

XIV. Taxonomy of the *Drosophila bipectinata* Species Complex¹

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Drosophila bipectinata was described in 1923 by Duda from a Museum specimen originally collected in India (Duda 1923). Within the *melanogaster* species group of the subgenus *Sophophora*, Hsu (1949) established a separate subgroup, the *ananassae* subgroup, for *D. bipectinata* and *D. ananassae* Doleschall 1858. Parshad and Paika (1964) described a third member of the *ananassae* subgroup, *D. malerkotliana*, from India (= "*Drosophila* sp." from Borneo, Okada 1964).

Recent studies by Kaneshiro and Wheeler (1970), and by the author, have indicated that the *ananassae* subgroup consists of two distinct species complexes: the *bipectinata* complex (in males of which the aedeagus is bifid and bare), and the *ananassae* complex (in males of which the aedeagus is fused and strongly hirsute). The *bipectinata* complex contains *D. bipectinata* and *D. malerkotliana*, and two further species which are described below as *D. pseudoananassae* sp. nov. and *D. parabiptinata* sp. nov. Subspecies are described for *D. malerkotliana* and for *D. pseudoananassae*. The specific or subspecific status of each form within the *bipectinata* complex was confirmed by extensive studies of reproductive isolation; results of these studies, and of the associated cytological investigation, will be published subsequently.

Drosophila bipectinata Duda 1923

Drosophila bipectinata Duda 1923. Ann. Mus. Nat. Hung. 20: 52.

Duda 1924. Arch. Naturgesch. 90A (3): 214.

Duda 1926. Suppl. Ent. 14: 98.

Kikkawa and Peng 1938. Jap. Jour. Zool. 7: 527.

Drosophila (Sophophora) bipectinata Sturtevant 1942. Univ. Texas Pub. 4213: 29.

Hsu 1949. Univ. Texas Pub. 4920: 122.

Wheeler 1949. Univ. Texas Pub. 4920: 175.

Patterson and Stone 1952. *Evolution in the Genus Drosophila*: 16.

Okada 1953. Zool. Mag. 62: 284.

Okada 1954. Kontyu 22: 39.

Okada 1955. Sci. Result Jap. Exp. Nepal Himalaya 1: 387.

Okada 1956. *Systematic Study of Drosophilidae and Allied Families of Japan*: 117.

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Okada 1964. Nature and Life in Southeast Asia III: 449.

Okada 1965. Kohtyu 33: 347.

Okada 1966. Bull. Brit. Mus. Nat. Hist. Suppl. 6: 82, 95.

=*Drosophila szentivanii* Mather and Dobzhansky 1962. Pac. Ins. 4: 247, NEW SYNONYM.

=sp. 6 Kaneshiro and Wheeler 1970: Dros. Inf. Serv. 45: 143.

General features, male and female: As described by Duda (1923), Kikkawa and Peng (1938), Hsu (1949) (periphallic organs), Okada (1954) (phallic organs), and Mather and Dobzhansky (1962).

Distribution: *D. bipectinata* occurs in both Oriental and Australian biogeographic zones, ranging from India and Nepal through Formosa, Borneo, the Philippines and New Guinea, to Samoa in the Pacific Ocean. The species is not, however, known from Australia.

✓ *Drosophila malerkotliana* Parshad and Paika 1964

pseudoananassae

= *Drosophila (Sophophora) sp.* Okada 1964. Nature and Life in Southeast Asia 3: 439.

Drosophila (Sophophora) malerkotliana Parshad and Paika 1964. Res. Bull. Panjab Univ. 15: 235.

=sp. 10 and sp. 11 Kaneshiro and Wheeler 1970. Dros. Inf. Serv. 45: 143.

General features, male and female: As described by Okada (1964) and Parshad and Paika (1964).

Distribution: *D. malerkotliana*, described from Malerkotla, Chandigarh and Pinjore, India, is restricted in range to the Oriental biogeographic zone from India through Thailand and Malaya east to Borneo and the Philippines.

