Histological Structures of Male Gonads of Some Cerambycid-Beetles, with Remarks on Their Systematic Relationships[1]

By

Shôzô Ehara

(Zoological Institute, Faculty of Science, Hokkaido University)

(*With 1 Plate*)

So far as the writer is aware, Demokidoff (1902) is the pioncer who worked on the male gonad of Coleoptera histologically. In the present report has been described the comparative histological anatomy of several species of the Cerambycidae in which no such work has been published. While studying the histology of testes of the cerambycid-beetles the writer's attention had been called to the fact that there are certain differences in the course of spermatogenesis in differnt species belonging to the family : in some species the whole area of adult testis is almost occupied by spermatozoa, whereas in others a number of primary spermatocytes were found in process of the growth period. The fact seems to be somewhat comparable to the relation between the male gonad of the Anura and Urodela. Therefore, the present writer has undertaken the work to ascertain systematic relationships among the members of the family from the point of spermatogenesis.

Before going further, the writer wishes to express his cordial thanks to Professor Tohru Uchida for his kind guidance in the course of this research.

Material and Method

The adult beetles were dissected alive under the binocular microscope, and their testes were fixed in Allen-Bouin's solution. Following the usual paraffin method, sections were prepared and subjected to the Heidenhain's iron-haematoxylin method for staining. The beetles used in the present study were collected by the writer in the vicinity of Sapporo and the Province Tokachi in Hokkaido during

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the years 1949 and 1950. The forty-one species under investigation cover the following three large subfamilies ; Lepturinae, Cerambycinae and Lamiinae as listed below. From two to seven sets of testes were examined in each species.

List of species considered

Subfam. Lepturinae

Gaurotes (*Paragaurotes*) *doris* Bates
Pidonia (*Pseudopidonia*) *amentata* Bates
Leptura (*Anoploderomorpha*) *cyanea* Gebler
Leptura (*Leptura*) *scolodes* Bates
Leptura (*Leptura*) *sequensi* Reitter[1])
Leptura (*Leptura*) *succedanea* Lewis
Oedecnema dubia Fabricius
Judolia (*Judolia*) *cometes* Bates
Strangalia (*Strangalia*) *aethiops* Poda
Strangalia (*Strangalia*) *arcuata* Panzer f. *mimica* Bates
Strangalia (*Strangalia*) *latipennis* Matsushita
Strangalia (*Strangalia*) *ochraceofasciata* Motschulsky
Strangalia (*Strangalia*) *vicaria* Bates

Subfam. Cerambycinae

Leontium viride Thomson
Rosalia latesi Harold
Rhopalopus (*Prorrhopalopus*) *signaticollis* Solsky
Pronocera sp.[2])
Phymatodes (*Poecilium*) *maaki* Kraatz
Xylotrechus clarinus Bates
Clytus auripilis Bates
Cyrtoclytus caproides Bates
Brachyclytus singularis Kraatz
Plagionotus pulcher Blessig
Paraclytus exultus Motschulsky
Purpuricenus spectabilis Motschulsky

Subfam. Lamiinae

Plectrura (*Phlyctidola*) *metallica* Bates
Monochamus heloni Pic
Monochamus saltuarius Gebler[3])
Monochamus rosenmülleri Cederhjelm
Dihammus fraudator Bates
Dihammus luxuriosus Bates
Mesosa longipennis Bates
Mesosa myops Dalman var. *japonica* Bates
Mesosa hirsuta Bates
Jezohammus nubilus Matsushita
Pterolophia jugosa Bates
Pterolophia rigida Bates
Sydonia divaricata Bates
Pogonocherus (*Pogonocherus*) *seminiveus* Bates
Agapanthia daurica Ganglbauer
Eutetrapha sedecimpunctata Motschulsky

---

1) This species is new to the fauna of Hokkaido. The following specimens from Hokkaido are retained now in the writer's collection : Nukabira, Prov. Tokachi, 1♂, 2♀♀, 15. VII. 1949., 1♂, 12. VII. 1950, 5♀♀, 13. VII. 1950, S. Ehara leg.

2) The genus *Pronocera* is new to the fauna of Hokkaido, and this species is probably identical with the specimens which were recorded by Takei (1949) from Honshu as *Pronocera brevicollis* ab. *daurica* Motschulsky. The following specimen is in the wtriter's hands : Takinosawa near Sapporo, 1♂, 1. VII. 1948, S. Ehara leg.

