

This article was downloaded by:[NEICON Consortium]
On: 11 September 2007
Access Details: [subscription number 781557153]
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number: 1072954
Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Journal of Natural History

Publication details, including instructions for authors and subscription information:
<http://www.informaworld.com/smpp/title~content=t713192031>

Histology of the brain of the larva of **Chilocorus nigritus** Fabr. (Coleoptera: Coccinellidae), with special reference to the fibre tracts

Y. N. Singh ^a; U. S. Srivastava ^a

^a Department of Zoology, University of Allahabad, India

Online Publication Date: 01 December 1973

To cite this Article: Singh, Y. N. and Srivastava, U. S. (1973) 'Histology of the brain of the larva of **Chilocorus nigritus** Fabr. (Coleoptera: Coccinellidae), with special reference to the fibre tracts', Journal of Natural History, 7:6, 623 - 627

To link to this article: DOI: 10.1080/00222937300770521

URL: <http://dx.doi.org/10.1080/00222937300770521>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article maybe used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

© Taylor and Francis 2007

Histology of the brain of the larva of *Chilocorus nigritus* Fabr. (Coleoptera : Coccinellidae), with special reference to the fibre tracts

Y. N. SINGH and U. S. SRIVASTAVA

Department of Zoology, University of Allahabad, India

Introduction

The detailed structure of the coleopteran brain, specially the larval brain, has been studied by very few workers. The accounts of Holste (1923, *Dytiscus marginalis*) and Wu (1929, *Osmoderma socialis*) are superficial and they ignored the fibrous connections. In the course of their study of the metamorphosis of *Calandra oryzae*, Murray & Tiegs (1935) were the first to give an elaborate description of the histology of the brain in a larval Coleopteran. Later, Satija & Dass (1963) described the detailed histology of the brain of an adult beetle *Onthophagus catta* and explained the fibre connection between the various nervous centres. The present paper provides a detailed account of the histology of the larval brain and the fibre tracts in the brain of the larva of *Chilocorus nigritus*.

Material and technique

The brains were dissected out and fixed in aqueous Bouin's and Carnoy's fixatives for 14–20 and 3 hours, respectively. 5–10 μ thick sections were cut. Satisfactory staining was achieved with Heidenhain's Azan stain. Diagrams were made with a camera lucida.

Observations

A thin layer of neurilemma invests the three neuromeres of the brain.

Protocerebrum

The protocerebrum comprises the antero-dorsal part of the brain and the mid-dorsal prolongations of the two lobes are joined by a thick protocerebral commissure.

Corpora pendunculata (mushroom body).—A pair of feebly developed pedunculate bodies are present. Each consists of a calyx (Cx), differentiated into an outer (O1) and inner (I1) lobe, and a prominent and elongated stalk (St). The calyx cup is distinct but shallow and globuli cells (Gc) are arranged mainly in two groups over the cup. These cells send fibres which descend in two groups, but finally unite to form a common stalk which runs postero-ventrally much below the level of the central body. The inner root is distinct and situated postero-laterally to the central body. The outer root is not clear. The two inner roots (Ir) of the two opposite sides come in contact with each other below the central body but do not fuse.

Globuli cells situated above the calyx cup send their fibres into the calyx. These fibres unite with each other and ultimately enter into the peduncle of the mushroom body. A prominent fibre tract (*a*) connects the mushroom body with the deutocerebrum.

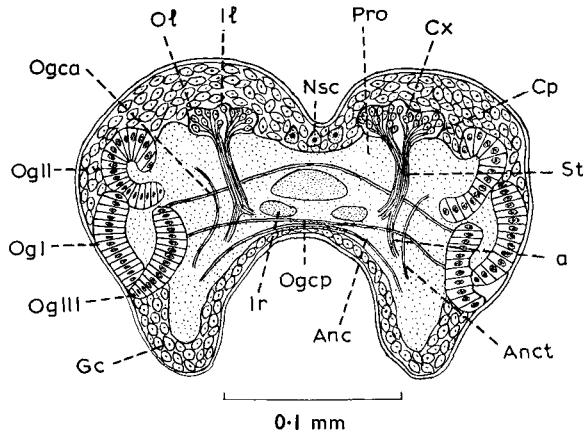


FIG. 1. Frontal section of the brain showing mushroom bodies, imaginal discs, central body and different fibre tracts. *a*=fibre tract between mushroom body and deutocerebrum; Anc=deutocerebral commissure; Anct=Antennocerebral tract; Cb=central body; Cp=corpora pedunculata; Cx=calyx of mushroom body; Gc=ganglion cell; Il=inner lobe of mushroom body; Ir=inner root of the stalk; Nsc=neurosecretory cell; OgI=Outer imaginal disc; OgII=middle imaginal disc; OgIII=inner imaginal disc; Ogca=anterior optic commissure; Ogcp=posterior optic commissure; Ol=outer lobe of mushroom body; Pro=protocerebrum; St=stalk of mushroom body.