Subspecies: In males from India, Thailand and Malaya the distal portion of the abdomen darkens with age to shiny black. In males from Borneo and the Philippines the abdomen remains pale brown throughout life. (No coloration differences occur in females). On the basis of the difference in male abdominal coloration two subspecies of *D. malerkotliana* are recognized: the name *D. malerkotliana malerkotliana* is proposed for the Indian, Thai, and Malayan populations in which male abdomens are black; the name *D. malerkotliana pallida* is proposed for the Borneo and Philippine populations in which male abdomens are pale brown. Kaneshiro and Wheeler (1970) note a difference in karyotypes between these two forms: the Y chromosome is J-shaped in *D. m. pallida* (sp. 10) and V-shaped in *D. m. malerkotliana* (sp. 11).

Type locality of D. m. pallida: Sabah, Borneo. Holotype and allotype deposited in the Queensland Museum, Brisbane, Australia. Twenty paratypes deposited in the Genetics Foundation, University of Texas collection.

✓ *Drosophila (Sophophora) pseudoananassae* sp. nov.

=*Drosophila ananassae* Mather 1956. Aust. Jour. Zool. 3: 569.

=sp. 8 and sp. 9 Kaneshiro and Wheeler 1970. Dros. Inf. Serv. 45: 143.

General: Small, pale brown flies. Distal portion of male abdomen black in specimens from Borneo and Malaya, permitting subspecific classification.

