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Haematological Alterations in *Dysdercus koenigii* Following Controlled Microwave Radiation Exposure

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Abstract: The changes in total hemocytes count, Differential haemocyte count and haemolymph volume after exposure to microwaves for 2,4,8, and 10 hours on 5-day old male *Dysdercus koenigii* have been studied. The observation shows that there is significant reduction in THC and DHC in adult *Dysdercus* with the increase in duration of exposure. However, the reduction in haemolymph volume with the increase in exposure duration is not significant.
Keywords: Microwaves, total haemocyte count, differential haemocyte count, haemolymph volume, *Dysdercus koenigii).*

INTRODUCTION

In insects there is only one extra cellular fluid which circulates within the body and is called the haemolymph (Florkin & Jauniaux, 1964). Haemolymph consist of fluid plasma and blood cells- the haemocytes. The plasma of haemopymph of insect consist of 1.5 per cent carbohydrates, 5.6 per cent protein, 1.5 per cent lipid and nucleated cells - haemocytes which remain suspended in it. Several different types of blood cells occur and the number also varies considerably in circulation, sometimes due to real change in the number present, but also because they may adhere in large number to various tissues so that they do not circulate (Jones 1962,67, Nappi &Staffolano, 1972 a). It has been frequently demonstrated that the number changes markedly during development stages (Jones 1965, Hoffman 1970), the fluctuation in the number has also been correlated with feeding habits (Jones1962), adverse condition and during physiological events (Bahadur & Pathak 1971), introduction of foreign particles (Roosenberger & Jones 1960). Ondracek *et al.,* (1977, 1984) studied dielectric properties of insect and reported that change in potential causes mortality in insects. Effect of electric shocks have been studied on the haemocytes of *Dysdercus koenigii* and it was reported that the haemocytes increased initially up to 24 hrs., but then showed a gradual decline (Madhu Sharma 1985). Robert *et al.,* (1973) have shown that *Rhizopertha* can be controlled by the combination of gamma, infrared, and microwaves radiation. Tilton (1966) and Tilton & Schroeder (1963) have shown that gamma and infrared radiation can be used as alternative method for pest control in insects. Rawat (1993) have reported that *Trogoderma granarium* can be controlled with microwave irradiation.

In the present studies an effort is made to study the effect of microwave exposure on the haemoplymph volume and haemocytes of male *Dysdercus koenigii,* an important cotton pest in the world.

MATERIAL AND METHOD

The bugs were reared in the laboratory at 28 ± 1°C and 15 male insects of 5-day age were exposed for 2,4, Sand 10 hrs. to microwaves with Klystron source. The haemolymph volume of the insect was measured by Amaranth dye dilution method (Bhargava and Gupta 1977). Total haemocyte count (THC) per mm^3 in irradiated insects was calculated using the method of Wheeler; Jones classification was used for identification of haemocytes. However, for differential haemocyte count (DHC) - prohaemocytes (germinal cells) and plasmatocytes (phagocytic cells) only were taken into consideration Wheeler's method was adopted for estimating the differential haemocyte count. Absolute number of haemocytes was calculated by combining the data of total haemocyte count and haemolymph volume.

RESULT AND DISCUSSION

Table: 1

Duration of Exposure in Hours	THC mm^3	DHC in %		Haemolymph Volume in µl	Absolute Number of Haemocytes
		Prohaemocyte	Plasmatocyte		
0 (Normal)	12,300 ±200	38	70	18 ±0.50	2,40,000
2	10,200 ±100	30	65	18 ±0.30	2,10,000
4	9,1 00 ±300	27	58	17±1.00	1,96,000

8	7,300 ± 500	24	49	16 ±0.70	1,87,000
10	4,200 ±300	16	42	16 ±0.20	1,72,000

The results are tabulated in table 1. In the case of control males THC was 12300 ± 200. The studies on the irradiated insects revealed that after 2 hrs. of exposure THC reduces to 10200 ± 100, at 4 hrs. of exposure THC reduces to 9100 ± 300. At 8 and 10 hrs. Of exposure the decline in the number of THC was 7300 ± 500 and 4200 ± 300 respectively.

The studies on DHC showed that prohaemocyte percentage in control insect was 38.

