COMPARATIVE HISTO-MORPHOLOGICAL STUDIES ON THE DIFFERENT INDIVIDUALS OF THE HONEY BEE COLONY

By

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THESIS

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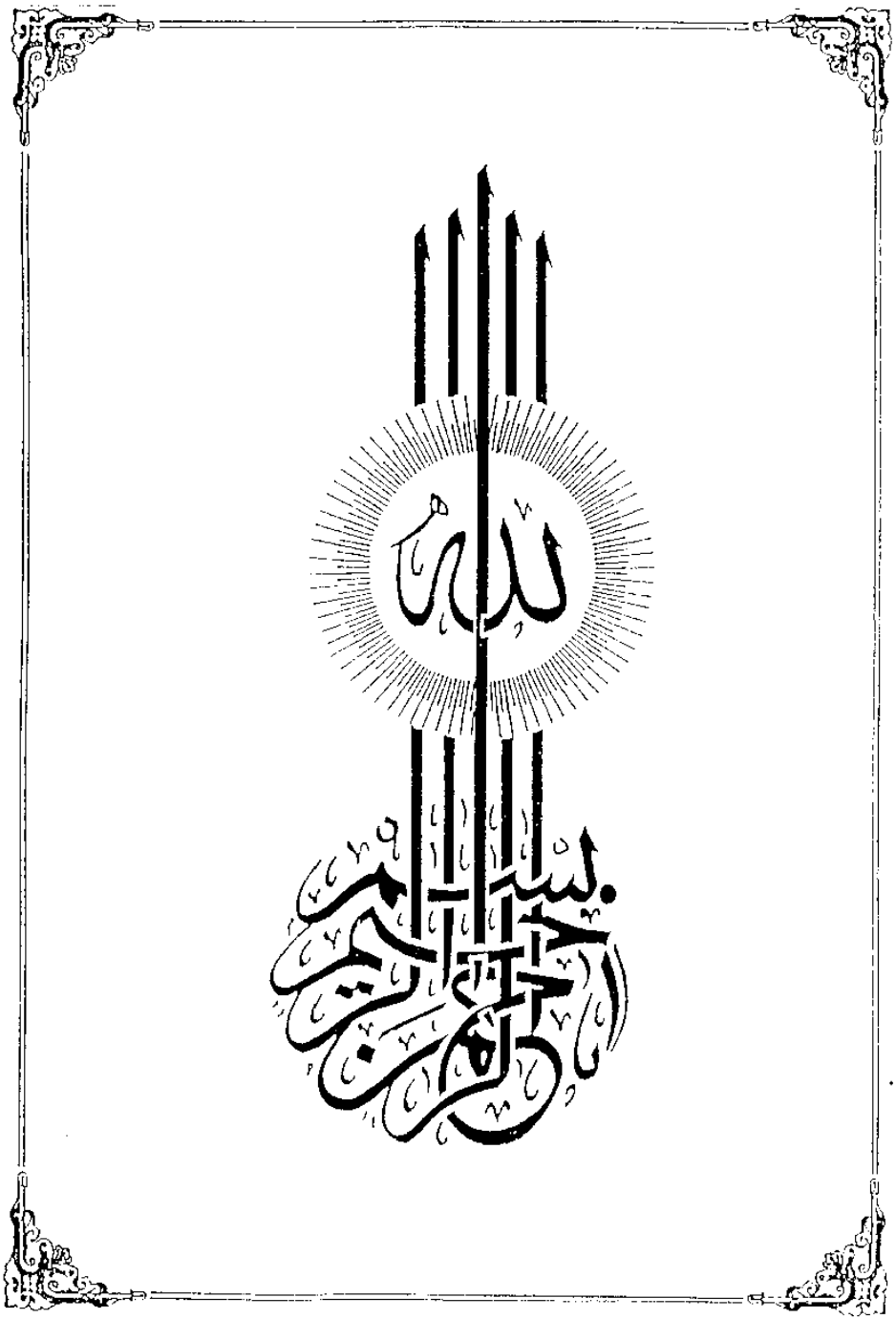

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Insect Ecology (Advanced)	4	Very Good
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INTRODUCTION

The nervous system of insects in general, has been extensively and intensively studied. The gross anatomy of brain and ventral nerve cord and the diversities exhibited by these structures have been described in detail in many species of insects; though, in honey bee Apis mellifera L. it is still lacking.

The topographical nerve patterns and the actual innervation of muscles have received attention by few authors, i.e. Holste (1910) on Dytiscus marginalis; Maki (1936) on Alder fly, Chauliodes formosanus; Chaudonneret (1950-1951) on Thermobia domestica and Youssef (1968 and 1969) on female and male of Nomia melandria Ckull.

