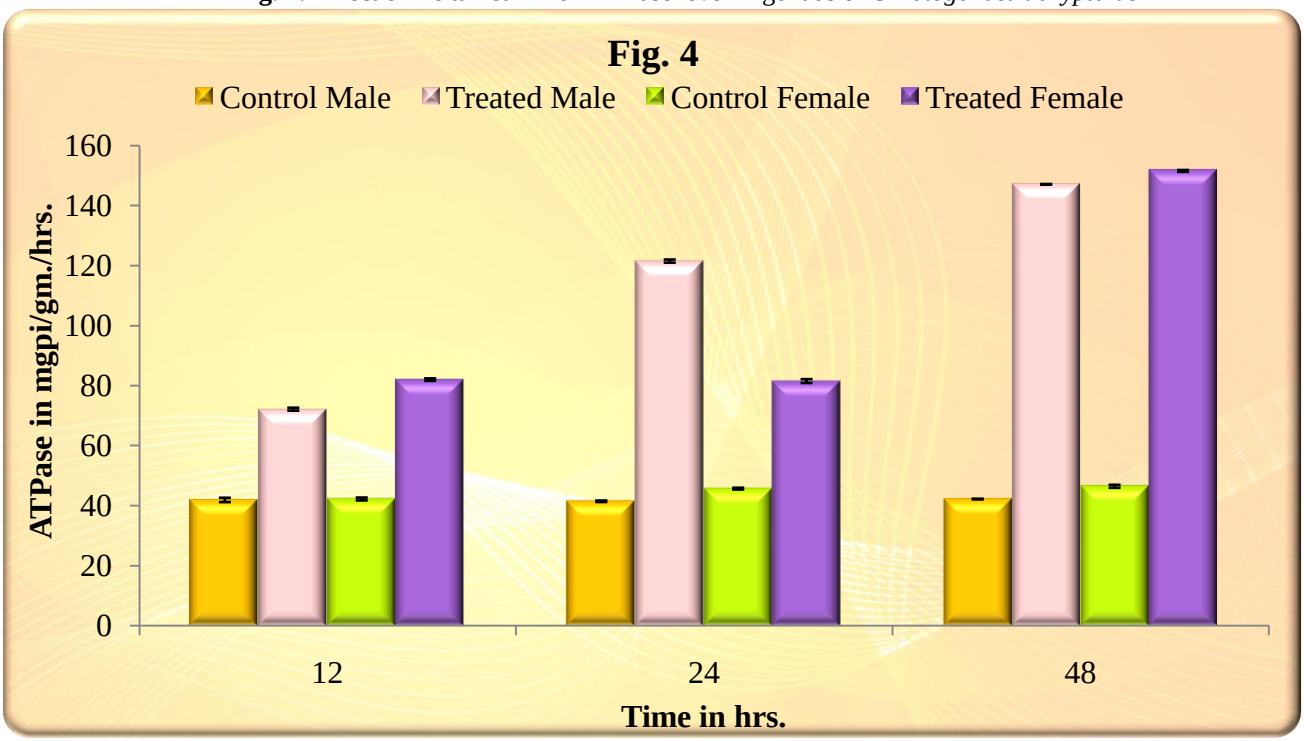


Fig. 5:-Effect of Carbofuran on protein level in gonads of *Chrotogonustrachypterus*

