



Study of oxygen consumption in male and female of "Ladybird beetle", *Coccinella Septempunctata* (Coccinellidae, Coleoptera)

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Abstract

Coccinella septempunctata is a common vegetable pest. The oxygen consumption in adult male and female insects of this species were investigated. It was found that in adult stages O_2 consumption in female is greater than in male

Keywords: *Coccinella septempunctata*, O_2 consumption, water displacement method.

Introduction

Coccinella septempunctata, commonly called ladybird beetle, belongs to family-Coccinellidae of insect order Coleoptera. They are very beneficial group of insects, being natural enemies of many agricultural pests, especially aphids and other creatures that damage plants by feeding on their sap. A single ladybird beetle can consume vast quantities of aphids in its lifetime, perhaps as many as 5,000 or more. *C.septempunctata*, the seven spotted ladybird beetle, sometimes called 'C-7' is a medium sized, orange coloured beetle with seven black spots on its elytron. Both adults and larvae are well known primarily as predators

of aphids (plant lice), but they prey also on other pests such as soft scale insects, mealy bugs, spider mites, etc. A few feed on plant and pollen mildews. *C. septempunctata* may be a more effective predator than some active ladybird beetle species, displacing them in some areas.

The adults are comparatively large (7-8mm) with a white or pale spot on either side of the head. The body is oval, and dome shaped. The spot pattern is usually 1-4-2, black on the orange or red forewings. Larva is dark and alligator like with three pairs of prominent legs, growing to 7-8mm in length. Eggs are spindle shaped and small, about 1 mm long

Materials and Methods

Coccinella septempunctata is found in abundance as a pest on the leaves of vegetable plants belonging to the family Solanaceae e.g. brinjal (*Solanum melongena*), potato (*Solanum tuberosum*), tomato (*Lycopersicon esculentum*), etc.

The insects were collected from brinjal plants grown in Saidpur area of Patna. The insects were kept in breeding chamber in the laboratory for constant supply of materials for experiments. Every morning the insects were provided with fresh leaves and tender shoots of the host plants.

To estimate the volume of oxygen consumed by each (male and female) insect of *C. septempunctata* in adult stage, the water displacement method was employed. This method is based on the theory that due to inspiration of oxygen the same volume of CO₂ is expired by the individuals. This CO₂ is absorbed by the KOH (placed inside the conical flask) which causes a vacuum and this vacuum will be filled by the water in which the graduated capillary tube is dipped.

To prepare this apparatus, capillary tube about 25 cm long, with a right angled bend at one end was taken. The short stem of this bend passes through a hole in cork fitted into the mouth of 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 CO₂. Another end of capillary tube was attached to a graduated capillary tube with help of 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 and the difference of these two readings was considered to be the volume of oxygen taken by the insect. This volume was converted into the volume of oxygen at standard temperature and pressure employing the formula.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Where

P ₁ = Pressure	At Standard
V ₁ = Volume	
temperature and pressure	
T ₁ = Temperature	At laboratory
P ₂ = Pressure	
V ₂ = Volume	
temperature and Pressure	
T ₂ = Temperature	

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

Observation

All activities of the living organisms including insects require energy. This energy is liberated by the oxidation of assimilated food, particularly Carbohydrates (glycogen) and fats of the insect body. For oxidation the required O₂ is taken up by insects during inspiration. In oxidation of assimilated food O₂ is used and energy is produced, along with the formation of CO₂ and H₂O as byproducts. The volume of Oxygen consumed the insects was estimated by water displacement method. The volume of O₂ per hour pering of body weight at laboratory temperature and pressure was calculated and later converted into the volume of O₂ at standard temperature and pressure (S.T.P.) as shown in Table I & II.

A group of 40 male and 40 female insects were taken separately in the previously measured plastic jar with net cover and the jars containing insects were weighed to find out the weight of insects.

i) Weight of jar with net cover = 6.400 gm

Weight of 40 male insects & jar = 7.800 gm
 Weight of 40 male Insects = 7.800 - 6.400

= 1.400 gm or 1400 mg

ii) Weight of jar with net cover = 6.400 gm

Rise of water level after one hour 0.86 ml

Weight of 40 female insects & jar = 7.350 gm

Volume of O₂ consumed by insects in one hour

Weight of 40 female Insects = 7.350-6.400

(0.87-0.86) ml 0.01 ml

= 0.950 gm or 950 mg

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

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 O₂ is greater in female than in male.

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

Initial rise of water level in the graduated capillary tube 0.87 ml

Results and Discussion

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

Table1: Oxygen consumption in Male *Coccinella septempunctata*.

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 per mg per hour at S.T.P.
1	40	1400	0.01	0.000007	0.0000084
2	40	1400	0.01	0.000007	0.0000084
3	40	1050	0.01	0.000009	0.0000108
Mean ±	40	1283.33	0.01	0.000008	0.0000092
SEM ±	0.00	95.26	0.00	0.0000005	0.0000007

In *Coccinella septempunctata* it has been found that the O₂ consumption in female is greater than in male le there is sexual difference regarding O₂

consumption. Similar results have been reported in *Antheraea mylima* by Singh, Tripathi and Sinha (1992).

Table-1: Oxygen consumption in Male *Coccinella septempunctata*.

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 per mg per hour at S.T.P.
1	40	950	0.01	0.0000105	0.0000126
2	40	950	0.01	0.0000105	0.0000126
3	40	800	0.01	0.0000125	0.0000150
Mean ±	40	900	0.01	0.0000112	0.0000134
SEM ±	0.00	40.82	0.00	0.0000005	0.0000007

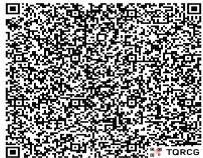
Wigglesworth (1965) reported the sexual difference regarding O₂ consumption in the insects of the same species. Kemp et al. (2004) found that in megachilid bee, *Osmia lignaria* Say (Hymenoptera: Megachilidae) in overwintering adults there is a step wise increases in oxygen consumption throughout wintering period irrespective of the sex.

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