RESULTS OF GONADECTOMY AND GONADAL TRANSPLANTATION IN THE SEX RACES OF *LYMANTRIA DISPAR* [1]

by SAJIRO MAKINO and KAZUO SAITO

In vertebrate animals, there is a well-known interrelationship between the hormone and sexual phenomena. Very little has been known of insects in this field however, and a number of important problems have remained unsolved. The poor status of evidence available calls for experimental study in this field. This induced us to undertake experiments of gonadectomy and gonadal transplantation in *Lymantria dispar* L., which is remarkable in showing "weak" and "strong" sexual races. Here we wish to present some essential results derived from our experiments. The detailed quantitative data together with the experimental procedures and discussion will be reported elsewhere in the near future.

The present experiments consist of gonadectomy and gonadal transplantations carried out using the larvae of the weak and strong races of *Lymantria dispar*. The larvae derived from a single egg-mass were used in each series of experiments, and were operated at ages ranging from the 4th to 6th instars.

A. GONADECTOMY

The adult males which emerged from gonadectomized larvae belonging to the strong race were a little dark in the coloration of their wings and thoracic and abdominal segments, as compared with the non-operated animals from the same race. The ovariotomized females showed no visible difference in their bodily coloration from the normal ones. In both cases, the characteristic structures, such as the frenulum, antenna, and genitalia, of the gonadectomized animals, presented also no appreciable change. Especially, the male genitalia appeared to be normal and permitted regular copulation in most cases.

B. GONADAL TRANSPLANTATION

The gonadal transplantations concerned here involved two different schemes of experiments.

1. Testicular and ovarian transplantations without gonadectomy were carried out in the larvae of the same races, and between the weak and strong races reciprocally; in every case the gonads of the host were not removed. The results of these experiments indicated that both testicular and ovarian transplantations were without effect on the bodily characters of the host which received the grafts. Various external organs, such as the frenulum, antenna, and genitalia, of the host remained unchanged, except that, in a few males of the weak race, the fore wings betrayed a tendency of lighter coloration than those of the control animals.

---

[1] The experiments were done in the Zoological Institute of the Hokkaido University, Sapporo, Japan, and the manuscript was prepared by the senior author during his stay at the Osborn Zoological Laboratory of Yale University, New Haven, through the generosity of Dr. C. L. REMINGTON, to whom the senior author is greatly indebted for reading the manuscript.

2. Reciprocal gonadal transplantations were carried out between the larvae of the weak and strong races, following the removal of the gonads of the host, that is, the ovaries or testes of the animals from the strong race were implanted in the animals of the weak race after removal of their testes or ovaries. The female animals of the weak race which were ovariotomized and received the ovarian or testicular grafts derived from the strong race, or the male animals of the weak race which, after testis-removal, were grafted with the ovaries or testes derived from the strong race, presented in every case no appreciable change in their bodily characters after emergence. The various external organs which concern the secondary sexual characters were apparently without change in all experimental animals. Thus the ovarian and testicular grafts implanted in the gonadectomized animals did not influence the sexual characters of the host in the reciprocal tranplantations between the weak and strong races.

C. THE SEXUAL BEHAVIOR OF THE OPERATED ANIMALS

The sexual behavior of the operated animals was observed through the process of copulation and of egg-laying. So far as the scope of this study is concerned, the operated animals acted just like the control animals in their sexual behavior. For instance, the males without testes copulated in a regular manner when mated with the normal females, which laid eggs after copulation with a deposit of the tufts of woolly abdominal hairs as usual. Also, the ovariotomized females copulated with the normal or gonadectomized males as usual, and showed after copulation the usual egg-laying behavior, but of course deposited the tufts of woolly hairs only. Further, the females which received testicular grafts following ovariotomy, mated with males in which the testes were removed, and tried after copulation to lay eggs, ending with the deposit of the tufts of woolly hairs.

In conclusion, from the results of our experiments it can be said that both gonadectomy and gonadal transplantations carried out between the weak and the strong races of *Lymantria dispar* bring about no alteration of the external sexual characters, and further that the operated animals showed normal sexual behavior in the acts of copulation and egg-laying.

Zoological Institute, Hokkaido University, Sapporo, JAPAN