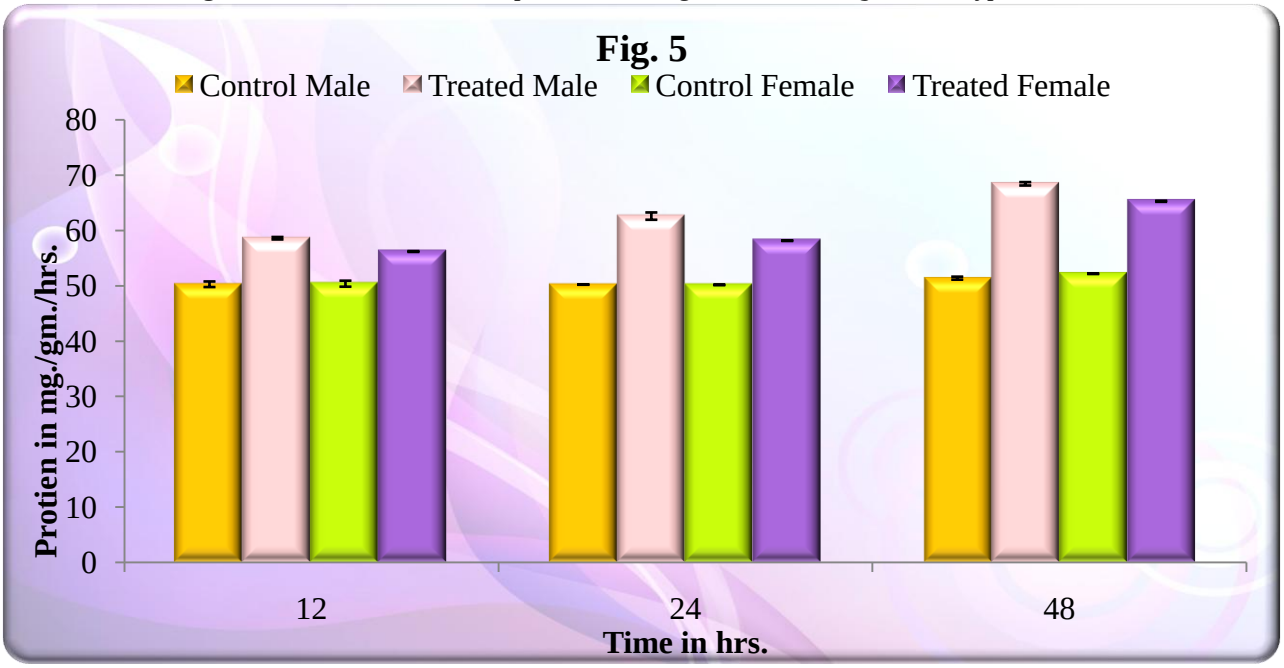


Fig. 6:- Effect of Carbofuran on Cholesterol level in gonads of *Chrotogonustrachypterus.*

