Research Journal of Applied Sciences 8 (2): 139-142, 2013
ISSN: 1815-932X


# Effect of Malathion on Biochemical Alterations in *Corcyra cephalonica*

Mohammad Ismail Ansari, Nisar G. Patel and Prakash T. Wankhedkar
P.G.&Research Center, Department of Zoology, Pratap College Amalner,
Dist. Jalgaon (M.S.), India

**Abstract:** The present research is carried out to observe the biochemical effect of Malathion on the glucose, glycogen and protein levels. The effects of $LC_{50}$ of commercial malathion (Hindustan Insecticide Ltd.) $C_{10}H_{19}O_6PS_2$ were tested in the laboratory on the larvae of rice moth *Corcyra cephalonica*. The rice moth *Corcyra cephalonica* (Stainton) (Lepidoptera-Pyralidae) is an important stored grain pest in Asia and South America. Its larval stages causes serious damage to rice, gram, sorghum, maize, ground nut, cotton seeds, peanuts, linseeds, raisins, nutmeg, chocolates, biscuits, wheat, coffee, cocoa, beans and milled products. Already contaminated or damaged stored food grains by *C. cephalonica* were collected from Dhule Dist. Maharashtra State, India and were reared in the laboratory conditions. The standard culture of this insect was maintained in the laboratory on normal dietary medium composed of coarsely ground jowar (Sorghum vulgare) mixed with 5% (w/w) yeast powder at 26±1°C and 93±5% Relative Humidity (RH). Young Corcyra larvae hatched out from the egg within 3-4 days and fed on the grains by webbing. The larval period lasted about 20-25 days and pupation took place inside the web itself moths start emerging after 35-40 days.The objective was to examine the changes in carbohydrate (glucose and glycogen) and protein contents. The larvae were released on treated as well as normal dietary medium. After 24 h 50% mortality was found at 8 ppm dose level. Then, 1/5th of $LC_{50}$ concentration were mixed with dietary medium and allowed larvae to feed for 168 h the surviving larvae were taken for estimation of glucose, glycogen and protein. After treatment lived larval bodies were used for estimation of carbohydrate (glucose and glycogen) and protein content. Recovery changes were also noted in the remaining lived larvae after 168 h of normal feeding. It was found that the concentration of glucose in normal, treated and recovery samples were 900 μg, 550 μg and 720 μg $mL^{-1}$, respectively while glycogen was 800 μg, 500 μg and 650 μg $mL^{-1}$, respectively and protein was 200 μg, 320 μg and 290 μg $mL^{-1}$, respectively.

**Key words:** *Corcyra cephalonica*, glucose, glycogen, protein, pesticide, malathion

## INTRODUCTION

The rice moth *Corcyra cephalonica* (Stainton) (Lepidoptera-Pyralidae) is an important stored grain pest in Asia and South America. The only recognized species of this genus is *Cephalonica*. Ayyar made the first record of *Corcyra cephalonica*. Its larval stages causes serious damage to rice, gram, sorghum, maize, ground nut, cotton seeds, peanuts, linseeds, raisins, nutmeg, chocolates, biscuits, wheat, coffee, cocoa, beans and milled products (Atwal, 1976; Piltz, 1977; Cox *et al*., 1981; Allotey and Kumar, 1985; Allotey, 1991).

According to an FAO study, 13 million tons of grain lost due to insects or 100 million tons failure to store properly (Wolpert, 1967). Influence of certain organochlorines, organophosphates and synthetic pyrethroids has also been reported against the ontogeny as well as larval biochemistry of this pest (Tiwari and Bhatt, 1987, 1992, 1994a-c, 1999a, b, 2000; Tiwari and Tripathi, 2001, 2006).

In the present study, malathion has been selected as one of the organophosphate to control the stored cereal pest rice moth *Corcyra cephalonica*. Hence, as an objective of such program the present research has been designed and conducted to investigate the effect of Malathion on some biochemical aspects of *Corcyra cephalonica*.