Type culture: Cairns, north Australia. Holotype and allotype of each sub-

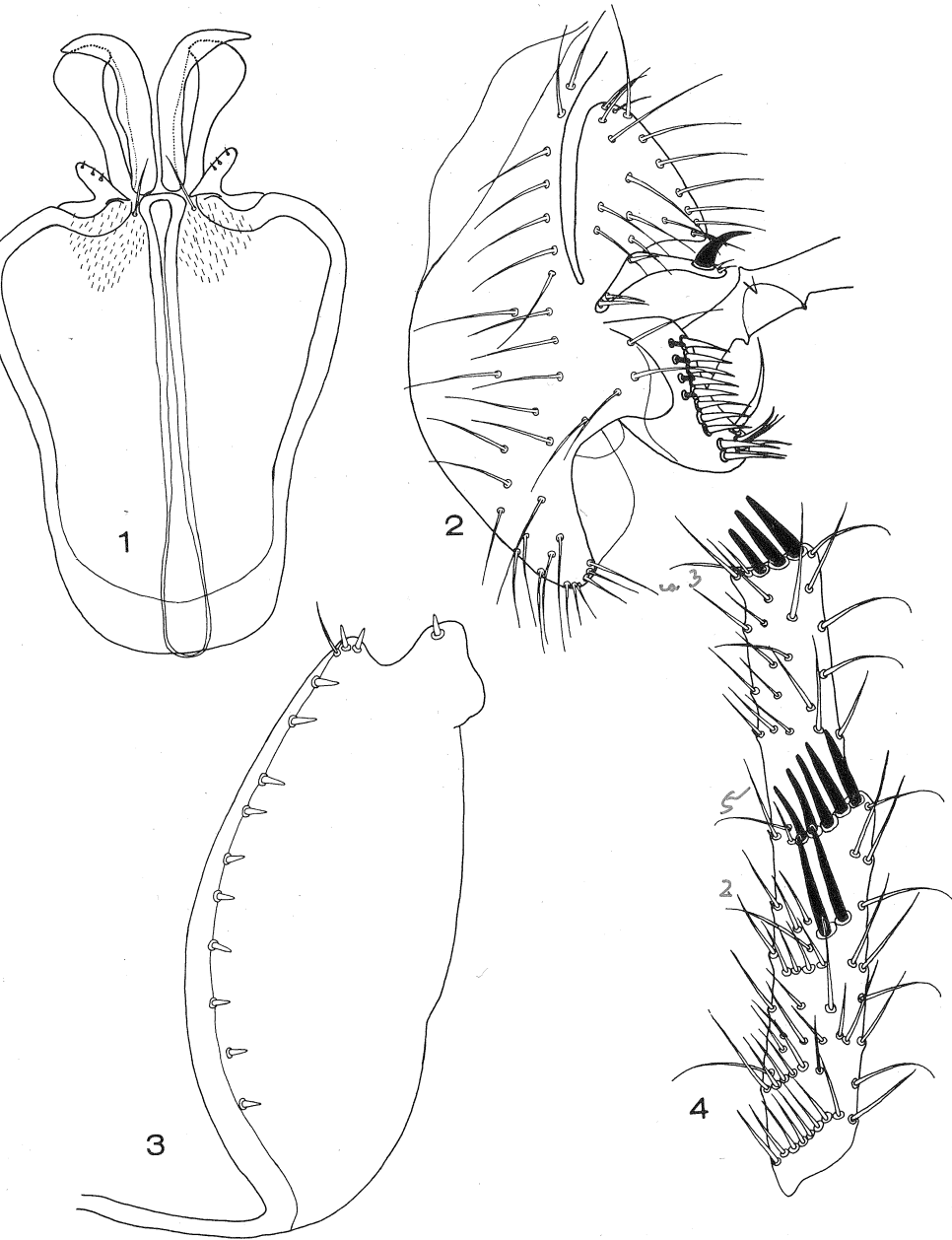


FIG. 1-4. *Drosophila pseudoananassae*, n. sp. 1.—male phallic organs. 2.—male genital arch. 3.—female egg guide. 4.—sex-comb of male fore-tarsus. Specimens from Port Moresby.

species deposited in the Queensland Museum, Brisbane, Australia. Twenty paratypes of each subspecies deposited in the Genetics Foundation, University of Texas collection.

Body length: Male 2.0 mm; female 2.3 mm.

Head, male and female: Arista with 4-6 branches above, 3 below, plus the terminal fork. Front pale brown, broad. Orbital bristles in the ratio 3:1:3. Carina

narrow, rounded. Ocelli pale orange. Eyes red. Greatest width of cheek 0.2 times greatest diameter of eye.

Thorax, male and female: Acrostichal hairs in 8 rows in front of dorsocentral bristles, 4 rows between dorsocentrals. Anterior scutellars convergent. Posterior dorsocentrals longer than anterior dorsocentrals (ratio 2:1). Sterno-index 0.7. Preapical bristles on all tibiae; apicals on first and second tibiae. Sex-comb of male (Fig. 4) in 3 transverse rows: two rows on distal portion of metatarsus consisting of approximately 2 teeth (proximal row) and 5 teeth (distal row), and one row on distal margin of second tarsal segment of approximately 3 teeth.

Wings, male and female: Transparent. Costal index 1.5 ± 0.2 ; 4V index 2.5 ± 0.3 ; 5X index 1.7 ± 0.2 ; 4C index 2.3 ± 0.3 . Third costal section with heavy bristles on basal half or slightly less. Wing length male 1.5 mm; female 1.6 mm.

Periphallic organs (Fig. 2): Genital arch narrow dorsally, broad laterally, with rounded process covering base of primary clasper. Toe rounded, bearing approximately 12 bristles. Claspers in 2 sets. Primary clasper large, with a row of 4 blunt lateral bristles, and a second row of approximately 8 medial bristles, longer, pointed; posteromedial end of primary clasper with approximately 7 strong pointed teeth, 1 elongated, curved towards deca sternum. Secondary clasper narrow, with 1 very strong, curved, pointed tooth and 2 minute teeth medially, 1 small tooth dorsally, and 2 small teeth laterally. Anal plate small. Deca sternum with median dorsal point and submedian ventral points.

Phallic organs (Fig. 1): Aedeagus brown, long, bifid, unbranched, distally curved, not ornamented. Anterior parameres V-shaped, with minute apical hair-like sensilla. Posterior parameres long, almost reaching tip of aedeagus, unbranched, apically swollen. Novasternum with a pair of submedian spines, each surrounded by a patch of minute hairs. Ventral fragma quadrate. Basal apodeme of aedeagus as long as ventral fragma. Phallic formula (Okada 1956) ABCdef-GHIKLMN. Phallosomal index 0.4.

Egg guides (Fig. 3): Brown, with approximately 13 teeth and one subterminal hair. Basal isthmus $\frac{1}{4}$ length of lobe.