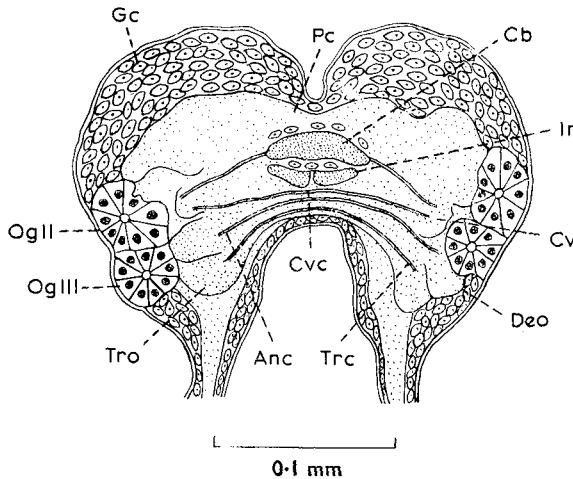


FIG. 2. Frontal section of the brain showing corpora ventralia, inner root, deutocerebrum, tritocerebrum and commissures. Cv=Corpora ventralia; Cvc=ventral commissure; Deo=Deutocerebrum; Pc=pons cerebralis; Trc=tritocerebral commissure; Tro=tritocerebrum. Other abbreviations as fig. 1.

Central complex

The central body and pons cerebralis constitute the central complex. The central body (Cb) is an elongated structure, with its anterior margin convex and posterior margin concave. In frontal sections it is seen above the root of the stalk of the mushroom body. Its anterior side is covered by a few cells having prominent nuclei. The accumulation of these cells is particularly dense in the middle region and on the two sides. The posterior area around the central

body is also covered by these cells. The cells are further distributed in the space between the central body and the inner roots of the mushroom body. The lateral margins of the central body are connected with the corpora ventralia by prominent fibre tracts.

The pons cerebralis (Pc) connects the two lobes of the protocerebrum and is situated in the postero-dorsal part of the protocerebrum a little antero-dorsally to the central body and between the two opposite calyces of the mushroom body. The two lateral projections of the pons cerebralis are connected by commissural fibres.

Corpora ventralia (Cv).—These are somewhat ovoid lobes, situated in the ventro-lateral part of the protocerebrum. The two corpora ventralia are connected with each other by the ventral commissure (Cvc).

Imaginal discs (Og).—There are three imaginal discs situated latero-posteriorly. They do not have their separate neuropiles, but their differentiation has commenced.

The inner imaginal discs (OgIII) of the two sides are connected with each other by two thick commissures (anterior optic commissure, Ogca, and posterior optic commissure, Ogcp). The anterior optic commissure runs through the protocerebral lobes and passes anteriorly and closely to the central body. The posterior optic commissure (Ogcp) runs parallel to the anterior and passes posteriorly to the central body.

Deutocerebrum

The two deutocerebral lobes (Deo) are placed ventro-posteriorly to the protocerebrum and are fused with the latter anteriorly, while posteriorly they are fused with the tritocerebrum (Tro). The deutocerebrum gives off the antennary nerves.

An antennocerebral tract (Anct) emerges from the inner margin of each antennal lobe and runs obliquely in the antero-median direction to join the deutocerebral lobe with the protocerebral lobe of its side. The stalks of the mushroom bodies and the deutocerebral lobes are joined with each other by a thick bundle of fibres (a) which runs internally to the antennocerebral tract. An antennal commissure (Anc) connects the deutocerebral lobes of two sides.

Tritocerebrum

The two tritocerebral lobes are small, spherical structures, situated postero-ventrally to the deutocerebrum. Each lobe is situated slightly laterally and outwards to the deutocerebral lobe of its side. A thick tritocerebral commissure (Trc) joins the two tritocerebral lobes of the opposite sides.

Discussion

According to Satija & Dass (1963) the structural development of pedunculate bodies is related to the optic activity of the insects concerned, but such bodies are present in a blind ant *Typhlopone* (Rabl-Ruckard, 1875), which indicates that they do not govern the optic activity. Similarly Satija & Dass (1963) reported well developed corpora pendunculata in a passive beetle *Onthophagus catta* and Flögel (1878), Newton (1879) and Power (1943) have reported only rudimentary pedunculate bodies in Diptera, though the optic activity in these insects is usually very high. The pedunculate bodies in

hemipterans (Dujardin, 1850), which are comparatively passive insects, are well developed.

Holste (1923) reported three groups of globuli cells surrounding the calyx cup in *Dytiscus* and Satija (1958 a) and Satija and Dass (1963) only one group in *Locusta* and *Onthophagus catta* respectively. The number of roots also varies in different insects; for instance, there are two roots in *Onthophagus* (Satija & Dass, 1963) and three in *Micropteryx* (Buxton, 1917). Buxton asserts that three is the primitive number whereas Satija & Dass (1963) believe that two is the primitive number because lower groups of insects like Orthoptera and Odonata have two roots. In the larva of the coleopteran *Chilocorus* each pedunculate body has only one root and it is feebly developed. Thus it would appear that the number of roots has no relationship with the evolutionary status of the insect concerned.