## MATERIALS AND METHODS

The larvae of rice-moth *C. cephalonica* were used in the present study. Already contaminated or damaged stored food grains by *C. cephalonica* were collected from Dhule Dist. and were reared in the laboratory conditions. The standard culture of this insect was maintained in the laboratory on normal dietary medium composed of coarsely ground jowar (Sorghum vulgare) mixed with 5% (w/w) yeast powder at 26±1°C and 93±5% Relative Humidity (RH). Young Corcyra larvae hatched out from

**Corresponding Author:** Mohammad Ismail Ansari, P.G.&Research Center, Department of Zoology, Pratap College Amalner, Dist. Jalgaon (M.S.), India

the egg within 3-4 days and fed on the grains by webbing. The larval period lasted about 20-25 days and pupation took place inside the web itself, moths start emerging after 35-40 days.

A commercial malathion (Hindustan Insecticide Ltd.) with empirical formula of $C_{10}H_{19}O_6PS_2$ was used for this study. Stock solution was prepared by dissolving a measured amount in solvent and then desired concentrations were made. Then, the dietary medium mixed and treated separately with 9 different dose levels of stock solution and one control group. The larvae of *C. cephalonica* were transferred to these dietary medium in different petridishes and allowed to feed. Each petridish consisted of 20 larvae after 24 h of time interval the dead and live larvae were recorded. $LC_{50}$ value was found at 8 ppm dose levels of Malathion. The 1/5th concentration of the $LC_{50}$ value was mixed with the dietary medium allowed larvae to feed for 168 h. After 168 h lived larvae (whole body) were taken from petridish for estimation of glucose and glycogen by DNSA Method and protein by Biurette Method. Remaining lived larvae were transferred to normal dietary medium for recovery. After 168 h the changes in glucose, glycogen and protein contents were estimated by same procedure as described earlier.

DNSA reagent was prepared just before use went through the procedure and took reading at 540 nm of normal (control), treated and recovery samples. Similarly proteins were estimated by Biurette Method went through the procedure, took reading at 540 nm of normal (control), treated and recovery samples by spectrophotometer (Systronics 106) and graph were plotted.

## RESULTS AND DISCUSSION

In the present study, an attempt has been made to study the effect of malathion on some biochemical alterations in the larvae of *C. cephalonica*. It was observed that the $LC_{50}$ value was found at 8 ppm concentration level of malathion after 24 h. Then treatment with 1/5 th concentration of $LC_{50}$ were given to another fresh larvae group for 168 h. After treatment lived larval bodies were used for estimation of carbohydrate (glucose and glycogen) and protein content. Recovery changes were also noted in the remaining lived larvae after 168 h of normal feeding. It was found that the concentration of glucose in normal, treated and recovery samples were 900 μg, 550 μg and 720 μg $mL^{-1}$, respectively while glycogen was 800 μg, 500 μg and 650 μg $mL^{-1}$, respectively and protein was 200 μg, 320 μg and 290 μg $mL^{-1}$, respectively.

The results shows that glucose and glycogen content were found to be normal in the larvae which were fed on normal diet while pesticidal (malathion) treatment caused an overall decrease after recovery it was found that there was some elevation in the concentration of glucose and glycogen in the larvae of *C. cephalonica*. The Fig. 1 shows the concentration of the glucose and glycogen contents in the normal, treated and recovery samples.

Similarly, the protein content was also found to be normal in the larvae which were fed on normal diet while pesticidal treatment caused an overall increased in protein content. Recovery treatment showed that the protein content in the larvae gradually decreased as compared to the treated larvae.

The present investigation showed that different dose level of malathion affects different biochemical cycles. The toxicity of malathion increases significantly with the sincrease in its concentration. Malathion at 1/5th concentration of $LC_{50}$ reduced the concentration of glucose and glycogen while the concentration of protein content increased. It means malathion altered the carbohydrate and protein metabolism in the larvae of *C. cephalonica*. Reduction in carbohydrate was attributed to its utilization at the time of high energy demand warranted due to altered metabolism (Mansingh, 1972; Ahamed *et al*., 1978; Reddy and Rao, 1982; Chockalingam *et al*., 1988; Machale *et al*., 1991). Utilization of protein at the time of depletion of carbohydrate, deranged protein synthesis and proteolysis were attributed for the reduction in protein level (Maheswari and Sehgal, 1981; Reddy and Rao, 1982; Bharathi and Govindappa, 1987; Chockalingam *et al*., 1988). Subba (1985) studied the effects of organophosphates (quinalphos and monocrotophos) and a pyrethroids (sumicidin) on the protein metabolism in the haemolymph of *Periplaneta americana*. Researchers reported that the total protein content increased for 2 h following treatment and then declined. In another study Rajender (1985) reported, the effects of quinalphos and organophosphates on the metabolism of the nerve tissues of *P. americana* and he found that after 24 h and there

