International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Oxygen Consumption in Male and Female of "Red Pumpkin Beetle", *Aulacophora Foveicollis* (Chrysomelidae, Coleoptera)

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Abstract: ***Aulacophora foveicollis, commonly called "red pumpkin beetle" belongs to family Chrysomelidae of the insect order Coleoptera. It is a serious pest of vegetables belonging to family Cucurbitaceae. The oxygen consumption in adult male and female insects of the species, Aulacophora foveicollis were investigated by water displacement method. It was found that O2 consumption in females is greater than in males.***

Keywords: *Aulacophora foveicollis*, O_2 consumption, water displacement method.

1. Introduction

Aulacophora foveicollis, commonly called "red pumpkin beetle", is an insect of family Chrysomelidae and order Coleoptera. It is a serious pest of vegetables belonging to the family Cucurbitaceae e.g. pumpkin or kaddu (*Cucurbitapepo*, Cucurbita maxima), ghia tori (Luffacylindrica), kheera (Cucumissativus), water melon (Citrulus vulgaris), etc. The adults of red pumpkin beetle are 5-8 mm long and 3.4-3.75 mm broad. The body is coloured brilliant red dorsally and black ventrally. The adults feed on the leaves, flowers and buds of younger plants and damage them.

2. Materials and Methods

Aulacophora foveicollis, commonly called "red pumpkin beetle", is found in abundance on the leaves, flowers and buds of host plants, namely pumpkin or kaddu, ghia-tori, cucumber, water melon, etc. For the present work this insect was collected from kaddu plants, grown in NandlalChhapra village, situated south of New Bypass Road, Patna. The collected insects were kept in breeding chambers in the laboratory for constant supply of insects for experiments. Every morning the insects were provided with fresh leaves, flowers and tender shoots of the host plant, kaddu for feeding.

To estimate the volume of oxygen consumed by each of the adult insects of *Aulacophora foveicollis* the water displacement method was employed. This method is based on the theory that due to inspiration of oxygen, there is usually oxidation of carbohydrates and there is formation and expiration of same volume of CO_2 by the insect. This CO_2 is absorbed by KOH (Potassium hydroxide) placed inside the conical flask. This causes a partial vacuum in the flask. This vacuum is filled by the water in which the graduated capillary tube is dipped. This capillary tube remains connected with the flask in which the experimental insect is present.

The apparatus for the experiment was prepared by taking a capillary tube, about 25 cm long with a right angled bend at one end. The short stem of this bend was passed through a hole in cork fitted into a small conical flask. A very small pot was hanged by the cork inside the flask, half way down the conical flask. Carefully soda lime (KOH) was placed in the pot to absorb CO_2. Another end of the capillary tube was attached to a graduated capillary tube with the help of a rubber tube. This graduated capillary tube was dipped in a dye.

To start the experiment weighed insects were kept inside the conical flask and initial rise of water level in the graduated capillary tube was noted. After one hour again the water level was noted. The difference of the two readings was considered to be the volume of oxygen consumed by the insect. This volume was converted into the volume of O_2 at standard temperature and pressure by employing the following formula:

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

P_1 = Pressure
V_1 = Volume
T_1 = Temperature
} At standard Temperature and Pressure

P_2 – Pressure
V_2 = Volume
T_2 = Temperature
} At Laboratory Temperature and Pressure

The data so collected was statistically analysed to know mean and standard error of mean (SEM).

3. Observation

All activities of the living organisms including insects require energy. This energy is obtained by the oxidation of assimilated food, particularly carbohydrates (glycogen) and fats of the insect body. For oxidation the required O_2 is taken up by insects during inspiration. In oxidation of assimilated food O_2 is used and energy is liberated, along with the

formation of CO_2 and H_2O as by products. The volume of O_2 consumed by the insects was calculated by the water displacement method. The volume of O_2 per hour per mg of body weight at laboratory temperature and pressure was noted and later converted into the volume of O_2 at standard temperature and pressure (S.T.P.) as shown in Table-I and II.

A group of 23-25 male insects and 20-25 female insects were taken separately in previously measured plastic jars with mosquito net cover and the jars containing insects were weighed to find out the weights of insects.

(i) Weight of jar with net cover = 6.400 gm
Weight of 25 male insects with jar = 7.180 gm
Weight of 25 male insects = 7.180 gm – 6.400 gm or 0.780 gm or 780 mg

(ii) Weight of jar with net cover = 6.400 gm
Weight of 20 female insects with jar = 6.880 gm
Weight of 20 female insects = 6.880 gm – 6.400 gm or 0.480 gm or 480 mg

The weights of insects, both male and female were repeated thrice to ascertain the mean weight of the insects.

To know the amount of oxygen consumed by the insects in one hour the following observation and calculation were made from the experiments designed for the purpose.

Initial rise of water level in the graduated capillary tube was 0.86 ml.

Rise of water level after one hour was 0.87 ml.

Volume of O_2 consumed by insects in one hour = 0.87-0.86 ml or 0.01 ml.

Further calculations are shown in Table-I and II for the male and female insects respectively. It appears from the data that the consumption of O_2 is greater in female than that in male.

Table I: Oxygen Consumption in Male *Aulacophora foveicollis*

Sl. No.	No. of insects	Body wt. in mg	O_2 consumption in ml per hour	O_2 consumption in ml per mg per hour at room temperature & pressure	O_2 consumption in ml per mg per hour at S.T.P.
1	25	780	0.01	0.0000128	0.0000153
2	23	710	0.01	0.0000140	0.0000168
3	25	780	0.01	0.0000128	0.0000153
Mean	24.33	756.67	0.01	0.0000132	0.0000158
SEM	0.54	19.05	0.00	0.00000033	0.00000041

Table II: Oxygen Consumption in Female *Aulacophora foveicollis*

Sl. No.	No. of insects	Body wt. in mg	O_2 consumption in ml per hour	O_2 consumption in ml per mg per hour at room temperature & pressure	O_2 consumption in ml per mg per hour at S.T.P.
1	20	480	0.01	0.0000208	0.0000250
2	25	510	0.01	0.0000196	0.0000235
3	25	510	0.01	0.0000196	0.0000235
Mean	23.33	500	0.01	0.000020	0.0000240
SEM+	1.36	8.16	0.00	0.00000033	0.00000041

4. Results and Discussion

Like all other animals insects require oxygen for oxidation of assimilated food to liberate energy for activities of the body. The oxygen requirement varies from insect to insect and in the same insect in male and female.

In *Aulacophora foveicollis*it was found that the oxygen consumption in female is greater than in male. Similar results have been reported in *Antheraea mylitta* by Singh, Tripathi and Sinha (1992).

Wriggles worth (1965) reported the sexual difference regarding O_2 consumption in the insects of the same species. Kemp et al. (2004) found that in megachilid bee, *Osmialignaria* Say (*Hymenoptera; megachilidae*) in over wintering adults there is stepwise increases in O_2 consumption throughout wintering period irrespective of the sex.

Bahan, Reena et al. (2010) reported that oxygen consumption in male and female of lady bird beetle, *Coccinellaseptempunctata* (Coccinelidae, Coleoptera) differed and the O_2 consumption in female was greater than that in male as in the present case.

Njoroge et al. (2018) correlated the oxygen consumption with acoustic activity in *Callosobruchus maculates* during hermetic storage.

5. Acknowledgement

The authors are thankful to Prof. (Dr.) NandipatiTiwari, Head of the Department of Zoology, College of Commerce, Patna for providing laboratory facilities for the present work.

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