Some new and unrecorded species of *Drosophila* (Diptera : Drosophilidae) from India

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SYNOPSIS

An account is given of 19 species of *Drosophila*, representing five subgenera. Keys to species are given for the three larger subgenera. Five species are described as new, and three species are recorded from India for the first time. A list of species so far recorded from India is given.

INTRODUCTION

JUDGING from reports on *Drosophila* taxonomy from other parts of the world, it appears that in India an almost completely virgin field awaits exploration. The indications are clear that this family is widely distributed in India, too, but at present our knowledge of their distribution is very scanty and fragmentary. Since January, 1965, the present authors have examined a large number of Drosophilids collected from several different localities in India, and the results of their studies are given in the present paper.

Details of the collecting sites and methods of collection have been given by Gupta (1969). Paper cups and quarter pint milk bottles with suitable baits were employed for trapping the flies. A stout string was tied around the neck of the bottle so that it could be hung at a convenient position on the lower branches of trees and bushes, as suggested by Kikkawa & Peng (1938). Besides this trap bait method of collection, occasional net-sweeping was also made on decaying fruits and various grasses.

In compiling the key an attempt has been made to include all the species of *Drosophila* so far recorded from India; species having insufficient descriptions are however omitted, although they are included in the check list on p. 71.

Genus *Drosophila* Fallén

Drosophila Fallén, 1823, *Diptera Sueciae Geomyzides* **2** : 4. Type: *Musca funebris* Fabricius; Sweden.

Subgenus *Sophophora* Sturtevant

Sophophora Sturtevant, 1939, *Proc. Nat. Acad. Sci.* **25** : 139. Type: *Drosophila melanogaster* Meigen.

Dark bands of abdominal tergites present, not interrupted medially; eggs with 2 filaments; cheeks relatively narrow; no prescutellars.

Key to Indian species of the subgenus Sophophora

1 Usually dark coloured species 2
– Usually light coloured species 3
2 First two tarsal segments of male fore leg each with sex-comb, proximal comb with about 10 and distal with about 8 black teeth . ***bifasciata*** Pomini
– First two tarsal segments of male fore leg similarly with sex-comb, proximal comb with 2 and distal with 1 black teeth . . . ***helvetica*** Burla
3 Face milky white in males 4
– Face yellowish in males 5
4 Second orbital bristle about half length of other two. At the base of primary clasper one very long bristle (very rarely two). . . ***seguyi*** Smart
– Second orbital bristle about one-third length of other two. At the base of primary clasper no such long bristle . . . ***jambulina*** Parshad & Paika

5 Acrostichal hairs in six rows 6
– Acrostichal hairs in eight rows 7
6 Secondary clasper completely separated from the anal plate . . ***kikkawai*** Burla
– Secondary clasper completely fused with the anal plate 8
7 Thoracic pleura with a longitudinal black stripe . . . ***rufa*** Kikkawa & Peng
– Thoracic pleura without such stripe 9
8 Costal index about 2·7 to 2·9. First two tarsal segments of male fore leg each with sex-comb, proximal comb with about 18–19 black teeth and distal one with about 14–17 similar teeth . . . . ***montium*** de Meijere
– Costal index about 2·1. First two tarsal segments of male fore leg similarly with sex-comb, proximal comb with about 24 black teeth and distal one with about 19 similar teeth . . . . . ***punjabiensis*** Parshad & Paika
9 In male, abdominal terminal tergites yellow 10
– In male, abdominal terminal tergites black 11
10 Or_2 about half length of vibrissa. In male, several transverse rows of blackish-brown bristles on the ventral surface of the first and second tarsal segments of fore leg . . . . . ***ananassae*** Doleschall
— Or_2 about one-third length of vibrissa. In male, two oblique combs of short black bristles on the inner surface of the first tarsal segment of fore leg; a few stout black bristles on the distal part of second tarsal segment of the fore leg . . . . . ***bipectinata*** Duda
11 Posterior margin of the genital arch with a process covering the upper part of the clasper . . . . . ***melanogaster*** Meigen
— Posterior margin of the genital arch without such process 12
12 Male wing apically with black spot 13
— Male wing apically without black spot 14
13 Posterior paramere with basal process 15
— Posterior paramere without basal process 16
14 Carina narrow and flat. Clasper with primary teeth long, about 14 arranged in a convex row, secondary teeth 2, on upper inner corner; secondary clasper absent . . . . . ***takahashii*** Sturtevant
— Carina narrow and high. Claspers two; primary teeth in two sets, anterior set of 2 and posterior of 3; secondary clasper with a large tooth ***malerkotliana*** Parshad & Paika
15 In male, proximal two tarsal segments of fore leg each with 2 or 3 transverse sex-combs of 1–4 black teeth . . . . . ***nepalensis*** Okada
— In male, proximal two tarsal segments of fore leg each with two transverse sex-combs, proximal comb with about 4–6 black teeth, distal one with about 3–4 similar teeth . . . . . ***raychaudhurii*** Gupta
16 Costal index about 3·5. In male, a comb with about four black, short stout bristles on the inner distal surface of the first tarsal segment of fore leg; a similar comb of a few black bristles on the inner distal surface of second tarsal segment . . . . . ***suzukii*** (Matsumura)
— Costal index about 2·4. In male, two transverse sex-combs on the first tarsal segment of fore leg, proximal comb with a row of 2 stout black teeth and distal one with a row of 4 similar teeth; two similar combs on the second tarsal segment with two teeth each ***pulchrella*** Tan, Hsu & Sheng

Drosophila (*Sophophora*) *melanogaster* Meigen, 1830

Drosophila melanogaster Meigen, 1830, *Syst. Beschr.* **6** : 85.

Habitats.—Many males and females were collected over fermenting fruits from Chakia, Varanasi, Nainital and Bombay. This species was found to occur throughout the year, but was very poorly recorded from the wild and areas far from human habitation.

Distribution.—Worldwide, in both tropical and temperate regions.

Drosophila (Sophophora) ananassae Doleschall, 1858

Drosophilia ananassae Doleschall, 1858, *Nat. Tijd. Ned. Ind.* **17** : 128.

Habitats.—Several individuals were collected from houses at Varanasi, Mughalsarai, Bhagalpur (Bihar), Calcutta and Agartala. No individual was recorded from the wild.

Distribution.—Widely distributed in the tropical and subtropical regions of the world.

Drosophila (Sophophora) bipectinata Duda, 1923

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

Habitats.—A few males and females were collected from Chakia forest, Varanasi, after the rains.

Distribution.—Japan, Formosa, India, Nepal, Borneo, Sumatra and Micronesia.

Drosophilia (Sophophora) malerkotliana Parshad & Paika, 1964

Drosophila (*Sophophora*) sp. Okada, 1964, *Nature and life in Southeast Asia* **3** : 439.
Drosophila (*Sophophora*) *malerkotliana* Parshad & Paika, 1964. *Res. Bull.* (*N.S.*) *Punjab Univ.* **15** : 235.

Habitat.—This was a very common species and was largely collected over fermenting fruits from Chakia forest, Varanasi, Sirsi (Mirzapur), Burdwan (W. Bengal). It appeared abundantly just after the rains.

Distribution.—India.

Drosophila (Sophophora) kikkawai Burla, 1954

Drosophila (*Sophophora*) *kikkawai* Burla, 1954, *Rev. Brasil. Biol.* **14** : 47.