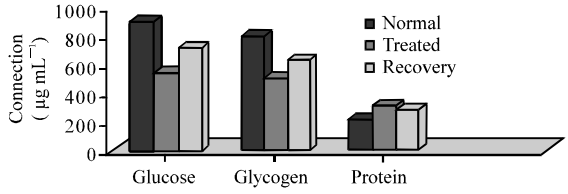


Fig. 1: Concentration of glucose, glycogen and protein

was a decrease in the total carbohydrate, glucose and glycogen content vis a vis a simultaneous increase in protein, free amino acid and total RNA. According to Hussain *et al.* (2009), the soluble protein contents increased significantly at $LC_{10}$ and decreased insignificantly at $LC_{20}$ in adult beetles of *Tribolium castaneum*. Morya *et al.* (2010) studied the effect of powdered leaves of *Lantana camara*, *Clerodendrum inerme* and *Citrus limon* on physiological parameters like Total Haemocyte Count (THC), total protein content and glycogen level. They found that there was significant reduction in the THC (39-53%), protein (30-38%) and glycogen (40-61%) content in the treated larvae of rice moth *C. cephalonica*with respect to their controls. Subba (1985), Rajender (1985), Hussain *et al.* (2009) and Morya *et al.* (2010) supports the present investigation. The carbohydrate metabolism has been found influenced the glucose and glycogen content of the larvae were found decreased and protein content was found increased by pesticidal treatment. The observation reveals that the lethality of pesticide is directly proportional to their concentration present in diet. The present observations corroborate with various researchers who observed the reduction in carbohydrate contents and increase in protein content in different test animals.

## CONCLUSION

From the results described above it is concluded that the malathion at the sub lethal dose (1/5th concentration of $LC_{50}$) altered some biochemical cycles, the levels of carbohydrate (glucose and glycogen) contents were reduced and the protein content was found to be increased in the larvae of *C. cephalonica*.

## REFERENCES


Ahamed, I.K., M.R. Begum, S. Sivaiah and K.V.R. Rao, 1978. Effect of malathion on free aminoacids, total proteins, glycogen and some enzymes of palecypod *Lamellidens marginallis* Lamarck. Proc. Indian Acad. Sci., 87: 377-380.

Allotey, J. and R. Kumar, 1985. Competition between *Corcyra cephalonica* (Stainton) and *Ephestia cautella* (Walker) in Cocoa beans. Insect Sci. Appl., 6: 627-632.

Allotey, J., 1991. Development and fecundity of the rice-moth, *Corcyra cephalonica* (Pyralidae). Discovery Innovation, 3: 123-126.

Atwal, A.S., 1976. Agricultural Pests of India and South East Asia. Kalyani Publishers, New Delhi, India, pp: 502.

Bharathi, D. and S. Govindappa, 1987. Effect of carbaryl on the organic constituents of hemolymph of the blister beetle *Mylabris pustulata*. Environ. Ecol., 5: 65-70.

Chockalingam, S., K.P.S. Jeyachandran and B. Shanthy, 1988. Effect of sub lethal concentrations of dairy effluent on the biochemical constituents in the nymphs of dragon fly *Brachythermis contaminate*. Pollut. Res., 7: 23-28.

Cox, P.D., L.A. Crawford, G. Gjesturd, C.H. Bell and C.R. Bowley, 1981. The influence of temperature and humidity on the life cycle *Corcyra cephalonica* (Stainton) (Lepidoptera: Pyralidae). Bull. Entomol. Res., 71: 171-181.

Hussain, R., M. Ashfaq and M.A. Saleem, 2009. Biochemical abnormalities produced by spinosad in *Tribolium castaneum* adult beetles. Int. J. Agric. Biol., 11: 241-244.

Machale, P.R., A.K. Khan and R. Sarojini, 1991. Biochemical changes induced by cuprous oxide in the various tissues of the freshwater crab, *Barytelphusa guerinii*. J. Adv. Zool., 12: 115-120.

