

The localization and structure of a neurohemal H-organ in *Acrida bicolor* (Thunberg) and *Locusta migratoria* (Linnaeus) (Orthoptera)

Serap MUTUN

Izzet Baysal University, Science and Literature Faculty, Bolu-TURKEY

Ayla ÖBER

Ege University, Science Faculty, Biology Department Bornova, Izmir-TURKEY

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Abstract: *Acrida bicolor* (Thunberg) and *Locusta migratoria* (Linnaeus) nymphs were taken as objects to investigate the presence of neurohemal H-organ in Orthoptera of which was previously reported in Lepidoptera. A triangle-shaped H-organ was clearly observed in between the suboesophagial and prothoracic ganglions in two species.

Key Words: *Acrida bicolor*, *Locusta migratoria* (Orthoptera), H-Organ

***Acrida bicolor* (Thunberg) ve *Locusta migratoria* (Linnaeus) (Orthoptera) da nörohemal H-organ lokalizasyonu ve yapısı**

Özet: Lepidopterlerde bulunduğu bilinen, Orthopterlerde ise muhtemel varlığından söz edilen bir nörohemal yapı dolan "H-organ", *Acrida bicolor* ve *Locusta migratoria* (Orthoptera) da araştırılmıştır. Her iki örnek türde de bulunduğu, subözofagial ve protorasik ganglionlar arasında yer aldığı ve şekilleri ışık mikroskobu ile gösterilmiştir.

Anahtar Sözcükler: *Acrida bicolor*, *Locusta migratoria* (Orthoptera), H-Organ

Introduction

Neuroendocrine system of insects has been the subject of many studies pertaining to growth hormones (1,2,3). Especially same grasshopper species were chosen for such investigations by Geldiay (4,5), Freon (6,7), Chalaye (8,9), Girardie and Girardie (10).

Weyer (11), Day (12) and Scharrer (13) have observed the distribution and types of neurosecretory cells in ventral nerve cord ganglions as well as in brains and suboesophagial ganglions in many insect groups.

Perisymphatic organs of ventral nerve-cord, initially neurohemal structures, have been morphologically and physiologically demonstrated to occur in many species. A prominent structure was first reported by Abou-Halawa (14,15) in the neurohemal region in between the suboesophagial and prothoracic ganglions of Lepidopteras and named as H-organ. The accumulation of neurosecretory material within this organ that arising from the prothoracic glands and the relationship of

the two tissues were noted. The growth of the H-organ in larvae of *Galleria mellonella* was then observed (16). Abou-Halawa and Slama (17) have stated probable existence of this mass additionally in Orthoptera.

Acrida bicolor and *Locusta migratoria* species, which their biology and regional distribution are well known previously (18), were taken as the object of the present work to investigate the existence of the H-organ.

Materials and Method

Acrida bicolor nymphs and adults, and *Locusta migratoria* nymphs were used for the studies. The specimen of these two species were fed by dried oat and freshly maintained grain, and distilled water was supplied through two glass-tubes. They were housed at 90% relative humidity and at the temperature 28-32° C.

Samples collected from fields in Bornova and Mene-men provinces in izmir were either dissected immediately or after a while keeping them in the laboratory at daylight. The nymphs were dissected in Ringer solution without any anesthetics. For each species 25-30 samples were dissected at each stage. The total tissue was dyed with 1% methylene blue for one or two minutes and fixed by ammonia molybdate for 20 minutes. Following dehydration and clearing processes, they were mounted in Canada Balsam and observed by Carl Zeiss Stereomicroscope to be photographed.

Results

H-organ was seen both in males and females from the second developmental stages up to adult in *A. bicolor* and *L. migratoria*. It is located between suboesophageal and prothoracic ganglions. The tissue mass was found very close to the suboesophageal ganglion sticks on the connectives at the posterior. Triangle shaped H-organ is composed of a central body and its extensions. Besides the anterior arms outstretched to the prothoracic gland, there was a slender branch starting from the ventral and extending to prothoracic ganglions. This branch passes true the connectives between the suboesophageal and prothoracic ganglions, attached to the prothoracic gland at dorsal.

There were two nerve fibers in *L. migratoria* as it was demonstrated Figs (1-2), while a single thread-like nerve fiber was found in *A. bicolor*, as shown in

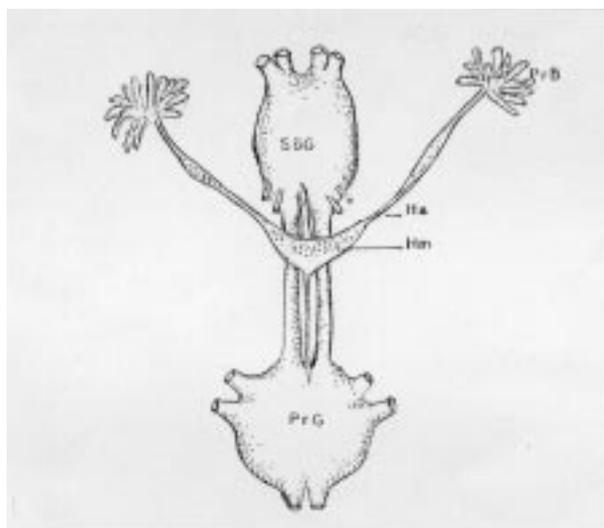


Figure 1. Schematic drawing of H-organ of *Locusta migratoria* Ha: anterior branch, Hm: central body, PrB: Prothoracic gland PrG: Prothoracic ganglion, SöG: Suboesophageal ganglion.

Figs (3-4).