Habitat.—Many males and females were collected from Nainital by sweeping over discarded fruits, but very few were recorded from Chakia forest, Varanasi and other places in Uttar Pradesh.

Distribution.—China, Nepal, Japan, Hawaii, Micronesia, Samoa, South America, India, Formosa and Spain.

Drosophila (Sophophora) takahashii Sturtevant, 1927

Drosophila takahashii Sturtevant, 1927, *Phillip. J. Sci* **32** : 371.

Habitat.—Several individuals were collected over citrus fruits at Naini (Allahabad) and Digha sea-beach (W. Bengal).

Distribution.—Borneo, Formosa, Nepal, China, Japan, India, Manchuria, Okinawa, Taiwan.

Drosophila (Sophophora) nepalensis Okada, 1955

Drosophila sp. from Kakani, Nepal: Okada, 1954, *Kontyu* **22** : 38.
Drosophila (*Sophophora*) *nepalensis* Okada, 1955, *Sci. result. Japan. Exped. to Nepal. Himalaya*, 1952–53 **1** : 388.

Habitat.—Parshad & Paika (1964) have reported that this species is associated with low temperature and humidity. The present authors were able to collect a very few individuals from Nainital, at an altitude of about 6364 feet above sea level, by sweeping over fermenting fruits.

Distribution.—Nepal, India.

Drosophila (Sophophora) raychaudhurii Gupta, 1969

Drosophila (*Sophophora*) *raychaudhurii* Gupta, *Proc. Zool. Soc. Calcutta.* **22** : 53–61.

Habitat.—A few individuals were collected during the monsoon and just after the rains from Chakia forest, but the species was largely recorded from Naini and Digha sea-beach over citrus fruits.

Distribution.—India.

Drosophila (Sophophora) seguyi Smart, 1945

Drosophila subobscura Séguy, 1938, *Mem. Mus. Hist. nat. Paris* (n.s.) **8** : 352; preocc. *Drosophila subobscura* Collin in Gordon, 1936, *J. Genet.* **33** : 60.
Drosophila seguyi Smart, 1945, *Proc. R. ent. Soc. Lond.* (B) **14** : 53–56 (replacement name for *D. subobscura* Seguy preocc.); Burla, 1954, *Rev. Brasil. Biol.* **14** : 41–54.

External characters of male and female

Arista with about 4–5 dorsal and 2–3 ventral branches in addition to terminal fork. Distance from anterior dorsocentral to posterior dorsocentral about half distance between 2 anterior dorsocentrals. Sex-comb on male fore leg in 2 sets, metatarsal comb with about 15–22 stout teeth, tarsal comb with about 13–17 small teeth.

Wings hyaline. C-index about 2·3; 4V-index about 3·1; 4C-index about 1·5; 5X-index about 3·1. Two equal bristles at apex of first costal section; heavy bristles on about basal half of third costal section. Other details as described by Smart (1945) and Burla (1954).

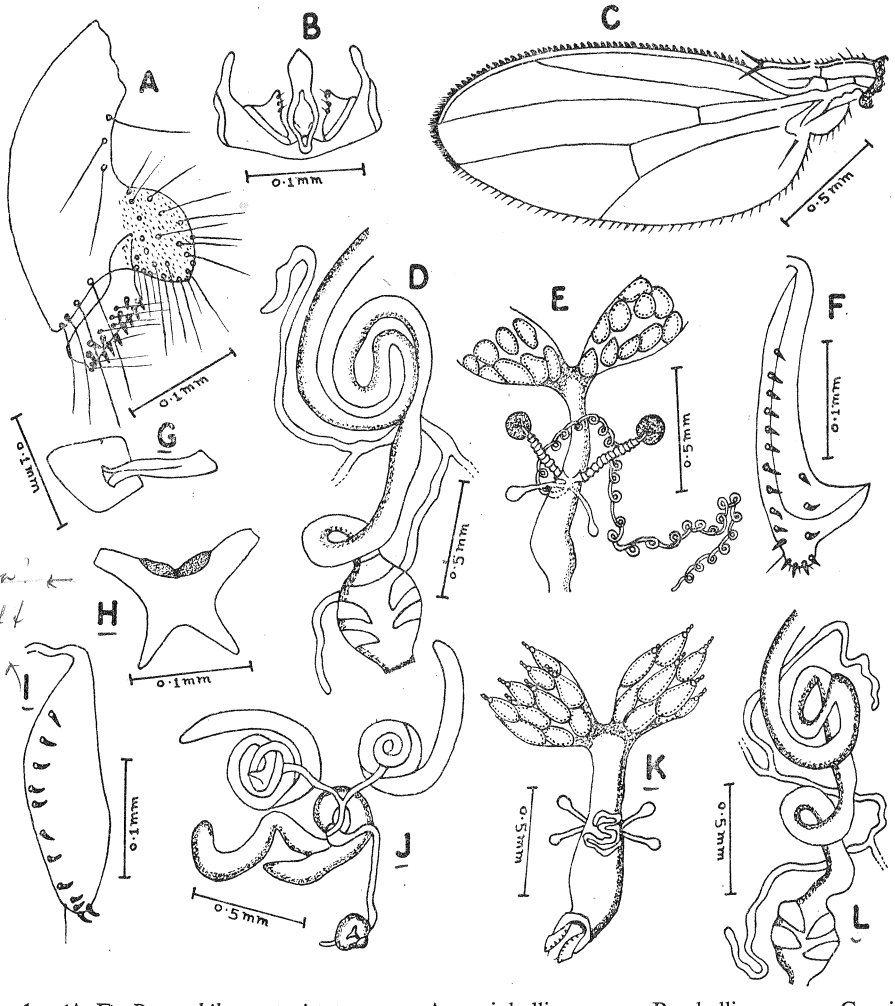

FIG. 1.—(A–F) *Drosophila pentavittata* sp. n. A, periphallic organs; B, phallic organs; C, wing; D, proximal intestine; E, female reproductive organs; F, egg-guide. (G–L) *Drosophila seguyi* Smart. G, ejaculatory apodeme; H, decasternum; I, egg-guide; J, male reproductive organs; K, female reproductive organs; L, proximal intestine.

Periphallic organs as described and figured by Burla (1954). Decasternum (fig. 1H): median piece nearly X-shaped; posterior margin forked; anterior end with a notch and a pair of lateral arms. Phallic organs as described and figured by Burla (1954). Egg-guides (fig. 1I): lobe with about 12 marginal teeth, tip of lobe somewhat pointed, third and fourth teeth very close to each other; discal teeth absent; subterminal hair situated between fourth and fifth marginal teeth; basal isthmus longer.

Internal structure of males and females.

Proximal intestine (fig. 1L), C = 2·0; rectal papillae, R = 1·8; Malpighian tubules with common stalks moderate in length, posterior branches ending free; testis (fig. 1J) pale yellow, with about 3

outer and 1 inner coils; ejaculatory apodeme (fig. 1G) with hyaline elliptical plate, pointed distally, stem slightly longer than plate; ventral receptacle long; spermatheca small and hyaline (fig. 1K).

Egg

Typical of the subgenus.

Puparia

Light golden-yellow; anterior spiracles with about 6–7 filaments, horns including spiracles about one-tenth length of puparium; posterior spiracles divergent.

Habitat.—This species was found to occur throughout the year, with a peak in October, and was largely recorded from Chakia forest, Varanasi, Nainital, Sirsi and Burdwan. It seems to be a very common species here.

Distribution.—Kenya, Ivory Coast, China, Brazil and India (new record).