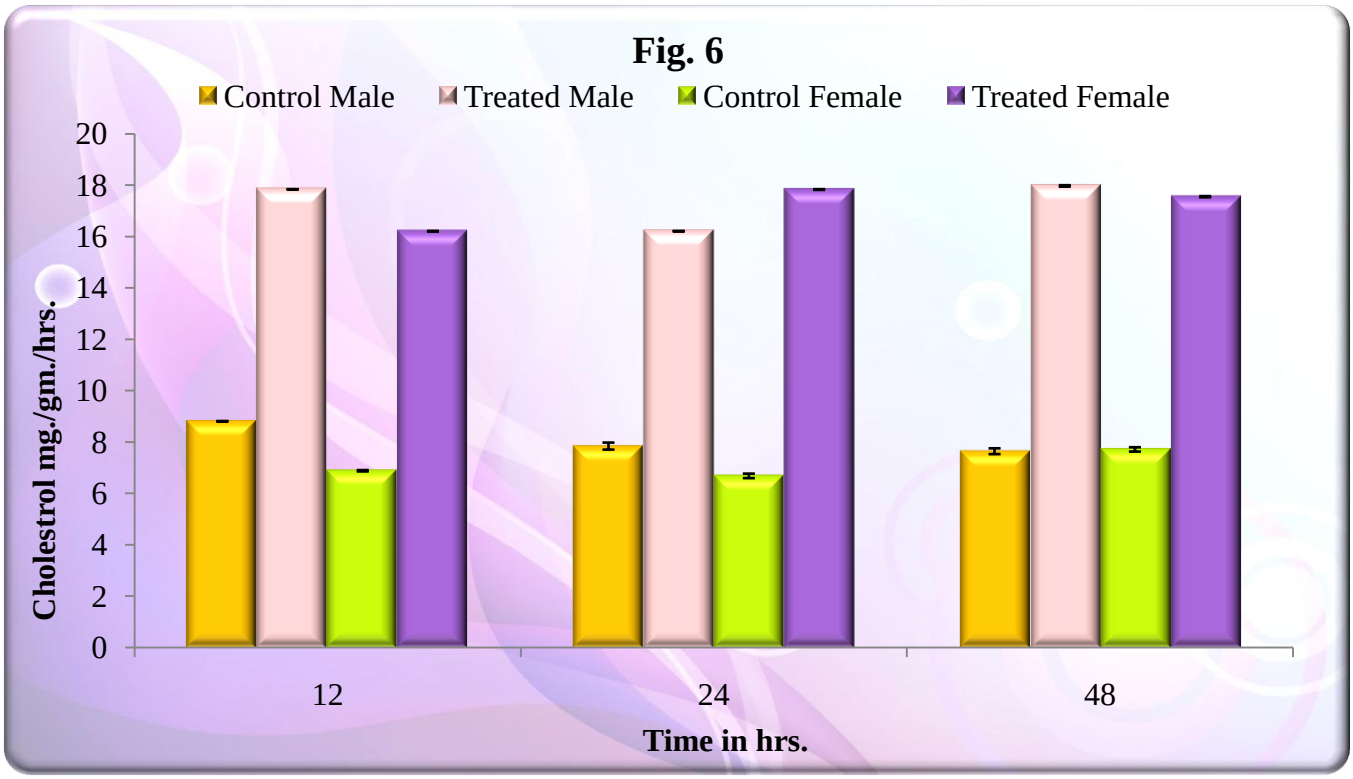


Fig. 7:-Effect of Carbofuran on Alkaline Phosphatase level in gonads of *Chrotogonustrachypterus.*