Satija & Dass (1963) reported a connection between the stalks of the opposite sides but it is absent in the larva of *Chilocorus* and also in its adult (authors' observation). The inner borders of the stalk of *Chilocorus* larva are lobulated and come in contact with those of the opposite sides, hence the fibrous connection between these two margins are absent. Satija & Dass (1963) also find it absent in the beetle *Onthophagus catta*. Such connections have been found in the larvae and adults of *Philosamia ricini* and *Polistes* (Singh, 1967). It seems that this connection does not exist in the beetles because Murray & Tiegs (1935, in *Calandra*) did not describe it either.

The presence of paired ventral tubercles are reported by Satija & Dass (1963) in *Onthophagus catta* and a few other insects, e.g. *Dysdercus* (Satija & Sohal, 1962); *Micropteryx* (Buxton, 1917); *Drosophila* (Power, 1943); *Apis mellifera* and *Calliphora erythrocephala* (Satija, 1958 b, c). On the other hand, their absence has been reported in a cockroach (Newton, 1879); *Locusta* (Satija, 1958 a); *Osmoderma socialis* (Wu, 1929). These are also absent in *Chilocorus* larva.

Summary

The finer anatomy of the brain of the larva has been studied. The protocerebrum consists of pons cerebralis, corpora ventralia, mushroom bodies and three optic lobes. The central complex is represented by the pons cerebralis and central body, and the latter is joined with the corpora ventralia by fine fibre tracts. The anterior and posterior optic commissures join the inner optic lobes of the two sides. The antennary nerves arise from the deutocerebral lobes. The antennocerebral tract joins the deutocerebral and protocerebral lobes with each other. Tritocerebral lobes are small and a commissure joins the two tritocerebral lobes.

References

- BUXTON, P. A. 1917. On the protocerebrum of *Micropteryx* (Lepidoptera). *Trans. R. ent. Soc. Lond.* **1** : 112-153.
- DUJARDIN, F. 1850. Mémoire sur le système nerveux des insectes. *Ann. Sc. nat. (Zool.)*, (3) **14** : 195-205.
- FLÖGEL, J. H. L. 1878. Über den einheitlichen Bandes Gehirns in den verschiedenen insekten Ordnungen. *Z. wiss. Zool. (Suppl.)* **30** : 556-592.
- HOLSTE, G. 1923. Das Gehirn von *Dytiscus marginalis* L. *Z. wiss. Zool. (Suppl.)* **120** : 251-280.
- MURRAY, F. V. & TIEGS, O. W. 1935. The metamorphosis of *Calandra oryzae*. *Q. Jl. microsc. Sci.* **77** : 405-495.

- NEWTON, E. T. 1879. On the brain of the cockroach, *Blatta orientalis*. *Q. Jl. microsc. Sci.* **19** : 340-356.
- POWER, M. E. 1943. The brain of *Drosophila melanogaster*. *Jl. Morph.* **72** : 517-559.
- RAEL-RUCKARD. 1875. Studien über insekten Gehirne von Reichert und Du Bois-Raymonds. *Arch. f. anat. Physiol. wiss. Midi* **42** : 468.
- SATIJA, R. C. 1958 a. A histological and experimental study of nervous pathways in the brain and thoracic nerve cord of *Locusta migratoria migratoriodes* (R. & F.). *Res. Bull. Panjab Univ. (Zool.)* **137** : 13-32.
- 1958 b. A histological study of the brain and thoracic nerve cord of *Apis mellifera* with special reference to the descending nervous pathways. *Res. Bull. Panjab Univ. (Zool.)* **139** : 43-65.
- 1958 c. A histological study of the brain and thoracic nerve cord of *Calliphora erythrocephala* with special reference to the descending nervous pathways. *Res. Bull. Panjab. Univ. (Zool.)* **142** : 81-96.
- SATIJA, R. C. & DASS, B. 1963. Histological studies on the brain of *Onthophagus catta* (F.) (Coleoptera). *Res. Bull. Panjab Univ. (N.S.)* **14**, III-IV : 231-241.
- SATIJA, R. C. & SOHAL, R. S. 1962. The brain of *Dysdercus cingulatus* Fabr. (Hemiptera: Heteroptera). *Res. Bull. Panjab Univ. (N.S.)* **13**, I-II : 125-140.
- SINGH, Y. N. 1967. Studies on the nervous system of certain endopterygote insects and postembryonic changes in it. Ph.D. Thesis, Bihar University, Muzaffarpur (India).
- WU, C. F. 1929. The nervous system of white grub (the larva of *Osmoderma socialis* Hem.). Parts I and II. *Lingnan Sci. Jl.* **7** : 651-694.