Subgenus *Hirtodrosophila* Duda

Hirtodrosophila Duda, 1923, *Mus. Nat. Hungarici* **20** : 41. Type: *Drosophila latifrontata* Frota-Pessoa; Taiwan.

Antennal segment 3 large, bearing unusually long hairs; carina short, confined to upper part of face; arista usually with one ventral branch basal to terminal fork; no prescutellar bristles. Fungivorous species.

Drosophila (Hirtodrosophila) pentavittata sp. n.

External characters of male and female

Arista with about 3–4 dorsal and 1 ventral branches in addition to the long terminal fork. Antennae yellow; second segment dorsally black; third segment whitish-yellow. Frons yellow, medianly with a black longitudinal stripe passing over ocellar triangle. Anterior reclinate orbital about half length of posterior reclinate and about two-thirds length of proclinate. Carina whitish-yellow, narrow and low. Face and cheek yellow, greatest width of cheek from base of oral to eye border about one-eighth greatest diameter of eye. Second oral subequal to vibrissa, base of orals black. Palpi whitish-yellow, having 1 large apical and 2 or 3 other prominent small setae. Eye bright red, its longest axis slightly oblique to body axis.

Acrostichal hairs regular, in 6 rows, no prescutellars. Anterior scutellars convergent. Distance from anterior dorsocentral to posterior dorsocentral about half distance between 2 anterior dorsocentrals. Mesonotum and scutellum light yellow, with 3 longitudinal black stripes; from base of lateral stripe a black longitudinal stripe extends on either side anteriorly up to the mid-half of the mesonotum. Thoracic pleura whitish-yellow, with one broad longitudinal black stripe. Sterno-index about 0·65. Legs whitish-yellow, preapicals on mid and hind tibiae; apicals on fore and mid-tibiae.

Wings (fig. 1C) hyaline. R_2 almost straight, distal costal break deeply incised, alar lobe slightly black. C-index about 1·79; 4V-index about 2·4; 4C-index about 1·54; 5X-index about 1·75. Two equal bristles at apex of first costal section; heavy bristles on about basal four-fifths of third costal section. Halteres yellow, upper surface of stalk brown.

Abdomen whitish-yellow, with 4 black, broad longitudinal stripes. Each tergite with 4 rows of bristles, posterior row of bristles slightly stout and prominent. Periphallic organs (fig. 1A): genital arch with 4 bristles on lower portion and 2–3 bristles on upper portion; anal plate pubescent, almost oval and fused with genital arch; clasper with about 12–15 scattered black teeth, 8–10 slightly tough hairs. Phallic organs (fig. 1B): aedeagus pale yellow, pointed apically, slightly broadened subapically and narrowing medianly; anterior paramere triangular, with about 3 sensilla; novasternum much broader than long. Egg-guides (fig. 1F): lobe yellow, obliquely truncate at tip, and with about 15 marginal and 3 discal teeth; subterminal hair inserted between fourth and fifth marginal teeth; basal isthmus very short.

Average length of male body (from 3 males), 1·92 mm.; wing, 1·69 mm.

Average length of female body (from 4 females), 2·4 mm.; wing, 1·87 mm.

Internal structure of male and female

Proximal intestine (fig. 1D), C = 2·0; rectal papillae: R = 1·9; Malpighian tubules light yellow with their common stalks rather short; spermatheca hyaline, with annular stalk; parovaria very small; ventral receptacle long and with about 30–35 coils (fig. 1E).

Habitat.—The few males and females were seen at Digha sea-beach over a fruit-bait supplemented with baker's yeast.

Holotype ♂, INDIA: Digha sea-beach, Midnapore district, West Bengal, 29.viii.1966 (*Gupta & Ray-Chaudhuri*). *Paratypes*: 2 ♂, 4 ♀ (including allotype), same data as

holotype. In the Department of Zoology, Banaras Hindu University, Varanasi, India.

D. pentavittata is unique in the subgenus *Hirtodrosophila* in having a conspicuously striped thoracic pattern, resembling that of *D. busckii.*

Subgenus *Scaptodrosophila* Duda

Scaptodrosophila Duda, 1923, *Mus. Nat. Hungarici Ann.* **20** : 37. Type: *Scaptodrosophila scaptomyzoidea* Duda; New Guinea.
Pugiodrosophila Duda, 1924, *Archiv Naturgesch.* (A) **90** : 203. Type: *Drosophila pugionata* de Meijere; Simalur.
Xiphiodiochaeta Duda, 1925, *Mus. Nat. Hungarici, Ann.* **22** : 200 (incorrect replacement name for *Pugiodrosophila*). Type: *D. pugionata* de Meijere.
Pholadoris Sturtevant, 1942, *Univ. Texas Publ.* 4213 : 28. Type: *D. victoria* Sturtevant; United States.
Paradrosophila Duda, 1923, *Mus. Nat. Hungarici, Ann.* **20** : 43. Type: *D. pictipennis* Kentesz; New Guinea.

Wheeler & Takada (1964) synonymised the subgenus *Pholadoris* with the subgenus *Scaptodrosophila* Duda, and the latter name is now being used instead of *Pholadoris* or *Paradrosophila* in Duda's sense (*personal communication* from Dr. Okada to Dr. Ray-Chaudhuri).

Three strong, subequal sternopleural bristles; prescutellars present; posterior gonapophyses of male copulatory apparatus fused or contiguous with penis; egg with 6 or more filaments (except *latifshahi*, which has 4).

Key to Indian species of the subgenus Scaptodrosophila

1 Mesonotum and scutellum unicolourous 2
– Mesonotum and scutellum not unicolourous 3
2 Mesonotum and scutellum brown. Tarsal segments of male fore legs with many long curved upright hairs along the anterior margin ***latifshahi*** sp. n.
– Mesonotum and scutellum pale-yellow. Tarsal segments of male fore legs normal . . . . . ***paratriangulata*** sp. n.
3 Mesonotum and scutellum with silvery-white striations arranged longitudinally . . . . . ***silvalineata*** sp. n.
– Mesonotum and scutellum with scattered silvery-white spots arranged longitudinally . . . . . ***chandraprabhiana*** sp. n.

Drosophila (Scaptodrosophila) chandraprabhiana sp. n.

External characters of male and female

Arista with about 3 dorsal and 1–2 ventral branches in addition to the terminal fork. Antennae dark brown; third segment blackish. Frons including ocellar triangle dark brown, frons darker anteriorly; silvery-white around ocellar triangle; orbits with white spots along eye margin. Frons more than half as broad as width of head. Anterior reclinate orbital about two-thirds length of other 2, inserted just outside proclinate. Second oral about half length of vibrissa. Carina narrow, high, slightly broader below. Palpi brown, with one slightly larger and several other prominent setae. Face and cheek yellowish, greatest width of cheek about one-sixth greatest diameter of eye. Eyes dark red with short dark piles.

Acrostichal hairs regular, usually in 6 rows, prescutellars clearly differentiated. Anterior scutellars divergent, posterior scutellars crossing each other. Distance from anterior dorsocentral to posterior dorsocentral about two-fifths distance between 2 anterior dorsocentrals. Mesonotum and scutellum black-brown with scattered white spots arranged longitudinally. Thoracic pleura blackish-brown. Sterno-index about 0·7. Legs brown, preapicals on all 3 tibiae; apicals on fore and mid-tibiae. No ornamentation like sex-comb in male.