At 2 hrs. Of exposure the decrease in percent prohaemocyte was from 38 to 30. At 4 hrs. exposure the decline in percent prohaemocyte has been noted to be 27. At 8 and 10 hrs. of irradiation, the percent prohaemocyte obtained was 24 and 16 respectively. Accordingly, the plasmatocyte percentage decreases from 70 in normal to 65 at 2hrs., 58 at 4 hrs., 49 at 8 hrs., and 42 at 10 hrs. of irradiation.

The change in haemolymph volume was not significant. It was found that haemolymph volume was 18 ± 0.30 µI at 2 hrs., 17 ± 1.00 µIat 4 hrs., 16 ± 0.70 µIat 8 hrs. and 16 ± 0.20 µI at 10 hrs. exposure to microwaves.

The result for absolute number of haemocytes revealed that in case of normal the number was 2,40,000. After 2 hrs. exposure to microwaves the number decreases to 2,10,000. At 4 and 8 hrs. Of irradiation the decline in absolute number of haemocytes was 1,96,000 and 1,87,000 respectively. The decline in absolute number of haemocytes up to 1,72,000 was reported after 10 hrs. of microwaves exposure.

DISCUSSION

Haemolymph of most insects is a clear, colorless fluid. Usually, the haemocytes increases during the period of active growth and decreases just prior to ecdysis. The proportion of the different cell types often changes during life cycle Many workers have claimed different reasons for the change in number of haemocytes. (Jones 1965, Hoffman 1970; Bahadur & Pathak 1971; Tilton *et al.*, (1960) Tilton & Schroeder (1963); Bhargava et al (1977) Rawat (1993) and Warchalemski (2000). The present studies revealed that the males of 5-day age, after exposure to microwaves showed gradual decrease in THC and DHC with the increase in exposure time. However, the change in volume was not very significant (P<0.001) The reduction in THC of an insect after exposure to microwaves was significant (PC 0.01). With the increase in exposure duration the THC has shown reduction to 25 percent at 4 hrs. and 67 percent at 10 hrs. of exposure.

On the increase in duration of exposure to microwaves, the percent amount of prohaemocyte and plasmaotocyte have shown significant reduction in number. However, the prohaemocytes were always less than plasmatocytes.

The reduction in absolute number of haemocytes was also observed, the reduction in number was in proportional to increase in exposure time.

The reduction in THC & DHC can be attributed to the change in dielectric potential in haemolymph or because of increase in temperature causing electronic imbalance in chemical constituents of haemolymph. Nebson (1998) have reported the potential use of RF & microwave dielectric properties in pest control especially for stored grain pest. Birla (2004) used radio frequency for pest control. Vincent (2003) reported that minor alternation in physical properties can be helpful in management of agriculture insect. The studies on effect of gamma radiation on life stages of Mediterranean flour, moth *Ephestiakuchriella* by Ayvaz (2006) have revealed that insects can be controlled by this measure. The 80% mortality have been reported by Reddy ,((2006) by low energy electron radiation treatment in *Callososbrucnuschinensis.*

Hence, the decline in THC and DHC after 8 and 10 hrs. Of irradiation was statistically significant (P<0.01) in male *Dysdercus koenigii.* During studies high mortality was observed after 8 and 10 hrs. of irradiation.

REFERENCES

1. Ayvaz Abdurrahman and TuncbiIekS. Aydin,2006, Effect of Gamma radiation on stages of Mediterranean flour moth. Ephestiekuchriellazeller(Lepidoptera : Pyrahdae) *of Pest Science* vol. 79 (4) : 215-222.
2. Bahadur, J., and Pathak, J.P.N. (1971) Changes in total heamocyte counts of the bug, Halya *dentata* under certain specific conditions. *J. Insects Physiology 17: 329-334.*
3. Bhargava, S., and Gupta. S. (1977) Hematological studies on the Red cotton Bug, Dysdercus *koeniqii Curr. Sci, 46: 17*
4. Birla S.L., Wang S., Tang J., and Mailman G., (2004) Improving heating uniformity of fresh fruit in radio frequency treatments for pest control. *Post harvest Biology & Technology* 33 (205-217)