3) This species is new to the fauna of Hokkaido. The following specimen from Hokkaido is deposited in the writer's collection : Nukabira, Prov. Tokachi, 1♂, 15. VII. 1949, S. Ehara leg.

Observations

So far as the writer's observations go, the testicular follicles were found to be arranged in a radial manner as usually found in other families of the Coleoptera. In each follicle, the apical portion is packed with immature germ cells, while the proximal regions with the mature cells ; and the intermediate region contains those of various developmental stages, with younger cells in apical portion.

Lamiinae

In the apical part of the testicular follicles of *Monochamus rosenmülleri* were found many primary spermatocytes of the growth period, and in the portion adjacent to the region just referred to are present the primary and secondary spermatocytes in dividing. In the proximal part the germ cells in various stages from early spermatids to mature spermatozoa are arranged, with the younger ones apically.

The testes of sixteen species belonging to the Lamiinae were more or less of the *Monochamus*-type. In the follicles of these testes, younger germ cells were found in the limited apical portion, while a large number of spermatids and spermatozoa were found occupying the majority of space, though slightly variable in species and specimens. At any rate, the adult testes of the species belonging to the Lamiinae include both primary and secondary spermatocytes in most cases. In the testes of species belonging to the Lamiinae, the 1st meiotic division seems to take place even in the individuals collected during coitus or near to death. For instance, the testes of a specimen of *Mesosa longipennis* collected by the end of August were found to include many spermatocytes of various stages from the growth period to the 2nd meiotic division.

Cerambycinae

In the testes of *Leontium viride* the course of spermatogenesis was observed as follows : the whole testes are occupied with numerous spermatozoa, except a few portions which are found to contain some cells showing the 1st and 2nd meiotic divisions. The boundary of follicles in the adult testes is rather indistict, which is probably a general feature in the *Leontium*-type. It seems to be interesting that in *Rhopalopus signaticollis* the testes contain numerous spermatids and spermatozoa, leaving a number of the primary and secondary spermatocytes only in a few limited portions, for the specimens used were collected in 1949 and also in early June of 1950, a short time after emergence. In twelve species of Cerambycinae, the similar case (*Leontium*-type) was observed. In these testes spermatids and spermatozoa occupy nearly the whole part exclusively, leaving primary and secondary spermatocytes only in a few localities, and it occurs not rarely that the whole testis is occupied only with spermatozoa and spermatids.

So far as the writer's observations go, in this subfamily *Rosalia batesi* is exceptional, containing a good many primary and secondary spermatocytes in most follicles. In some testes of this species a good many dividing figures of primary spermatocytes were observed in groups at the apical parts of each follicle.

Lepturinae

In the Lepturinae, thirteen species were observed and all showed the *Leontium*-type, as occurred in the Cerambycinae, with the exception of a few species, such as *Leptura scotodes* and *Gaurotes doris*, in which a good many primary spermatocytes were observed.

Discussion

Judging from the results obtained from the present study, the testes of adult cerambycids can be divided in general into two types: those of species belonging to the Lamiinae, and those of species belonging to the Lepturinae and Cerambycinae. In the first group the testes include germ cells of various developmental stages including the cells of growth period as well as mature spermatozoa, sometimes spermatogonial cells. Namely, in the adult testes of the Lamiinae both the multiplication divisions of spermatogonia and reduction divisions can be observed. On the other hand, in the adult testes of the second group the meiotic divisions are not so frequent, but the spermioteleosis has been highly advanced or nearly finished.

As given in the above fact the subfamily Lamiinae is different from both the subfamilies Lepturinae and Cerambycinae. The taxonomy of the family Cerambycidae being as yet complete, the histological data possibly give some supports on their classification, collateral to the following taxonomical features.

It has been generally accepted among taxonomists that the subfamily Lamiinae is separated from other subfamilies in respect to the following external characters of the adult, as was enumerated by Gahan (1906) and others:

1. Fore-head perpendicularly fallen down from the vertex. 2. Maxillary palpi pointed at apex. 3. Generally, tibia of fore legs provided with a groove.

In 1923 Craighead pointed out as follows: "The Lamiinae larvae are all characterized by the oblong head, the sides of which are parallel or converge posteriorly. This form of the head sets them in sharp contrast to all other cerambycids." Gardner (1927) and Kojima (1928, 1931) are of the same opinion with him.