Wings (fig. 2E) slightly dusky, veins dark brown. Costa somewhat swollen before the second costal break. R_2 straight, not curved to costa apically. C-index about 1·6; 4V-index about 2·5; 4C-index about 1·6; 5X-index about 1·6. Two equal bristles at apex of first costal section; heavy bristles on about basal five-eighths of third costal section. Halteres light yellow, knob and stalk with pale-brown spots exteriorly.

Abdomen uniformly darker, tergites with broad uninterrupted black bands. Sternites light brown and somewhat quadrate. Periphallic organs (fig. 2C): genital arch dark brown, broad and rounded below, with about 25–32 bristles running from top of posterior margin along margin downward,

heel roundish with a spur-like projection, under margin strongly convexed; anal plate elliptical, dark brown, separated from genital arch and densely bristled, bristles on plate rather long; clasper with about 8 black teeth arranged in a slightly concave row, inner surface of clasper setigerous. Decasternum (fig. 2B): light yellow, apparently bilobed, proximal end attached to the anal plates, bearing 2–3 fine hairs on each lobe. Phallic organs (fig. 2A): aedeagus bifid, somewhat broadened at middle, dorsally connected by a bar; anterior paramere dumb-bell-shaped, separated from aedeagus, with about 6 sensilla and with numerous fine hairs at the apex; posterior paramere very short, with peg-like distal tip and articulate with the aedeagus; ventral fragma quadrate, slightly longer than broad; novasternum with median process and laterally bristled depression, one pair of bristles near base of each anterior paramere. Phallosomal index about 0·3. Egg-guides (fig. 2G): lobe pale-yellow, weakly sclerotised, truncate at discal portion and with about 15–19 marginal teeth; discal teeth absent; subterminal hair situated between third and fourth marginal teeth; basal isthmus short and narrow.

Average length of male body (from 10 males), 2·4 mm.; wing, 1·89 mm.

Average length of female body (from 10 females), 2·7 mm.; wing, 2·2 mm.

Internal structures of male and female

Proximal intestine (fig. 2J), C = 2·0; rectal papillae: R = 1·6; Malpighian tubules dull yellow, with their common stalks moderate in length and posterior branches apposed to each other at tips;

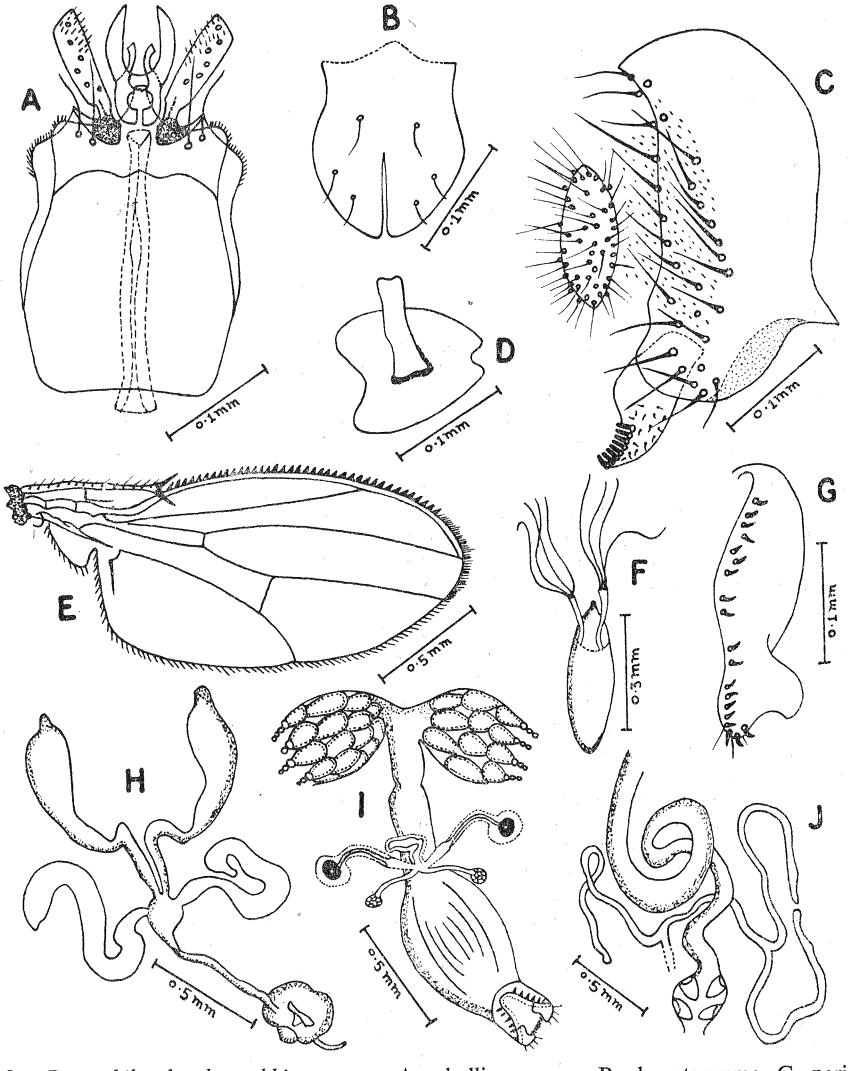

FIG. 2.—*Drosophila chandraprabhiana* sp. n. A, phallic organs; B, decasternum; C, periphallic organs; D, ejaculatory apodeme; E, wing; F, egg; G, egg-guide; H, male reproductive organs; I, female reproductive organs; J, proximal intestine.

testis (fig. 2H) orange, broadened towards free end, uncoiled; paragonia large and slender; ejaculatory apodeme (fig. 2D) somewhat triangular, having a groove at either extremity, and with a short and thick stalk; ventral receptacle very small (fig. 2I).

Egg (fig. 2F)

With 6–8 long filaments emerging from the common stalks.

Puparia

Dark brown; anterior spiracles with about 6–7 small filaments, horns including spiracles about one-eighteenth length of puparium; posterior spiracles parallel.

Holotype ♂, INDIA: Chandraprabha, Chakia forest, Varanasi district, Uttar Pradesh, 27.iii.1965 (*Gupta & Ray-Chaudhuri*). *Paratypes:* 12 ♂, 19 ♀ (including allotype), same data as holotype; 12 ♂ and 10 ♀, same locality and collectors as holotype, vii.1965–ix.1965; 41 ♂ and 53 ♀, same locality and collectors as holotype, ii, iii.1966. In the Department of Zoology, Banaras Hindu University, Varanasi, India.

Habitat.—The species started appearing just after the rains at Chandraprabha (Chakia forest), reaching a peak during February and March. It showed a close association with lemon trees.

D. chandraprabhiana is somewhat allied to *Spuriostyloptera multipunctata* Duda in having white orbits, convex ocellar triangle, straight R_2 vein and relatively long frons, but differs in having 4V-index smaller and mesonotal coloration black with scattered white spots (dark brown with black spots in *multipunctata*).

The species does not breed in the standard laboratory food medium, but a few specimens were reared when additional banana was mixed with this food medium. It has not so far been possible to maintain a strain through successive generations.

Drosophila (Scaptodrosophila) silvalineata sp. n.