5. Florkin, M. and Jauniaux, C. (1964) Heamolymph : composition, in Rockstein, *M. The physiology of Insecta, Vol. 3. Academic Press, New York.*
6. Hoffman, J.A., (1970) Regulations endocrines de la production et de la differentiation des heamocytes chez un Insects orthoptera :*Locustamiqratoria. Gen. Comp. Endorinol.,* 198-219.
7. Jones, J.C. (1962). Current concepts concerning insect haemocytes, *Amer.* zoo/., 2 : 209-246.
8. Jones, J.C (1965), The haemocytes of *RhodniusorolixusStal. Biol. Bull. Mar Lab.,*
9. *woods Hole* 129 : 282-294
10. Jones, J C. (1967a) Estimated changes within the haemocyte populations during the last larval and early pupal stage of *Sarcophagabullata J. Insect. Physiol.13:* 645-646.
11. Jones, J.C. (1967b) Normal differential counts of haemocytes in relation to ecdysis and feeding in *Rhodnius. J. Insect Physiol.* 13: 1133-1141.
12. Nappi, A.J., and Staffolano, J.G , Jr., (1972a). *J. Insect Physiol.* 18 : 169
13. Roosenberger, C.R., and Jones, J.C., (1960) Studies on total blood cell counts of the sourthermarmyworn larva,
14. *Pnodenaevidenia*(Lepidoptera), *Ann. Ent. Sec Amer*44 – 351-335
15. Wheeler, R.E., (1963) Haemocytes count in *Periplaneta*during the moulting cycle J. *Insect PhysioL,* 9 : 233-235.
16. Madhu Sharma 1985. *Ph.D Thesis* Effect of dielectric potential on *Dysdercus koenigii* submitted to *Rajasthan University, Jaipur.*
17. Nebson S.V. Bartley P.G.. Jr., Lawrence K.C. (1998) RF & Microwave dielectric properties of store grain insect and their kitptattont for potential pe« control. *ASAE,* 41 (3) 685-692
18. Ondracek J., and B. Brunnnofer (1984) Dielectric, properties of insect tissues.*Gen* Physiol. Biophys. 3, 251-257.
19. Ondracek J. (1977) Effects of electromagnetic field radio wave region on insects.*Ph. D.* thesis. *Institute of Entomology Czechoslovak Academy of Sciences. Prague (in Czech).*
20. Reddy Rani P.V., Todorik. S.,Miyanoshita A., Imamura, T. and Hayashi. T. (2006) Effect of soft electron treatment on adzuki bean weevil, *Callisobrucnuschinensis*(Col. Bruchidae). *Journal of Applied Entomology* 130 (6-7) 393-399.
21. Rawat K, (1993) Ph.D. Thesis, Effect of microwaves on various biological activities of Trogoderma *granarium. MDS University, Ajmer.*
22. Robert L Kirkpatrick, John H. Brower and Elvin W. Tilton (1973) Gamma, Infra-red and microwaves radiation combinations for control of *Rhyzopertha dominica*in wheat. *J. Stored* Prod. Res. 9, 19-23.
23. Tilton E. W. and Schroeder H. W. (1963) Some effects of infrared irradiations on the mortality of immature insects in kernels of rough rice. J. *econ.Ent. 56, 727-730.*
24. Tilton E.W., Burkholder, W.E. and Cogbum R.R. (1966) Effects of gamma radiations on *Rhyzopertha dominica, Sitophilusoryzae, Tribolium confusum*and *Lasioderma serricome. J. econ.Ent.* 59. 1363-1368.
25. Tilton E.W., Brower J.H., Brown G. A. and Kirkpatrick R.L (1972) Combination of gamma and microwaves radiation for control of the Angoumois grain moth in wheat *J. econ. Ent.* 65, 531-533.
26. Vincent Charles ; Hallman O.G., Pannetess B., and LessardFleuratFranus (2003) Management of Agriculture insect with physical control methods. *Annual Review of Entomology* Vol. 48 : 261-281
27. Warchalemski J. R..Pradzyuskao A, Gralik. J, Nawrot J, (2000) The effect of gamma and microwaves irradiation of wheat grain in the development parameters of stored grain pest. *Wind.Lek.;*53 (9-10) 599-81 11198929
28. Wilson Michael, Roberts Terry and MiyamotaJunshi (2004) Optimising Pesticide use. *John Wiley end Sons Ltd.*