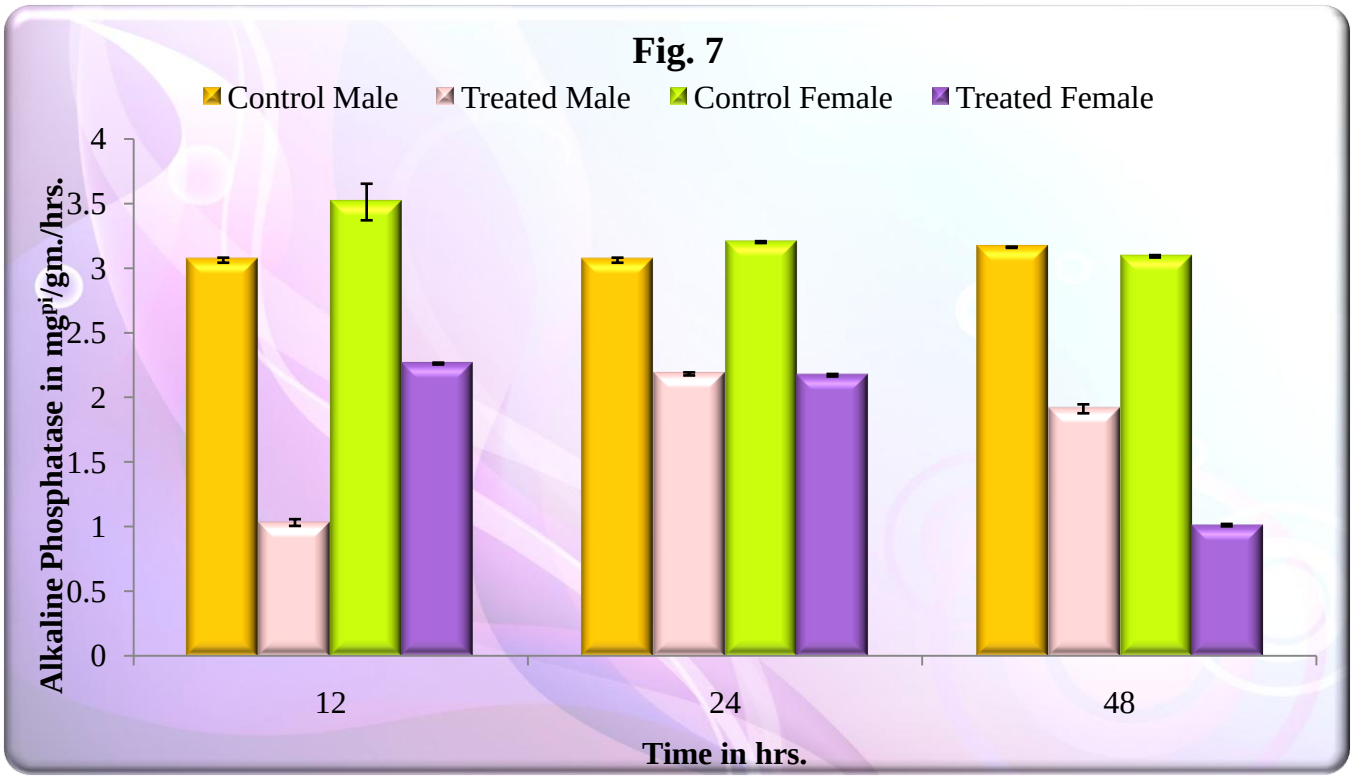
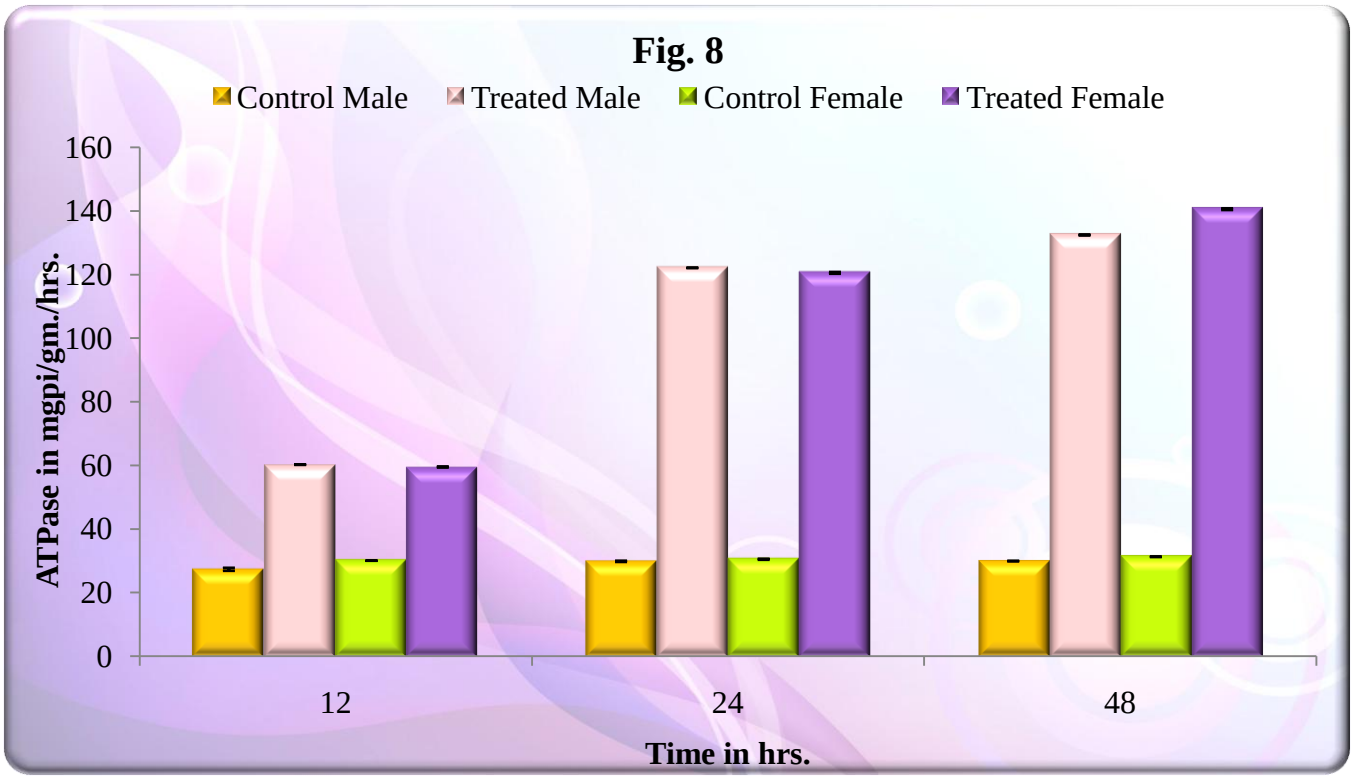