Internal structures, male and female: Intestinal coiling index 3.0. Rectal index 1.6. Malpighian tubules 2 anterior, free, common trunk 0.2 total length; 2 posterior, free, common trunk 0.2 total length; anterior and posterior subequal in length.

Internal genitalia, male: Testes yellow, tightly coiled, with 3-4 large outer and 1-2 small inner coils. Ejaculatory bulb globular.

Internal genitalia, female: Spermathecae well-developed, sclerotized, brown. Ventral receptacle tightly coiled.

Egg filaments: 2 long filaments, flattened apically.

Pupae: Anterior spiracles short, divergent, each with approximately 12 branches. Ratio pupal stalk/pupal body length 0.06. Posterior spiracles divergent, same length as anterior spiracles.

Distribution: *D. pseudoananassae* occurs in both Oriental and Australian biogeographic zones, from Malaya, Borneo and the Philippines east to New Guinea, northern Australia and the British Solomon Islands.

Subspecies: *D. pseudoananassae* is polytypic with respect to male abdominal coloration (as is *D. malerkotliana*). Males from the north Australia-New Guinea region, and from the Philippines, possess brown abdomens and are designated *D. pseudoananassae pseudoananassae*. In males from Borneo and Malaya the distal portion of the abdomen darkens with age to shiny black; these populations are designated *D. pseudoananassae nigra*. (No coloration differences occur in females). Kaneshiro and Wheeler (1970) note a difference in karyotypes between the two forms: the Y chromosome is J-shaped in *D. p. pseudoananassae*, and rod-shaped in *D. p. nigra*; in addition the latter form possesses an extra small pair of metacentric chromosomes. The polytene chromosome configuration of both forms is, however, the same, consisting of 4 long autosomal arms (representing the larger pairs of metacentrics in the metaphase karyotypes) and two shorter X chromosome arms, arising from a large chromocentre.

Type locality of *D. p. nigra*: Sabah, Borneo. Holotype and allotype deposited in the Queensland Museum, Brisbane, Australia. Twenty paratypes deposited in the Genetics Foundation, University of Texas collection.

Drosophila (Sophophora) parabiptinata sp. nov.

= sp. 7 Kaneshiro and Wheeler 1970. Dros. Inf. Serv. 45: 143.

General: Small flies. Distal portion of male abdomen darkens with age to shiny black. Closely resembles *D. bipectinata*.

Type culture: Sabah, Borneo. Holotype and allotype deposited in the Queensland Museum, Brisbane, Australia. Twenty paratypes deposited in the Genetics Foundation, University of Texas collection.

Body length: Male 2.1 mm; female 2.3 mm.

Head, male and female: Arista with 4–5 branches above, 3 below, plus the terminal fork. Front brown. Orbital bristles in the ratio 3:1:3. Carina narrow, convex. Ocelli pale orange. Eyes red. Greatest width of cheek 0.2 times greatest diameter of eye.

Thorax, male and female: Acrostichal hairs in 8 rows in front of dorsocentral bristles, 4 rows between dorsocentrals. Anterior scutellars convergent. Posterior dorsocentrals longer than anterior dorsocentrals (ratio 2:1). Sterno-index 0.6. Preapical bristles on all tibiae; apicals on first and second tibiae. Sex-comb of male in 2 longitudinal rows on distal portion of metatarsus consisting of approximately 5 teeth (proximal row) and 7 teeth (distal row), and 1–2 teeth on distal border of second tarsal segment (Fig. 8). An additional tooth is sometimes present above the latter, as in Fig. 8. *Abdomen of ♂ black posteriorly (4 seg)*

Wings, male and female: Transparent. Costal index 1.6 ± 0.2 ; 4V index 2.6 ± 0.3 ; 5X index 2.2 ± 0.2 ; 4C index 1.7 ± 0.2 . Third costal section with heavy bristles on basal 3/5. Wing length male 1.8 mm; female 2.2 mm.