External characters of male and female

Arista with about 3 dorsal and 2 ventral branches in addition to the terminal fork. Antennae dark brown; third segment black. Frons including ocellar triangle dark brown and slightly blackish anteriorly, silvery-white lining around ocellar triangle, orbits also with silvery-white lining along eye margin. Frons more than half as broad as width of head. Proclinate orbital bristle equal to posterior reclinate orbital, anterior reclinate orbital two-thirds length of other 2, situated nearer to proclinate than posterior reclinate. Second oral thin and about half length of vibrissa. Palpi brown, with several prominent setae. Carina brown, broad and ridged below. Face and cheek dark brown, greatest width of cheek from base of oral to eye border about one-eighth greatest diameter of eye. Clypeus blackish-brown. Eyes dark red with thick piles.

Acrostichal hairs regular, in 6 rows, prescutellars well differentiated. Anterior scutellars divergent. Distance from anterior dorsocentral to posterior dorsocentral about two-fifths distance between 2 anterior dorsocentrals. Mesonotum blackish-brown, with 11 silvery-white striations arranged longitudinally. Thoracic pleura brown. Sterno-index about 0·75. Legs brownish-yellow, preapicals on all 3 tibiae; apicals on fore and mid-tibiae.

Wings (fig. 3E) slightly dusky, R_2 straight not curved to costa apically. C-index about 1·5; 4V-index about 2·4 to 2·7; 4C-index about 1·7; 5X-index about 1·6. Two equal small bristles at apex of first costal section; heavy bristles on about basal five-eighths of third costal section. Halteres yellow with upper surface pale brown. No ornamentation like sex-comb in males.

Abdomen uniformly brownish-black, tergites with broad bands. Periphallic organs (fig. 3D): genital arch narrow, slightly broad below, and with about 17 bristles running from top of posterior margin along margin downward, with a pointed process at heel; anal plate elliptical, separated from genital arch; clasper oblong, with about 11 black large teeth arranged in a concave row, inner surface of clasper with about 6–7 fine small setae, no secondary teeth. Decasternum (fig. 3B): light yellow, apparently bilobed; proximal end attached to anal plates, with 3–4 fine hairs on each lobe. Phallic organs (fig. 3A): generally pale yellow; aedeagus bifid, slender and pointed apically, and with a thin transparent membrane between 2 lobes; anterior paramere large, elongate, slightly broadened and curved at middle, apically with many hairs, and with a longitudinal row of about 5–7 sensilla; posterior paramere hook-shaped, slightly broadened proximally and articulate with aedeagus; novasternum partly pubescent, with very small lateral process, without median notch, a long paired submedian spine near base of each anterior paramere; ventral fragma almost quadrate, slightly longer than broad; phallosomal index about 0·55. Egg-guides (fig. 3C): lobe light yellow, oblong, weakly sclerotised, with about 15–17 marginal teeth, ultimate tooth slightly distant from penultimate tooth; discal teeth absent; basal isthmus short and straight.

Average length of male body (from 10 males), 2·14 mm.; wing, 1·89 mm.
Average length of female body (from 10 females), 2·4 mm.; wing, 2·2 mm.

Internal structures of male and female

Malpighian tubules yellow, with common stalks short and branches long; testis (fig. 3G) orange, uncoiled and broadened at free end, anterior ejaculatory duct slightly long; ejaculatory apodeme (fig. 3F) with almost quadrate plate, notched at both cephalic as well as caudal margins, stem thick, dark and longer than the plate; ventral receptacle very small; spermatheca large and oval (fig. 3I).

Egg (fig. 3H)

With 6 long and 6 very small filaments emerging from the common stalks.

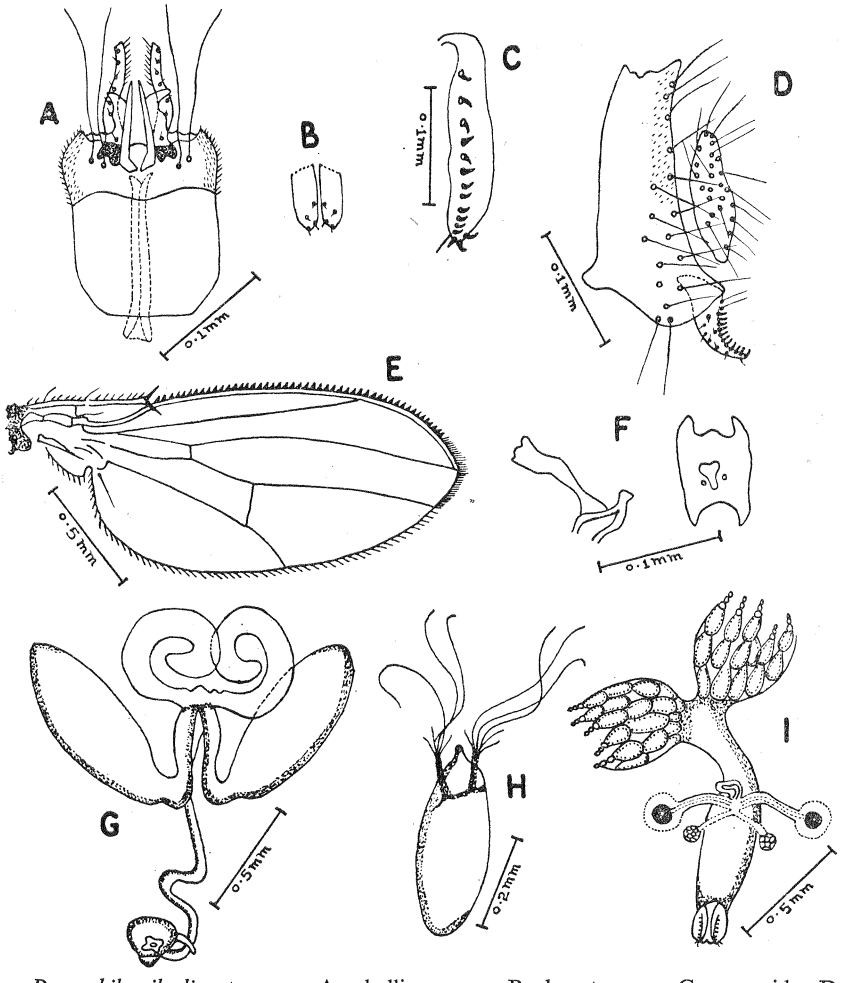

FIG. 3.—*Drosophila silvalineata* sp. n. A, phallic organs; B, decasternum; C, egg-guide; D, periphallic organs; E, wing; F, ejaculatory apodeme (lateral and dorsal aspects); G, male reproductive organs; H, egg; I, female reproductive organs.

Holotype ♂, INDIA: Chandraprabha, Chakia forest, Varanasi district, Uttar Pradesh, 27.iii.1965 (*Gupta & Ray-Chaudhuri*). *Paratypes*: 5 ♂, 4 ♀ (including allotype), same data as holotype; 1 ♂ and 1 ♀, same locality and collectors as holotype, ix.1965; 59 ♂ and 67 ♀, same locality and collectors as holotype, ii, iii.1966. In the Department of Zoology, Banaras Hindu University, Varanasi, India.

Habitat.—This species was found to co-exist with *Drosophila chandraprabhiana* and was recorded from Chandraprabha only. It appeared abundantly in March, and also showed a close association with lemon trees.

D. silvalineata seems to be closely related to *D. chandraprabhiana* in having white

orbits, straight R_2 vein, relatively long frons, apparently bilobed decasternum and the egg filaments emerging from the common stalks. It differs distinctly from *chandraprabhiana* in having silvery-white striations on the mesonotum instead of scattered white spots, and the novasternum without median process but with paired long submedian spines (median process with paired small submedian spines present in *chandraprabhiana*), ejaculatory apodeme with almost quadrate plate (triangular in *chandraprabhiana*), primary clasper with 11 black large teeth (8 black teeth in *chandraprabhiana*), egg-guide lobe oblong (broad and truncate below in *chandraprabhiana*).

