

Dr. Prof. T. Okada
with author's
highest regards.
T. Okada

Comparative Studies of Male Genital Structures of Hybrids and Their Parental Species

STURTEVANT¹ was first to show that male genital apparatus offers quite constant and diagnostically valid species differences especially among insects. Since then it has been extensively used in such studies by many workers and in some cases offered a new approach for understanding the mechanism of speciation. The practical importance of these structures has also been now realized by modern systematists (HSU²; STALKER³; MALOGOLOWKIN⁴; OKADA^{5,6}; SPASSKY⁷; TAKADA^{8,9}; KANESHIRO¹⁰; YANG and WHEELER¹¹; WHEELER and TAKADA¹²).

Drosophila bipectinata DUDA¹³ and *D. malerkotliana* PARSHAD and PAIKA¹⁴ are both sympatric species. Genetic analysis of 3 species, *ananassae*, *bipectinata* and *malerkotliana* made by NARDA^{15,16} has revealed that the latter 2 species are closely related and produce F₁ sterile male and fertile female hybrids. The author wishes to present a comparative account of genital structures of the hybrids and their parental species.

Material and method. Reciprocal crosses between *D. bipectinata* and *D. malerkotliana* were made and the hybrids thus produced were inbred for F₂ progeny and also back crossed with both the parental species. A sufficient number of hybrids from both crosses were utilized for the study of genital structures so as to find out variability within them. Preparations were made from the living organisms as well as after KOH treatment. Diagrams were made with the help of Carl Zeiss Camera-lucida attached to an Olympus microscope.

Observation. Reciprocal crosses (*malerkotliana* ♀ × *bipectinata* ♂; *bipectinata* ♀ × *malerkotliana* ♂) produced a number of F₁ hybrids of both sexes. The inbreeding test, F₁ ♂ × F₁ ♀, failed to produce offspring while backcrosses in both ways produced offspring.

F₁ (*malerkotliana* ♀ × *bipectinata* ♂) females crossed separately to males of both the parental species, produced offspring of both sexes which were more like *bipectinata* and *malerkotliana* respectively. However, some males obtained in *bipectinata* cross showed abdominal tergite coloration, faint but resembling *malerkotliana* male. In second cross, F₁ males crossed separately to both parental species, produced no offspring.

In an alternative back cross F₁ (*bipectinata* ♀ × *malerkotliana* ♂) females crossed separately to males of both

the parental species, produced offspring of both sexes similar in phenotype to the above cross. In second cross, F₁ males crossed separately to both parental species, produced no offspring.

Thus inbreeding and backcross tests clearly indicate that hybrid females are fertile while males are sterile.

Comparison of phenotype and male genital structures of the parental species and their hybrid. *Drosophila bipectinata*. General body coloration yellow, each abdominal tergite with a dull brown, narrow posterior band. Male prothoracic legs with two obliquely placed sex-combs on metatarsal segment, upper comb with about 5–8 teeth, lower one with 6–9 teeth, 1–2 teeth on distal part of first tarsal segment of same leg (Figure C). Periphallallic organs (Figure B): Genital arch elongate, narrowing anteriorly, with about 26–30 bristles along the posterior margin, toe pointed, posterior margin with a process covering a small part of primary clasper. Anal plate triangular. Primary clasper with about 13 marginal bristles, one of them large and directed upward; primary teeth in 2 groups usually 2 and 3. Secondary clasper with a large tooth. Phallic organs (Figure A): Aedeagus bifid, somewhat broadened at middle, pointed and curved apically. Anterior paramere U-shaped. Posterior paramere

¹ A. H. STURTEVANT, *Psyche* 26, 153 (1919).

² T. C. HSU, *Univ. Texas Pubs.* 4920, 80 (1949).

³ H. D. STALKER, *Ann. ent. Soc. Am.* 46, 343 (1953).

⁴ C. MALOGOLOWKIN, *Revta. bras. Biol.* 13, 245 (1953).

⁵ T. OKADA, *Kontyu* 22, 36 (1954).

⁶ T. OKADA, *Kontyu* 23, 97 (1955).

⁷ B. SPASSKY, *Univ. Texas Pubs.* 5721, 48 (1957).

⁸ H. TAKADA, *Annotnes zool. jap.* 36, 208 (1963).

⁹ H. TAKADA, *Univ. Texas Pubs.* 6615, 315 (1966).

¹⁰ K. Y. KANESHIRO, *Univ. Texas Pubs.* 6918, 55 (1969).

¹¹ H. Y. YANG and M. R. WHEELER, *Univ. Texas Pubs.* 6918, 132 (1969).

¹² M. R. WHEELER and H. TAKADA, *Univ. Texas Pubs.* 7103, 225 (1971).

¹³ O. DUDA, *Ann. Mus. Nat. Hung.* 20, 24 (1923).

¹⁴ R. PARSHAD and I. J. PAIKA, *Res. Bull. Panjab Univ. Sci.* 15, 225 (1964).

¹⁵ R. D. NARDA, *Caryologia* 21 (4), 293 (1968).

¹⁶ R. D. NARDA, *J. Genet.* 60, 1 (1970).

large, dilated dorsobasally. Ventral fragma triangular, longer than broad. Novasternum without median notch but with a pair of submedian spines.