Neurosecretory material became visible by methylene blue in the center of the H-organ. It, however, was not always distinct in its branches.

H-organ was found to start its development at the beginning of the second nymphal stage and reaching its maximum size at the 4th-5th stages. Then just after the fifth stage, in the following adult life, a decrease was observed in its size.

Discussion and Conclusion

The location of the H-organ in between the suboesophageal and prothoracic glands in *A. bicolor* and *L. migratoria* (Orthoptera) were similar to the findings of Abou-Halawa and Slama (17) in *Pieris brassica*, *Hyalophora cecropia*, *Bombyx mori* and *Macrothracia rubi* which are all belong to Lepidoptera orders. However, the relationship between H-organ and ganglions was found different in *Galleria mellonella*, *Actias selene* and *Sphinx ligustri* than the above lepidopteran species by the same researchers, because of their proximity in *A. selene* and their link by means of two thick nerves in *S. ligustri*.

H-organ deposits neurosecretory materials arising from suboesophageal and prothoracic ganglions via connections and maintains a source of material that is potential to influence the development. Abou-Halawa (15) has also emphasized the importance of this neurosecretory material on the developmental processes. Bhargawa and Slama (16) had measured the volume of H-organ in *Galleria mellonella* (Lepidoptera) from

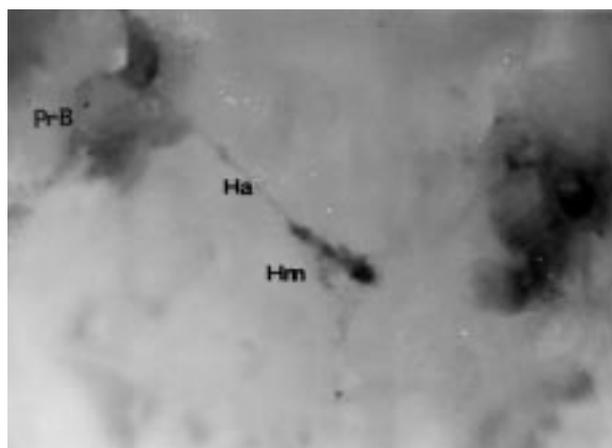


Figure 2. Actual localization of the H-organ of *Locusta migratoria* x220 (5th nymphal stage)

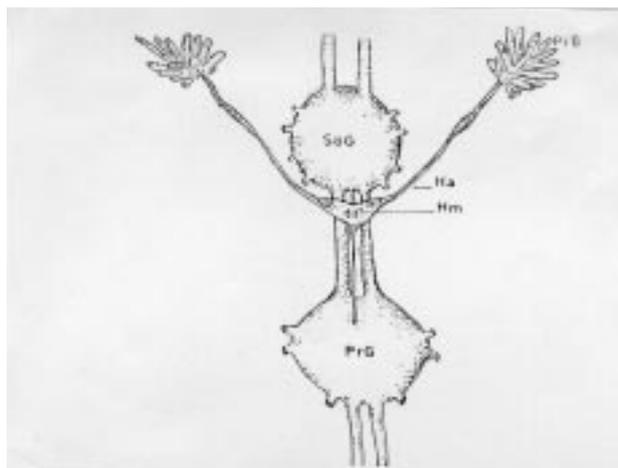


Figure 3. Schematic drawing of H-organ of *Acrida bicolor*.

6th instar onwards and found an acyclic growth in the gland, contrary to the prothoracic gland.

In the present work it was suggested that H-organ plays some role during the development of these insects, which fits well with the results of Abou-Halawa and Slama (17).

The overall-morphology of the H-organ differed with regard to the specimens. In Pieridae and Nymphalidae the organ shape was square but it represented a wing-like structure lacking of posterior branch (17). It, however, was found in *A.bicolor* and *L.migratoria* at a triangle shape without any posterior branch.

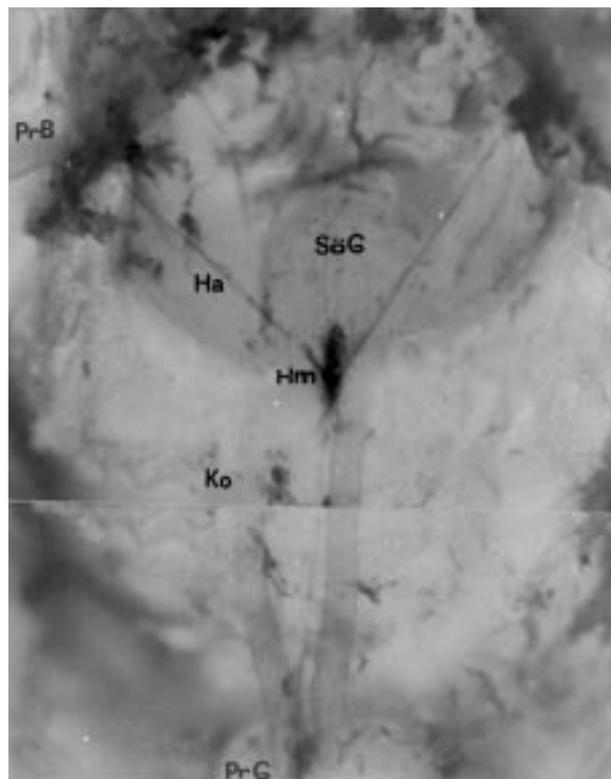


Figure 4. Actual localization of H-organ of *Acrida bicolor* x140 (4th nymphal stage).

The ultrastructure of this organ plus its similarities and differences with other neurohemal structures would be of considerable interest to investigate further as there is found only limited work on the subject.

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