The species does not breed in the laboratory food medium.

∨ *Drosophila (Scaptodrosophila) paratriangulata* sp. n.

External characters of male and female

Arista with about 4 dorsal and 2 ventral branches in addition to the terminal fork. Antennae pale yellow; third segment greyish. Frons including ocellar triangle brownish; frons more than two-thirds as broad as width of head. Carina narrow, high. Face and cheek straw colour, greatest width of cheek from base of oral to eye border about one-seventh greatest diameter of eye. Anterior reclinate orbital about half length of other 2. Second oral very thin and about two-fifths length of vibrissa. Palpi yellowish, with 2 large prominent bristles and numerous other small setae. Eyes bright red.

Acrostichal hairs regular, in 8 rows, prescutellars clearly differentiated. Anterior scutellars convergent, posterior scutellars crossing each other. Distance from anterior dorsocentral to posterior dorsocentral about half distance between 2 anterior dorsocentrals. Mesonotum and scutellum unicolorous, pale yellow. Thoracic pleura paler, having a faint stripe. Sterno- index about 0·7, middle sternopleural bristle as long as anterior one. Legs straw colour, preapicals on all 3 tibiae; apicals on fore and mid-tibiae. No ornamentation like sex-comb in males.

Wings (fig. 4D) hyaline. C-index about 1·6; 4V-index about 2·7; 4C-index about 1·56; 5X-index about 1·45. Two bristles at apex of first costal section; heavy bristles on about basal three-quarters of third costal section. Halteres pale yellow.

Abdomen yellow, tergites with dark brown bands medially interrupted; band on tergites 2–4 laterally projected forward; sixth tergite completely black in male. Periphallic organs (fig. 4B and C): genital arch completely pubescent, broad below, with about 11 bristles on lower half and about 2 bristles on upper half, heel roundish, undermargin strongly convex; anal plate pubescent, elliptical and slightly constricted at lower tip, separated from genital arch and with about 22–29 bristles; clasper with about 12 primary black teeth arranged in a concave row and with about 6–7 marginal bristles. Phallic organs (fig. 4A): aedeagus pale yellow, bifid, large and apically pointed; anterior paramere large, contiguous to aedeagus, somewhat broadened at middle and with a row of about 5 sensilla along entire length; posterior parameres seem to be fused with each other to form a large triangular flap; ventral fragma almost quadrate, broadly rounded at tip; novasternum pubescent, with strong lateral process and a highly developed median projection; submedian spines 2, strong, black and longer than anterior parameres; phallosomal index about 0·5. Egg-guides (fig. 4F): lobe yellowish, weakly sclerotised and narrowly rounded at tip, constricted at middle and with about 13–14 marginal yellow teeth, ultimate tooth situated far from penultimate tooth; no discal teeth present; subterminal hair situated between fourth and fifth marginal teeth; basal isthmus short.

Average length of male body (from 5 males), 1·66 mm.; wing, 1·43 mm.

Average length of female body (from 5 females), 1·89 mm.; wing, 1·63 mm.

Internal structures of male and female

Proximal intestine (fig. 4I), C = 2·0; rectal papillae: R = 1·4; Malpighian tubules whitish-yellow, with their common stalks slightly longer than moderate, posterior branches apposed to each other at tips; testis (fig. 4E) light yellow, with about 4 small inner and 3·5 outer coils; ventral receptacle large with several coils; spermatheca oval, dark brown; parovaria with small stalks (fig. 4G).

Egg (fig. 4H)

With 6 filaments.

Holotype ♂, INDIA: Chandraprabha, Chakia forest, Varanasi district, Uttar Pradesh, 25.vii.1965 (*Gupta & Ray-Chaudhuri*). *Paratypes*: 3 ♂, 4 ♀ (including allotype), same data as holotype; 3 ♂ and 7 ♀, same locality and collectors as holotype, viii, ix.1965; 2 ♂ and 3 ♀, Sirsi, Mirzapur district, Uttar Pradesh, 9.ix.1966 (*Gupta & Ray-Chaudhuri*). In the Department of Zoology, Banaras Hindu University, Varanasi, India.

Habitats.—The collection of this species was possible only after the rains at

Chandraprabha and Sirsi. With the decrease of rains its population also showed a gradual fall and became almost zero with the start of winter.

D. paratriangulata somewhat resembles *D. dorsocentralis* Okada from Okinawa in having three long sternopleurals, cross-striped abdominal tergites and large triangular posterior parameres, but differs in having an apically rounded wing (slightly pointed in *dorsocentralis*), anterior dorsocentrals not before the suture, heel of the genital arch not pointed and the row of clasper teeth not convexed.

The species does not breed in the laboratory food medium.

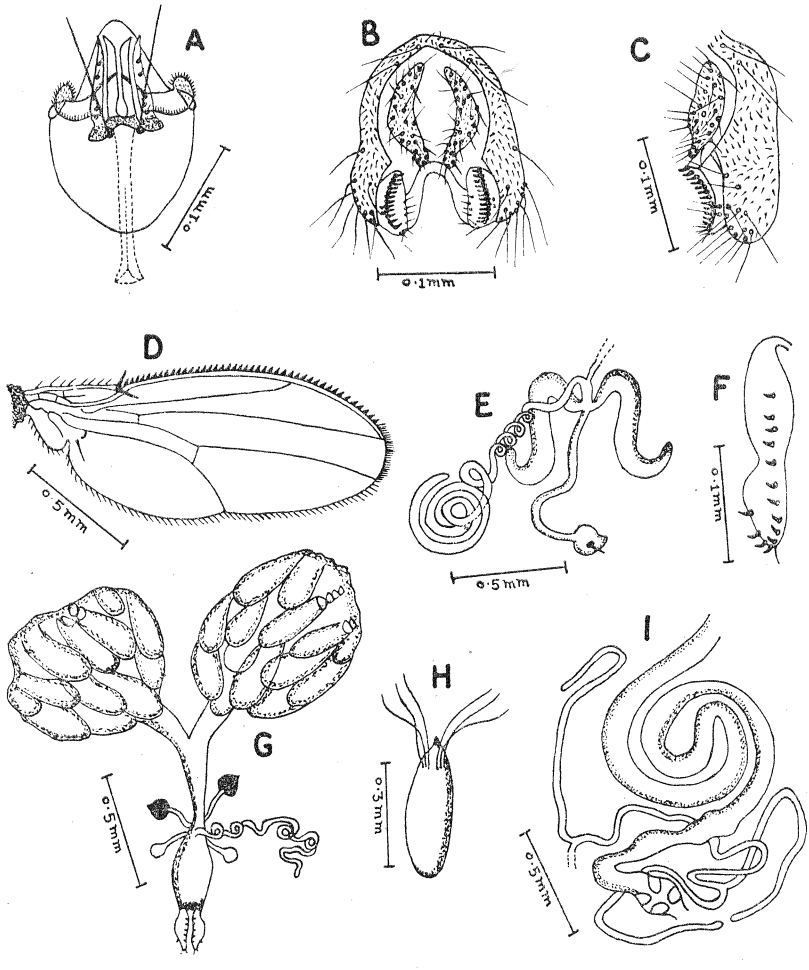

FIG. 4.—*Drosophila paratriangulata* sp. n. A, phallic organs; B and C, periphallic organs; D, wing; E, male reproductive organs; F, egg-guide; G, female reproductive organs; H, egg; I, proximal intestine.