Fig. 8:-Effect of Carbofuran on ATPase level in gonads of *Chrotogonustrachypterus.*



Discussion:-

Potential Toxicology:-

Toxicity of insecticides is highly dependent on the duration, frequency, intensity of exposure and the susceptibility of the target organism which is influenced by age, sex, fitness and genetic variation. The tested insecticides, Deltamethrin andCarbofuranexhibited a fair degree of contact toxicity on female and male adults of *Chrotogonustrachypterus*. LC_{50} values (24 hrs.) for Deltamethrin and Carbofuranon female and male*Chrotogonustrachypterus* were 22.069 ppm, 14.263 ppm and 2.498 ppm, 1.711 ppm respectively.Observation findings emphasis that male adults were more susceptible to compounds than female adults. Results directly reflected that more mortality of male *Chrotogonustrachypterus* also reduce the fertility. Earlier observations revealed that the LC_{50} value of Monocrotophos 36 SL and Cypermethrin 25 EC against female and male adults of *Chrotogonustrachypterus* by dipping method, were 353.9 ppm, 151.0 ppm and 33.11 ppm, 16.38 ppm respectively (Shakeet P. and Bakshi S., 2009).Jangir N. and Bakshi S. (2011) also observed that Fenvalerate (85.52 ppm) is more toxic than Chlorpyrifos (349.9 ppm). Present findings also supported byChoudhary*et al*. (2000), that Fenvalerate (pyrethroid) were more toxic than chlorpyrifos(phosphate) when they investigate relative toxicity of insecticides against *Acrotylushumbertianus* grasshopper. Toxicity on subterranean termite *Coptotermesformosanus* were determined on Deltamethrin(pyrithroid) LD_{50} was most toxic and Chlordane least toxic (Su, Nan- Yao *et al*., 1990). According to Blair D.Siegfrid (1993), the acute toxicity of three pyrthroids (permethrin, cypermethrin,bifenthrin) greater than one organophosphate insecticide (chlorpyrifos).RadkaDobsikova (2003), revealed that test of acute toxicity with Carbofuran confirmed the high toxicity of the chemical to selected species of aquatic organism than terrestrial organism. According to NitinSood and Sharma D C (2004), synthetic pyrethroids have higher persistent toxicity than neemderivaties. Experimental results also exhibit both the insecticides have shown to be consistent effective in controlling *Chrotogonustrachypterus* in field crops.The present findings derive ample support in pest management and saving the crops against damage from the pest *Chrotogonustrachypterus*. Conclusion of the present investigation analyse that the carbamates are more toxic than synthetic pyrethroids and organophosphates. Potential effect of toxicity on insecticides were -

Chlorpyrifos (349.9 ppm) <Monocrotophos (151.0 ppm) <Fenvalerate (85.52 ppm) <Cypermethrin (16.38 ppm) <Deltamethrin (14.26) <Carbofuran (1.71) (Table - 2)

