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ZOOLOGY

SOME ANATOMICAL FEATURES IN THE RESPIRATORY SYSTEM OF *CHILOLOBA ORIENTALIS* D & R (COLEOPTERA: SCARABAEIDAE)

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Abstract

Chiloloba orientalis D & R is an economically important pest on bajra *(Pennisetum typhoides Rich),* Jowar *(Sorghum vulgare Pers)* crops. This study will be the basis for a future comparative examination of the internal anatomy of Scarabaeid beetle. The respiratory system shows a typical tracheo-spiracular system with the air-sacs. The air-sacs are quite distensible and collapsible. The air-sacs are specially pronounced in insects, which are the most active ventilators.

Keywords: *Chiloloba orientalis*, *Pennisetum typhoids* (Rich), *Sorghum vulgare* (Pers), pest, Examination

Introduction

The ventilatory system is involved with the transport of oxygen to the various tissues of the insect body and the transport of carbon dioxide from them. The anatomy of the tracheo-spiracular system of Chioloba or/entails has been studied with a view to gain an understanding of its relation with the environment of this beetle.

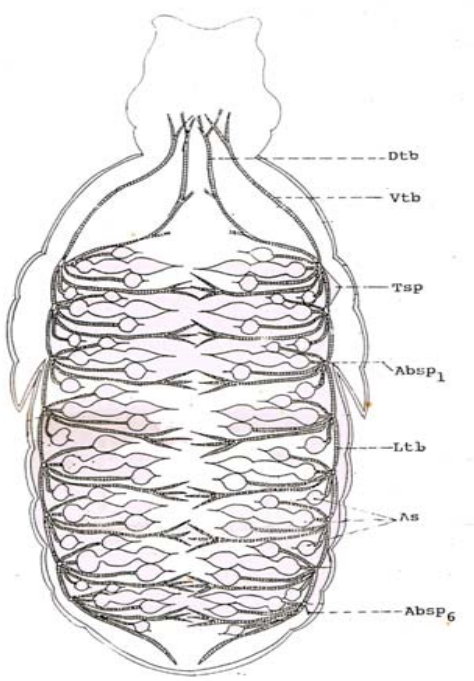
Materials and methods

These beetles were collected from the field of bajra, jowar, fresh specimens were used for the study of respiratory system. The fresh beetles immediately chloroformed and then dissected carefully to trace the tracheoles and air-sacs and the spiracles were treated with 5% KOH, only chitinous part could be seen under microscope.

Results and Discussion

The respiratory system of the adult beetles (Fig. 1) consists of numerous, white shingling air tubes termed as tracheas (Pruthi, 1969), the finest branches tracheoles reach even the minute tissues of the body and the opening of tracheae through which the air is taken in and given out called as spiracles. The tracheae frequently dilate into large thin walled air-sacs. The tracheoles and air-sacs lack the taenidia. The walls of the cuticular lining lack oriented taenidia and for this reason air-sacs are quite distensible and collapsible. Trached air-sacs are specially pronounced in insects, which are the most active ventilators.

Fig. 1



Absp-1 to Absp-6 - Abdominal spiracle first to sixth, As – Air sac, Dtb- Dorsal tracheal branch, Ltb- Lateral tracheal branch, Thsp –Thoracic spiracle Vtb- ventral brancheal branch

The spiracles - There are eight pairs of spiracles, two pairs lie in the thoracic region and six are lie in the abdominal region. All spiracles are similar in structure but different in their shapes and size. The thoracic spiracles are oval in shape and the abdominal

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spiracles are rounded in structure. The mesothoracic spiracles are situated in a small membranous area, one on posterolateral mesothorax and metathorasic spiracle lies in the posterior side of metathorax. The remaining six pairs of spiracle lie in the lateral side of the respective segment in the abdominal region. The opening of spiracle communicated by a tubular passage with a common atrium opens directly into the trachea. Each spiracle is in the form of a pit like chamber, the spiracular atrium. The atrium opens externally by atrial orifice and internally into a tracheal trunk by means of brancheal oriefice. The atrial wall is hairy and rugose and is strengthened by semicircular ridges. The sclerite bearing the atrium in the peritreme. At the base of the atrium is of valves or atrial lips, one of which bears an elongated flat process to which muscles are attached. These muscles regulate the movement of the valves either for closing or opening the atrial aperture.

The Tracheae - The tracheae are elastic, cuticular tubes which when filled with air have a silvery appearance in dissection. Their functional morphology and ultra structure has been written by Whitten (1955) from each original developing trachea are given off dorsally to the body wall, heart and aorta, various muscles and so on, medially to the alimentary trace and associated structure and ventrally to the nerve cord.

In this beetle the tracheae frequently dilate into large thin walled chambers called air-sacs are quite distensible and collapsible. The tracheae are supplied to thorax region from the ventral part of the mesothorasic, metathorasic and 1st abdominal pair of spiracles. The tracheae from these spiracles branch again and again to give rise to a dense network of tracheae, air-sacs and tracheoles. The ultimate branches system are tracheal system termed tracheoles which reach even the individual cells of the respective system irtthe body. The tracheoles penetrate the cells of the body.

Air-sacs - In most of the places within the body the tracheae are expanded to from thin walled air-sacs, consequently the air-sacs will collapse under pressure and they play a very important role in ventilation of the tracheal system. Tracheal air-sacs are specially pronounced in, those insects which are the most active ventilators. Air-sacs widely distributed along the main tracheal trunks in the abdominal region of this insect.

The air-sacs may have one or more of the functions (Wiggleswoh, 1968) i.e. (1) they assist flight by reducing the specific gravity of an insect of given size and they increase the volume of "tidal-air" which is changed when respiratory movements occur. (Fig. l)

Discussion

Considering the fact that these unique beetles are drastically modified for terrestrial environment and not so suited to aquatic locomotion. The spiracular armature with the hairy outgrowths have no such special functions as are often attributed to them. The distinctive feature of all coleopterans, spiracles is that there is only a single occulomotor muscle, without any dilator to open the spiracle. In all such cases, it looks as if the arrangements are concerned with the adjustment of heat produced. Indeed the intense physical activity carried out not only by a given species but even a part on organ may have well developed air-sacs (Tonapi, 1958). One of the possible reasons for the accessory development of sacs is that more air can be accommodated not so much to supply oxygen, as to inhibit the effects of excess heat, especially at the tissue level. A comparative survey of tracheal anatomy gives sufficient evidence to support such a view point.

The development of air-sacs lenders the tracheal system even more complicates. The purpose of the augmented tracheal supply, to the thoracic region of high metabolic activity is also to reduce metabolic heat, as has been noted in the case of various other insects (Miller, 1961, Tonapi, 1969). Recent qualitative information on the disproportionate air circulation during a state of elevated body temperature has confirmed the dual role of the tracheospiracular system (Tonapi, in Press). The fact that many insects remain submerged under water ground or ice for long period is no longer surprising, since a great majority of them have facultative of obligatory abilities which can also show discontinuous respiration during inactivation (Millar, 1964).

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