Summary

The spermatogenesis was observed in adults of forty-one species of the Cerambycidae. According to the spermatogenetic process of these beetles, testes of the family can be divided in general into two groups: those of the Lamiinae

and those of the Cerambycinae and Lepturinae. The present data are in accordance with the taxonomists' opinion, based on the external morphology, that the Lamiinae is largely different from other subfamilies.

Literature

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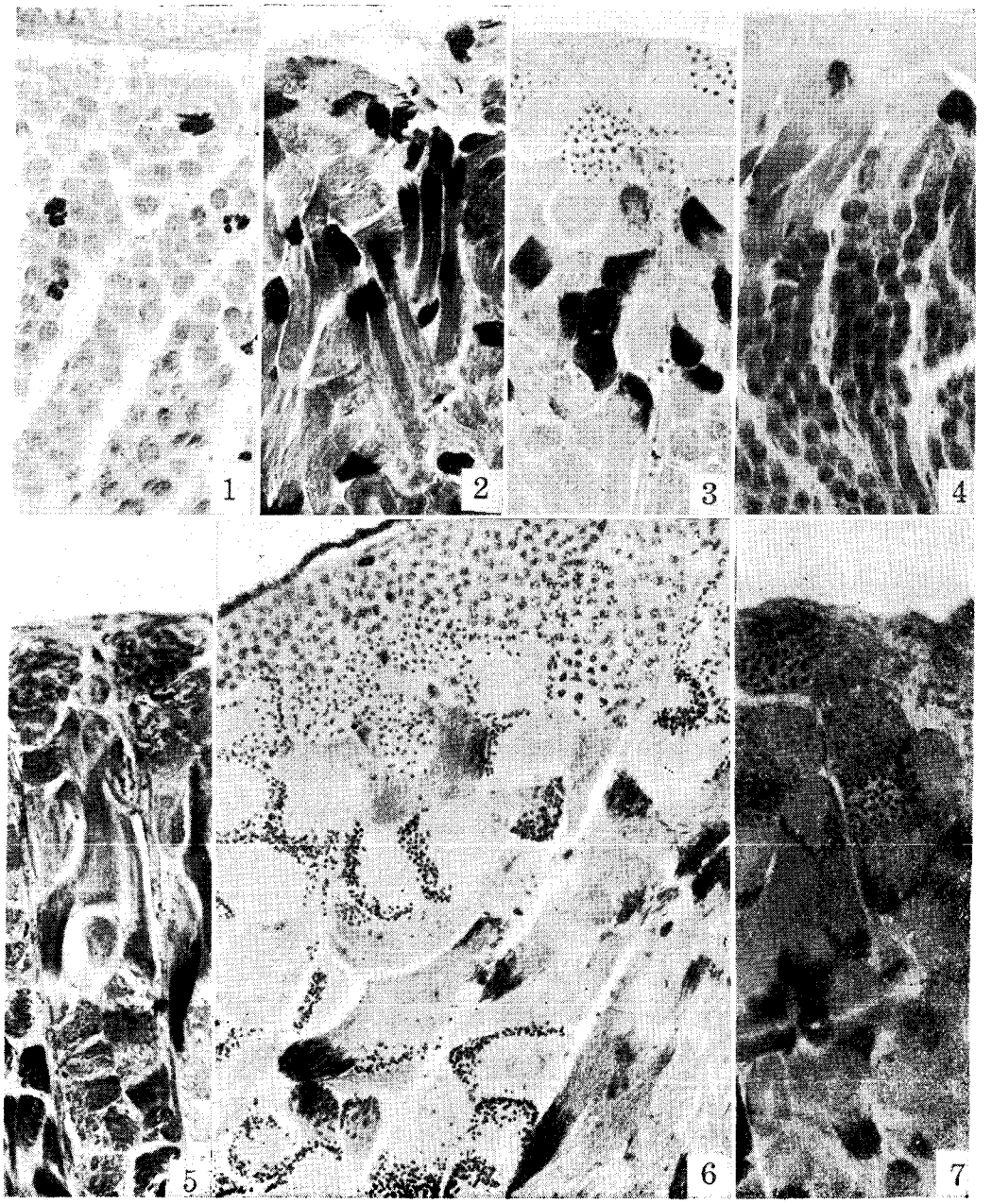
Explanation of Plate XII

Magnification: ×230 in all figures.