Periphallalic organs (Fig. 6): Genital arch narrower dorsally than laterally, with process covering base of primary clasper; bristle arising from depression in apex of process. Toe rounded, bearing approximately 12 bristles. Claspers in 2 sets. Primary clasper large, with row of 4–5 short, stout, blunt, lateral bristles in two sets of 2 (or one set of 2 and one set of 3), and second row of approximately

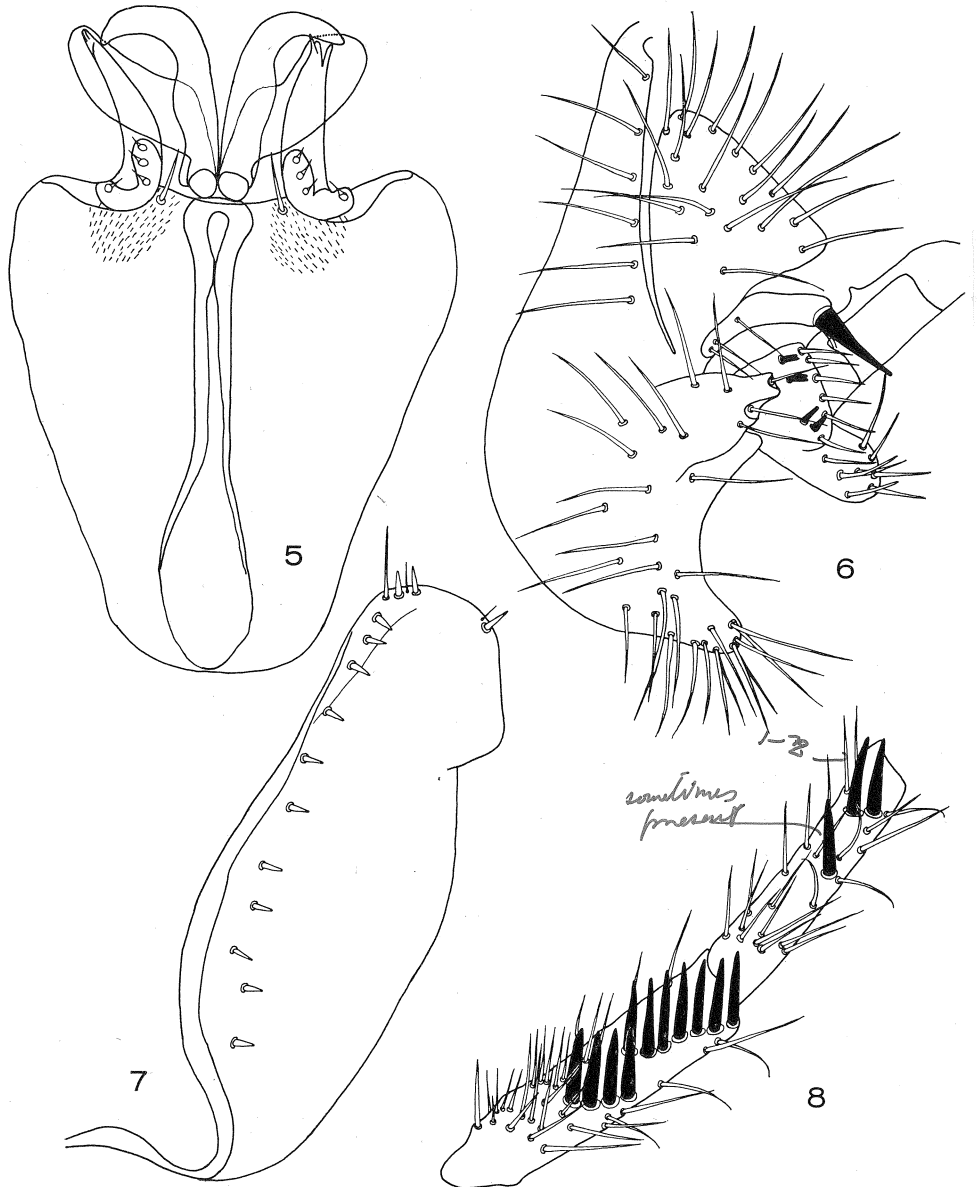


FIG. 5-8. *Drosophila parabipectinata*, n. sp. 5.—male phallic organs. 6.—male genital arch. 7.—female egg guide. 8.—sex-comb of male fore-tarsus. Specimens from Sandakan, Borneo.