In honey bee few work deals with the development of nervous system, musculature and innervation of internal organs (Nelson, 1915 and 1924; Morison, 1927 and 1928; Rehm, 1939; Daly, 1964; Youssef, 1964 and 1971).

The aim of the present work is to study the morphology and morphometrics of central nervous system

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during postembryonic development of worker and drone honey bee, and topography of musculature and nervous system in thorax and abdomen of adult honey bee.

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MATERIALS, METHODS AND TECHNIQUE:

Five pure Carniolan queen bees were bought from an apiary at El-Manzala (isolated area), and introduced into 5 nuclei. To obtain a continuous supply of living individuals, three of these hives were marked. The method adopted by Myser (1954) for marking the capped cells was used to secure the different stages with known ages. The brood combs containing different immature stages (eggs, larvae and capped broods) were eliminated. The capped cells were doped or marked with nail polish and replaced in the hive. After limiting intervals the hives were opened and all the new capped cells were marked with different colours of nail polish. Thus, the full grown larvae (newly capped larvae), propupae and pupae of known ages could be removed from the brood combs for the anatomical study.

To determine the age of different developmental stages of honeybee, the method adopted by Bertholf (1925) with slight modification (table 1a,b) was followed.

Studies were carried out on the following stages:

a) The Worker:

The third and fifth larval instars, the propupa (1, 2 and 3 days after capping), the pupa (4, 5, 11 days

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after capping) and the adult (soon after emergence).

b) The Drone:

The third and fifth larval instar (first and second days), the prepupa (2, 3 and 4 days after capping), the pupa (5, 9 and 13 days after capping) and the adult (soon after emergence).

The newly emerged adults were anesthetised by calcium cyanide. The wings and legs were severed and the anterior plate of head capsule was removed by a fine blade. The body was cut along the mid dorsal line and fixed in a petri dish, containing black bee wax by means of minuten nadlen pins thrust through the basal portion of the wings. The integument was then pinned back under physiological saline solution suggested by Gomaa (1970) which consisted of the following ions in mM./L. Na^+ = 120, K^+ = 4.7, Ba^{++} = 1.9, $H_2PO_4^-$ = 5, glucose or fructose = 10 and Cl^- = 121.6. The specimen was washed 3 to 4 times with saline solution to remove the fat bodies and was then transfered to a fixative solution suggested by Weaver and Thomas (1956) and modified by Chauthani and Callahon (1966) for 10 minutes to facilitate maceration of muscles and tracheae. The fixative consisted of 2.5 ml of 40 % formaldehyde, 1.25 ml. of

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glacial acetic acid and 10 g. of Chloral hydrate, diluted to 100 ml. with distilled water.

To prepare specimens for studying the innervation of muscles, the fixative was removed and replaced by tap water. Aniline blue 0.5 % in physiological solution was added for 5 minutes in sufficient amount to stain the nervous and muscular systems. The specimen was washed 3 to 4 times with tap water.

Bowin's solution was also used in the part of study of the musculature and innervation. The same technique was followed in the immature stages.

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Table 1,a: Duration of the different developmental stages of the honey bee worker.

Days after egg deposition	Stage	Instar	Moult	Remarks
1	Egg			First day of egg deposition
2	"			
3	"			The day of hatching
4	Larval	1st	1st	
5	"	2nd	2nd	
6	"	3rd	3rd	
7	"	4th	4th	
8	"	5th		The day of capping, larva began to spin the cocoon
9	propupal			one day after capping
10	"			two days after capping
11	"		5th	three days after capping
12	pupal			Four days after capping
13	"			
14	"			
15	"			
16	"			eight days after capping
17	"			
18	"			
19	"		6th	eleven days after capping
20	Adult			Soon after emergence

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Table 1,b: Duration of the different developmental stages of the honey bee drone :

Days after egg deposition	Stage	Instar	Moult	Remarks
1	Egg			first day of egg deposition
2	"			
3	"			the day of hatching
4	larval	1st	1st	
5	"	2nd	2nd	
6	"	3rd	3rd	
7	"	4th	4th	
8	"	5th		
9	"	5th		The day of capping, larva began to spin the cocoon.
11	propupal			two days after capping
12	"			three " " "
13	"		5th	four " " "
14	pupal			five " " "
15	"			
16	"			
17	"			
18	"			nine days after capping
19	"			
20	"			
21	"			
22	"		6th	thirteen days after capping
23	Adult			
24	"			Soon after emergence.

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PART I

MORPHOLOGY AND MORPHOMETRICS OF THE CENTRAL NERVOUS SYSTEM OF DRONE AND WORKER BEES DURING THE POST-EMBRYONIC DEVELOPMENT

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