Drosophila malerkotliana. General body coloration pale yellow, each abdominal tergite with a black band, except

in male where terminal tergites completely black. Sex-comb in 2 sets, upper metatarsal comb with 2 transverse rows of 1 and 3-4 tough bristles; lower tarsal comb with similar rows of 1 and 3 tough bristles (Figure 1). Periphallalic organs (Figure H): Genital arch with about 22-25 bristles along posterior margin. Other characters similar to *biplectinata*. Phallic organs (Figure G): Aedeagus bifid, broadened at middle, pointed and curved apically. Ventral fragma nearly quadrate. Other characters similar to *biplectinata*.

Hybrids. General body coloration pale yellow, each abdominal tergite with a narrow black band, except in male where terminal tergites light black. Male prothoracic legs with 2 obliquely placed sex-combs on metatarsal segment, upper one with about 3-5 teeth, lower one with 5-7 teeth, first tarsal with 2 transverse rows of 1, and 2-3 teeth (Figure F).

Periphallic organs (Figure E). Genital arch with about 25 bristles along posterior margin. Other characters similar to parental species.

Phallic organs (Figure D). Ventral fragma apparently quadrate, a little longer than broad. Other characters similar to parental species.

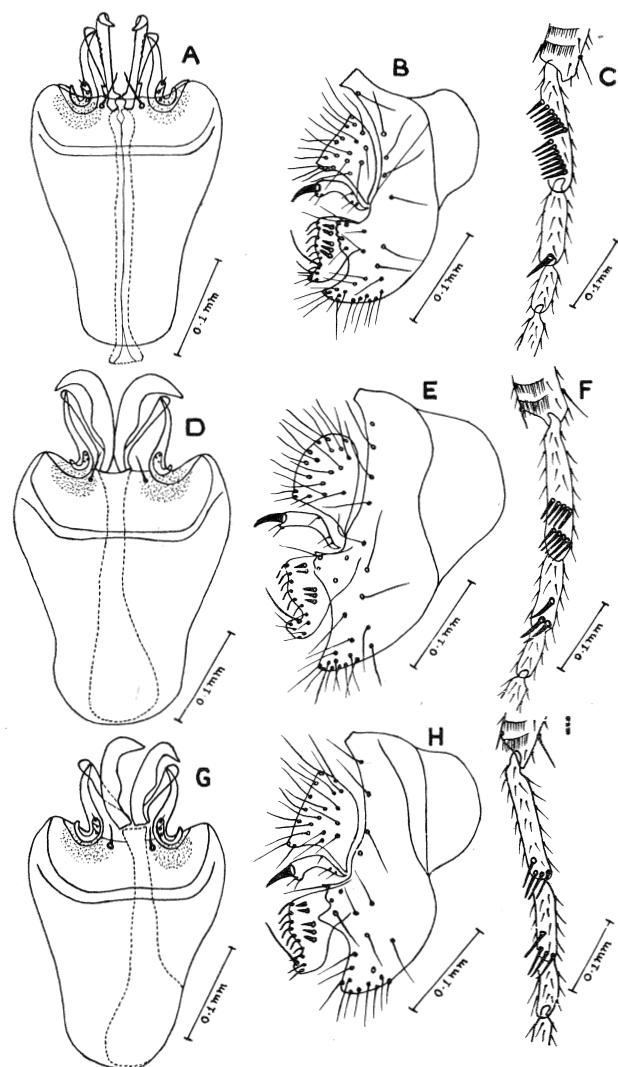
Remarks. *D. biplectinata* and *D. malerkotliana* are closely related species. Females of both species are very much similar but their males differ only in sex-comb pattern and abdominal tergite coloration. Furthermore, male genital components of both the species are apparently alike.

In the present studies it has been found that abdominal tergite coloration of male hybrids is like that of *malerkotliana* while sex-comb pattern is more like *biplectinata*. Other characters like aedeagus, parameres, basal apodeme, ventral fragma, genital arch, claspers are really of intermediate type.

Zusammenfassung. Körperfarbe und Strukturen des Genitalapparates sowie der Geschlechtskäme des 1. Beinpaars männlicher Hybriden aus reziproken Kreuzungen von *Drosophila biplectinata* × *D. malerkotliana* werden beschrieben. Die Hybriden zeigen intermediäre Merkmale, wobei vergleichend die Körperfarbe mehr *D. malerkotliana*, die Geschlechtskäme mehr *D. biplectinata* ähnlich sind.

J. P. GUPTA¹⁷

Cytogenetics Laboratory,
Department of Zoology,
Banaras Hindu University,
Varanasi 5 (India), 17 May 1972.



D. biplectinata, A) phallic organs; B) periphallalic organs; C) male prothoracic leg. *Hybrid*, D) phallic organs; E) periphallalic organs; F) male prothoracic leg. *D. malerkotliana*, G) phallic organs; H) periphallalic organs; I) male prothoracic leg.

¹⁷ Acknowledgments. The author is thankful to the U.G.C. for extending financial assistance and to Prof. J. P. THAPLIYAL, Head of the Department for facilities.