Drosophila (Scaptodrosophila) latifshahi sp. n.

External characters of male and female

Arista with about 5–6 dorsal and 2 ventral branches in addition to the terminal fork. Antennae light brown, third segment darker. Frons including ocellar triangle, pale brown; front more than two-fifths as broad as width of head. Carina pale brown, narrow, high but broadening below. Anterior reclinate orbital about two-thirds length of proclinate and about half length of posterior reclinate, inserted just outside proclinate. Second oral subequal to vibrissa. Palpi pale yellow, with 2–4 prominent setae. Face and cheek pale brown, greatest width of cheek from base of oral to eye border about one-ninth greatest diameter of eye. Eyes dark red.

Acrostichal hairs regular, in 6 rows, weak but distinct prescutellars. Anterior scutellars convergent. Distance from anterior dorsocentral to posterior dorsocentral about half distance between 2 anterior dorsocentrals. Mesonotum and scutellum unicolorous, brown. Thoracic pleura pale

brown. Sterno-index about 0·7. Legs pale yellow, preapicals on all 3 tibiae; apicals on fore and mid-tibiae. Sex-comb not present but metatarsal and tarsal segments of male fore leg with long curved upright hairs along anterior margin, metatarsal segment with about 9 transverse rows of yellow bristles, rows 3–9 with 4 bristles in each row (fig. 5I).

Wings (fig. 5D) dusky. C-index about 1·93; 4V-index about 2·2; 4C-index about 1·32; 5X-index about 1·6. Two stout, unequal bristles at apex of first costal section; heavy bristles on about basal five-sixths of third costal section. Halteres pale brown.

Abdomen uniformly brownish-black, sternites quadrate. Periphallic organs (fig. 5C): genital arch long, broad below, pubescent, lower half about 35–42 bristles, heel observable and lower than toe; anal plate oval, pubescent, with long bristles, separated from genital arch, constricted near lower tip, latter with dense short setae; clasper with about 7–8, usually 7 stout black teeth, arranged in a straight row and with about 8–11 marginal bristles. Decasternum (fig. 5H): median piece slender, slightly swollen at both extremities; anterior end with small lateral arms; posterior margin with pointed projections. Phallic organs (fig. 5A): bright yellow; aedeagus cylindrical, stout, vertical rod developed (fig. 5B); phallosomal index about 2·0; anterior parameres seem to be fused with novasternum, posterior parameres apparently represented by a thin cross bar connecting lateral tips of novasternum; ventral fragma quadrate and apically concave. Egg-guides (fig. 5G): lobe brownish, having long concavity at discal portion; tip of lobe somewhat pointed and with about 13–17 yellowish-brown marginal teeth, ultimate tooth transformed into a long bristle; discal teeth 2–3, in form of

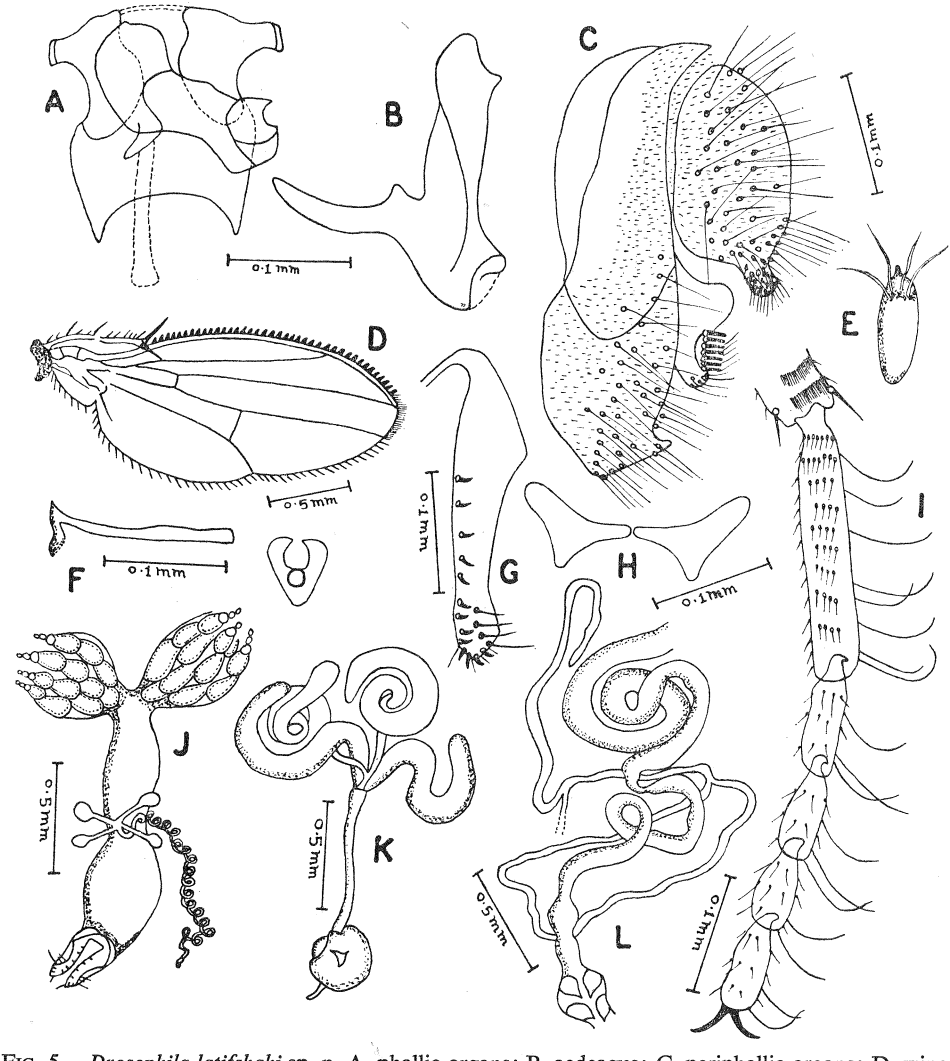

FIG. 5.—*Drosophila latifshahi* sp. n. A, phallic organs; B, aedeagus; C, periphallic organs; D, wing; E, egg; F, ejaculatory apodeme (lateral and dorsal aspects); G, egg-guide; H, decasternum; I, male prothoracic leg; J, female reproductive organs; K, male reproductive organs; L, proximal intestine.

long bristles; subterminal hair situated between fifth and sixth marginal teeth; basal isthmus slightly long.

Average length of male body (from 5 males), 2·4 mm.; wing, 2·2 mm.

Average length of female body (from 5 females), 2·7 mm.; wing, 2·4 mm.

Internal structures of male and female

Proximal intestine (fig. 5L), C = 2·0; rectal papillae ovoid, R = 1·5; Malpighian tubules bright yellow, with their common stalks moderate in length, posterior branches apposed to each other at tips; testis (fig. 5K) pale yellow, and with about 1·5 outer and 2 inner coils, sperm pump simple; ejaculatory apodeme (fig. 5F) with hyaline triangular plate, stem much longer than plate; ventral receptacle long, with about 21–27 coils; spermatheca without chitinised centre (fig. 5J).

Egg (fig. 5E)

With 4 filaments.

Puparia

Dark orange-brown; anterior spiracles with about 9–11 filaments, horns including spiracles about one-eighth length of puparium. Posterior spiracles divergent.