Maheswari, S.C. and S.S. Sehgal, 1981. Effect of Tepa on nucleic acid and protein content in the developing red cotton bug *Dysdercus koenigii* Fabr. Indian J. Entomol., 43: 341-347.

Mansingh, A., 1972. Effects of farnesyl methyl ether on carbohydrate and lipid metabolism in the tent caterpillar *Malacosoma pluvial*. J. Insect Physiol., 18: 2251-2264.

Morya, K., S. Pillai and P. Patel, 2010. Effect of powdered leaves of *Lantana camara*, *Clerodendrum inerme* and *Citrus limon* on the rice moth, *Corcyra cephalonica*. Bull. Insectol., 63: 183-189.

Piltz, H., 1977. *Corcyra Cephalonica* (Staint.). In: Diseases Pests and Weeds Tropical Crops, Kranz, J., H. Schumutterer and W. Koch (Eds.). Verlag Paul Parey, Berlin and Hamburg, Germany, pp: 439-440.

Rajender, K., 1985. Effect of quinalphos on the metabolism of nervous tissue of cockroach, *Periplaneta americana*. Assess. Environ. Pollut. Proc. Natl. Symp., 5: 113-119.

Reddy, G.S. and A.P. Rao, 1982. Biochemical studies on the haemolymph and heart muscle of normal and insecticide treated cockroach *Periplaneta americana L.* Proc. Anim. Sci., 91: 481-486.

Subba, R.O., 1985. Effect of certain insecticides on protein metabolism in the haemolymph of cockroach, *Periplaneta americana*. Assess. Environ. Poll. Proc. National Symp., 5: 107-112.

Tiwari, S.K. and C.P.M. Tripathi, 2001. Toxicity of temephos against the ontogeny of rice-moth, *Corcyra cephalonica* (Staint.) (Lepidoptera: Pyralidae). J. Adv. Zool., 22: 126-128.

Tiwari, S.K. and C.P.M. Tripathi, 2006. Tetramethrin induced toxicity against the ontogeny of rice-moth, *Corcyra cephalonica* (Staint.) (Lepidoptera: Pyralidae). Uttar Pradesh J. Zool., 26: 227-229.

Tiwari, S.K. and R.S. Bhatt, 1987. Effect of B.H.C. and Malathion on the developmental stages of the rice-moth *Corcyra cephalonica* (Staint.) (Lepidoptera: Pyralidae). Z. Angew. Zool., 4: 83-89.

Tiwari, S.K. and R.S. Bhatt, 1992. Toxicity of monocrotophos against the ontogeny of rice-moth, *Corcyra cephalonica* (Staint.). J. Applied Res., 3: 197-198.

Tiwari, S.K. and R.S. Bhatt, 1994a. Toxicity of methoxychlor against the ontogeny of rice-moth, *Corcyra cephalonica* (Staint.) (Lepidoptera: Pyralidae). Uttar Pradesh J. Zool., 14: 52-54.

Tiwari, S.K. and R.S. Bhatt, 1994b. Toxicity of dimethoate against the ontogeny of rice-moth, *Corcyra cephalonica* (Staint.) (Lepidoptera: Pyralidae). Bull. Life Sci., 4: 101-103.

Tiwari, S.K. and R.S. Bhatt, 1994c. Toxicity of chlordane against the ontogeny of rice-moth, *Corcyra cephalonica* (Staint.) (Lepidoptera: Pyralidae). Z. Angew. Zool., 80: 199-203.

Tiwari, S.K. and R.S. Bhatt, 1999a. Cypermethrin and fenvalerate induced toxicity against the ontogeny of rice-moth, *Corcyra cephalonica*. Bull. Life Sci., 9: 19-24.

Tiwari, S.K. and R.S. Bhatt, 1999b. Effect of barthrin on the developmental stages of rice-moth, *Corcyra cephalonica* (Staint.) (Lepidoptera: Pyralidae). J. Adv. Zool., 20: 103-105.

Tiwari, S.K. and R.S. Bhatt, 2000. Dichlorvos and phosphamidon induced toxicity against the ontogeny of rice-moth, *Corcyra cephalonica* (Staint.) (Lepidoptera: Pyralidae). Uttar Pradesh J. Zool., 20: 37-40.

Wolpert, V., 1967. Needless losses: Far Eastern Economical. Review, 55: 411-412.