Fig. 1. Cross section of testis of *Strangalia* (*Strangalia*) *vicaria* Bates (partly shown). **Fig. 2.** Cross section of testis of *Rhopalopus* (*Prorrhopalopus*) *signaticollis* Solsky (partly shown). **Fig. 3.** Cross section of testis of *Rosalia* (*Rosalia*) *batesi* Harold (partly shown). **Fig. 4.** Cross section of testis of *Xylotrechus clarinus* Bates (partly shown). **Fig. 5.** Cross section of testis of *Purpuricenus spectabilis* Motschulsky (partly shown). **Fig. 6.** Cross section of testis of *Monochamus rosenmülleri* Cederhjelm (partly shown). **Fig. 7.** Cross section of testis of *Mesosa myops* Dalman var. *japonica* Bates (partly shown).



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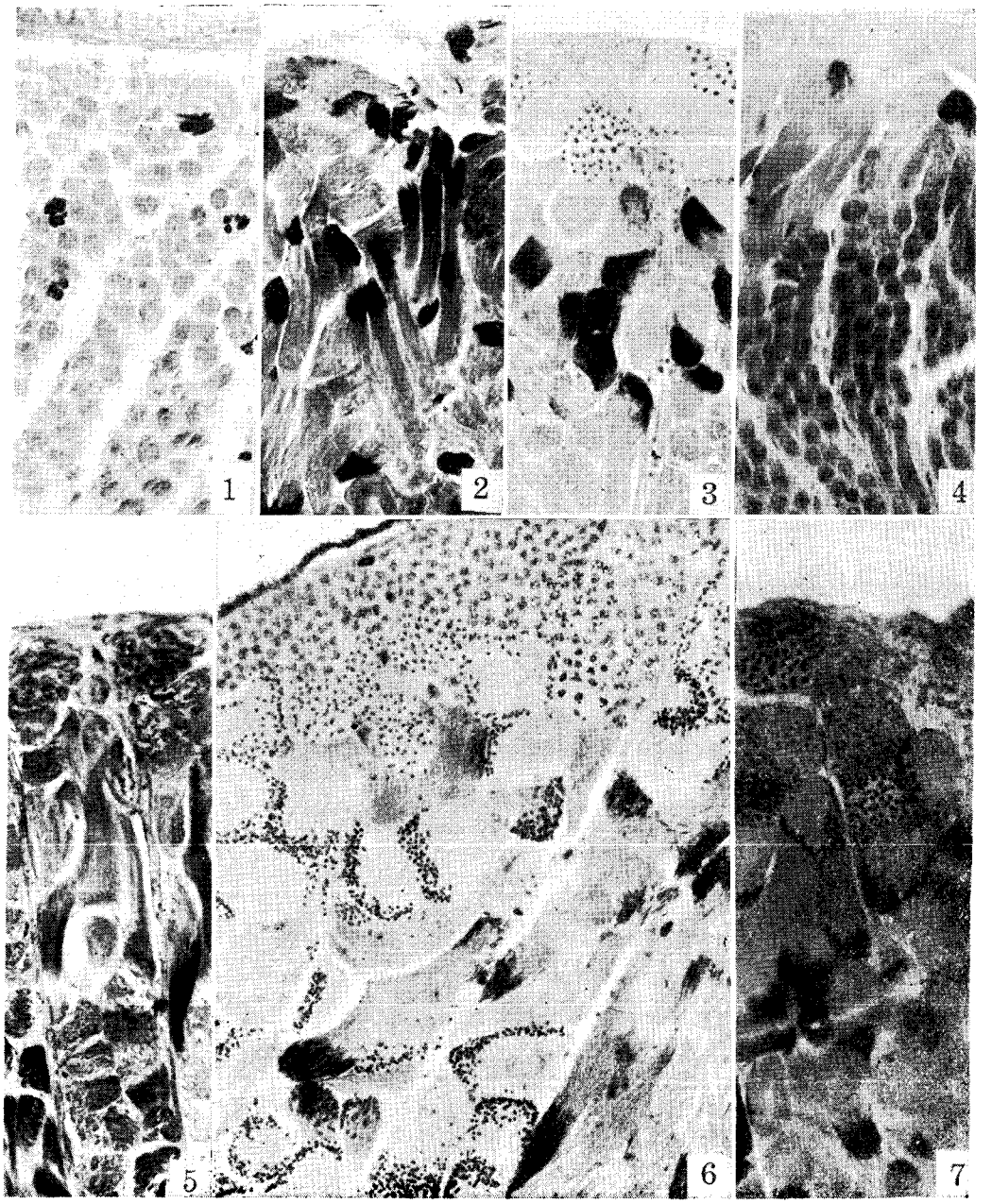

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