6 longer pointed bristles. Posteromedial end of primary clasper with approximately 8 strong bristles, 1 elongated, curved towards decasternum. Secondary clasper narrow, with 1 very large pointed tooth and 2 minute teeth medially, and 3 bristles dorsolaterally. Anal plate small. Decasternum with median dorsal point.

Phallic organs (Fig. 5): Aedeagus brown, long, bifid, unbranched, curved distally, not ornamented. Anterior parameres V-shaped, with minute apical hair-

like sensilla. Posterior parameres long, almost reaching tip of aedeagus, apically with a few small serrations. Novasternum with a pair of submedian spines each surrounded by a patch of minute hairs. Ventral fragma quadrate. Basal apodeme of aedeagus as long as ventral fragma. Phallic formula ABCdefGHIKLMN. Phallosomal index 0.5.

Egg guides (Fig. 7): Brown, with approximately 14 teeth, 1 large subterminal hair, and 2 minute subterminal hairs. Basal isthmus $2/5$ length of lobe.

Internal structures, male and female: Intestinal coiling index 2.5. Rectal index 1.7. Malpighian tubules 2 anterior, free, common trunk 0.1 total length; 2 posterior, free, common trunk 0.1 total length; anterior and posterior subequal in length.

Internal genitalia, male: Testes yellow, tightly coiled, with 3 large outer and 4 small inner coils. Ejaculatory bulb globular.

Internal genitalia, female: Spermathecae well-developed, sclerotized, dark brown. Ventral receptacle tightly coiled.

Egg filaments: 2 long filaments, broader apically.

Pupae: Anterior spiracles very short, divergent, each with approximately 12 branches. Ratio pupal stalk/pupal body length 0.06. Posterior spiracles divergent, same length as anterior spiracles.

Distribution: *D. parabiptinata* is restricted to the Oriental biogeographic zone (Borneo, Philippines, Cambodia, Thailand).

Chromosomes: Metaphase karyotype as figured by Kaneshiro and Wheeler (1970). The polytene configuration consists of 4 long autosomal arms representing the larger pairs of metacentrics in the metaphase karyotype, and 2 shorter X chromosome arms, embedded in a large chromocentre.

Key to Species

Morphologically the members of the *bipectinata* species complex are very similar. The following key is given as a working basis for separation of the species. Since females of all species are indistinguishable from one another, cultures must be established from wild-caught females before identification is possible. (Females of members of the *bipectinata* complex are also indistinguishable from females of several other species of *Drosophila*).

Claspers in 2 sets. Primary clasper large, teeth in 2 groups: a lateral group (in 1 or 2 rows) of short, stout, blunt, black teeth; and a medial group of longer, pointed teeth, 1 of which is greatly elongated and curved towards the decasternum. Secondary clasper small, elongate, with 1 very large curved black medial tooth, and 4–5 additional minute teeth. Basal portion of primary clasper covered by a process arising from posterior margin of genital arch. Aedeagus bifid and bare. Sex-comb in 3 or 4 rows..... *bipectinata* species complex.

1. (a) Metatarsal portion of sex-comb consisting of 2 (almost) longitudinal rows of stout black bristles 2
- (b) Metatarsal portion of sex-comb consisting of 1 or 2 short transverse rows of stout black bristles 3
2. (a) Abdomen of male pale brown *D. bipectinata*
- (b) Abdomen of male black posteriorly *D. parabiptinata*

3. (a) Abdomen of male pale brown 4
 (b) Abdomen of male black posteriorly 5
4. (a) Sex-comb consisting of 2 short transverse metatarsal rows, and 1 short row on the distal border of the second tarsal segment.
 *D. pseudoananassae pseudoananassae*
- (b) Sex-comb consisting of 1 or 2 short transverse metatarsal rows, 1 short row on the distal border of the second tarsal segment and 1 or 2 additional teeth above the latter *D. malerkotliana pallida*
5. (a) Sex-comb as in 4(a) *D. pseudoananassae nigra*
 (b) Sex-comb as in 4(b) *D. malerkotliana malerkotliana*

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