Biochemical Parameters:-

Protein:-

Current study results summarize *Chrotogonustrachypterus* treated with sub-lethal dose of Deltamethrin and Carbofuran exhibited hyperproteinemia or increase the protein level in both sexes till 48 h when the experiment was terminated. Smitha and Rao (2010), evaluate sublethal dose of selenium on silk worms showed significantly increase in females at 12hrsafter treatment and also showing hyperproteinemia on all exposure periods.The effect of *Bacillus thuringiensis* var. *kurstaki* on biochemical alteration in haemolymph found protein content increase in experiment (Tripathi and Singh, 2002). Toxicant influence of Fenvalerate the proteins and glycogen levels totally decreased in various tissues of *Channapunctatus* (Bloch) (Satyavardhan, 2010). Biochemical alterations after effect of sub-lethal doses (176.95 and 75.5 ppm) of Monocrotophos on gonads of female and male *C.trachypterus* as protein, cholesterol and alkaline phosphatase decrease and ATPase level increase (Shakeet and Bakshi, 2010a). Deltamethrin induced a significant decline in serum total protein concentration, albumin and globulin at third day of first, second and fourth week after application of Deltamethrin in buffaloes (El Nabarawy., 2008). Histochemical results revealed that animals given Carbofuran had decreased contents of carbohydrates and total proteins in the testicular tissue. Treating mice with Carbofuran and vitamin C showed an improvement in testicular damage (Wael M. Al-Amoudi, 2012). Significantly reduced total head protein after 24, 48, and 72 h treated of *Ageratum conyzoides* L. and *Artemisia vulgaris* (L.) in third and fourth instar larvae of *Spodopteralitura* (Renuga and Sahayaroj, 2009).

Cholestrol:-

Earlier observation of Shakeet and Bakshi (2010b), effect of Cypermethrin on biochemical parameters on gonads of *C.trachypterus* as the protein, cholesterol, acid phosphatase and ATPase increase in level and decrease the level of alkaline phosphatase. Current results showed that cholesterol level was highly significantly ($p<0.001$) raised at 12, 48 hrsand slightly decline at 24 hrs after exposed to Deltamethrin and Carbofuran in both sexes. The effects of sub-lehtal doses of Cypermethrinon the sixth instar larvae of *T. castaneum* (Saleem*et al.*, 2005) the high cholesterol level on gonads of *L. augur* parasitized by *H. vishwakarma.* Level of cholesterol level significantly increased in mice after exposure of carbosulfan and adverse effects on liver functions leading tophysiological impairment (R.L. Ksheerasagar1, M.B. Hiremath and B.B. Kaliwal, 2011).It is expected that the changes in the cholesterol level in the tissue may contribute to the dis-functioning of hormonal balance due to disturbed metabolism and affecting reproduction.

Alkaline Phosphatase;-

A non-significant increase in alkaline phosphatase activity treated with Deltamethrin at 24 hrs was recorded in female adults and significantly declined ($p<0.01$) at 12, 24 and 48 hrsin male adults. While after application of Carbofuran, highly significantly ($p<0.001$) increase in alkaline phosphatase level at 12 and 48 hrsin male adults and slightly flucations at 24 hrs in both sexes. Spinosad caused depletion in alkaline phophatase activity while increase in acid phosphatase activity in treated *T. castaneum* (Hussain, 2009).Methomyl (carbamate) induced gonadal dysfunction, biochemical contents and enzyme activities in male albino mice.Biochemical studies of testis and epididymis showed methomyl at doses of 2, 3 and 4mg/kg/day and in 4 mg/kg /day for 10 and 20 days ofmethomyl treatment caused significant decrease in the levels of DNA, RNA, protein, glycogen and sialic acid whereas cholesterol increased significantly and alkaline phosphatase and ATPase decreased (Manawadi S.I. and Kaliwal B.B., 2010).

ATPase (Adenosine Triphosphatase):-

The activity of the energy enzyme ATPase obtained highly significant increase in both the sexes treated with Deltamethrin and Carbofuran. The finding of the present investigation reveals that enough energy is consumed during metabolism due to the effect of the Deltamethrin since an increase in the activity of ATPase. Helena Cristina Da Silva de Asis*et al*., (2009) found that Deltamethrin inhibited the activity of gills and heart Na^+- K^+ ATPase,, induced liver total CYP 450 as well as the liver EROD activity.

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