Holotype ♂, INDIA: Chandraprabha, Chakia forest, Varanasi district, Uttar Pradesh, 26.viii.1965 (*Gupta & Ray-Chaudhuri*). *Paratypes*: 2 ♂, 4 ♀ (including allotype), same data as holotype; 5 ♂ and 7 ♀, Latifshah, Chakia forest, Varanasi district, Uttar Pradesh, 27.x.1965 (*Gupta & Ray-Chaudhuri*). In the Department of Zoology, Banaras Hindu University, Varanasi, India.

Habitat.—A few males and females were collected from Chakia forest. It is very sensitive to ether vapour.

D. latifshahi resembles *D. dorsata* Duda in general coloration, and in having long upright hairs on the fore legs, but differs in having well developed Or_2, and R_{2+3} not straight.

The species breeds in the laboratory.

Subgenus *Drosophila* Fallén

Drosophila Fallén, 1823, *Diptera Sueciae Geomyz.* **2** : 4; Sturtevant, 1939, *Proc. Nat. Acad. Sci.* **25** : 139; Sturtevant, 1942, *Univ. Texas Publ.* **4213** : 30.

Dark bands of abdominal tergites, when present, interrupted medially, at least on basal segments; egg usually with 4 filaments, rarely with fewer; cheeks often relatively broad; prescutellars absent; ventral receptacle finely coiled.

Key to Indian species of the subgenus Drosophila *s.s.*

1 Fore femur anteroventrally with a longitudinal row of short stout spinules 2
– Fore femur without such a row of spinules 3
2 Mesonotum black, with 5 longitudinal yellowish-brown obscurely demarcated stripes . . . . . ***curviceps*** Okada & Kurokawa
– Mesonotum dull tannish-yellow, without such stripes 4
3 Egg-guide with broad tip and short upper margin . ***brachynephros*** Okada
– Egg-guide with somewhat pointed tip and relatively long upper margin . 5
4 Abdominal pattern reduced in both sexes, male frons strongly whitish-pruinose when viewed from certain angles. First basitarsus of male normal . . . . . ***nasuta*** Lamb
– Abdomen with posterior black bands, broadened and interruped medially, frons dull brownish-yellow. First basitarsus of male with dense short hairs . . . . . ***immigrans*** Sturtevant
5 Three long sternopleural bristles present . . . . . ***trisetosa*** Okada
– Two long sternopleural bristles present 6
6 Mesonotum grey, with many dark brown spots . . . ***repleta*** Wollaston
– Mesonotum yellowish-brown to dark brown, without any spot . . . 7
7 Posterior margin of the genital arch with about one or two hairs at toe. Male anal plate separated from genital arch . . ***testacea*** von Roser
– Posterior margin of the genital arch with about 6 hairs on upper half and about 25 on lower half. Male anal plate contiguous with genital arch ***lacertosa*** Okada

Drosophila (Drosophila) immigrans Sturtevant, 1921

Drosophila immigrans Sturtevant, 1921, *Carn. Inst. Publ.* **301** : 83.

Internal structures: testis (fig. 6D) light yellow, and with about 1·5 inner thick coils and about 2·5 outer coils; paragonia forming U-shaped structure; Malpighian tubules comparatively large, their common stalks rather short; other details as described and figured by Okada (1956).

Habitat.—This was the commonest as well as an abundant species at Nainital and nearby localities. It was largely collected by net-sweeping over discarded fruits.

Distribution.—Cosmopolitan.

Drosophila (Drosophila) nasuta Lamb, 1914

Drosophila nasuta, 1914, *Trans. Linn. Soc.* **16** : 346 (Seychelles).

Male and female

General features and other details strictly coincide with those described by Lamb (1914), Harrison (1954), Okada (1964), and Wheeler & Takada (1964).

Internal structures: proximal intestine (fig. 6C), C = 2·0; rectal papillae: R = 1·6; Malpighian tubules with common stalks rather short; testis with about 3 inner and 4 outer coils; paragonia S-shaped; sperm pump with 2 diverticulae (fig. 6A); spermatheca large, ventral receptacle with about 22–27 coils (fig. 6B).

Puparia

Dark reddish-brown; anterior spiracles with about 17 filaments, horns including spiracles about half length of puparium. Posterior spiracles slightly divergent.

Habitat.—This species was only seen in the wild, where it appeared just after the rains and continued with a low frequency during the winter.

Distribution.—Borneo, Sumatra, Seychelles, Formosa, Moluccas, New Guinea, Samoa, Fiji, Hawaii and India.

Drosophila (Drosophila) lacertosa Okada, 1956

Drosophila (*Drosophila*) sp., *robusta* group 1, Okada, 1953, *Zool. Mag.* **62** : 285; Obha, 1964, *Kagaku* **24** : 130; Okada, 1955, *Zool. Mag.* **64** : 107; Okada, 1955, *Kontyu* **23** : 98.
Drosophila (*Drosophila*) *lacertosa* Okada, 1956, *Syst. St. Drosophilidae Allied Fam. Japan*, 158.

Male and female

Anterior reclinate orbital about half length of proclinate and about one-third length of posterior reclinate; acrostichal hairs regular, in 6 rows, no prescutellars; distance from anterior dorsocentral to posterior dorsocentral about half distance between 2 anterior dorsocentrals; other details as described by Okada (1956).

Internal structures: spermatheca (fig. 6E) yellowish-brown, forming an elongated pitcher-shaped structure and with a short and partly annulated pedicel; other features as described and figured by Okada (1956).

Habitat.—A very few individuals were collected at Nainital by net-sweeping over fermenting fruits.

Distribution.—Nepal, Japan, Korea and India (new record).

Drosophila (Drosophila) trisetosa Okada, 1966

Drosophila (*Drosophila*) *trisetosa* Okada, 1966, *Bull. Br. Mus.* (*nat. Hist.*) *Ent.* Suppl. **6** : 1–129.

Male

Arista with about 7 dorsal and 3 ventral branches in addition to a terminal fork; C-index about 3·0; 4V-index about 1·76; 4C-index about 0·82; 5X-index about 1·8; other details as described and figured by Okada (1966).

Habit.—A single male was collected from Chandraprabha over a banana bait, but no other specimens were seen during further collections made at that locality and others.

Distribution.—Nepal and India (new record).

malerkotliana Parshad & Paika, 1964
jambulina Parshad & Paika, 1964
punjabiensis Parshad & Paika, 1964
suzukii indicus Parshad & Paika, 1964
raychaudhurii Gupta, 1969

Subgenus *Scaptodrosophila* Duda
*chandraprabhiana**
*silvalineata**
*paratriangulata**
*latifshahi**

Subgenus *Hirtodrosophila* Duda
*pentavittata**

Species described from elsewhere but also recorded from India.

Subgenus *Sophophora* Sturtevant
melanogaster Meigen, 1830
ananassae Doleschall, 1858
bipectinata Duda, 1923
montium de Meijere, 1916
kikkawai Burla, 1954
rufa Kikkawa & Peng, 1938
takahashii Sturtevant, 1927
nepalensis Okada, 1955
pulchrella Tan, Hsu & Sheng, 1949
suzukii (Matsumura, 1931)
helvetica Burla, 1948
bifasciata Pomini, 1940
tristipennis Duda, 1924
seguyi Smart, 1945 (new record)

Subgenus Drosophila Fallén
immigrans Sturtevant, 1921
nasuta Lamb, 1914
curviceps Okada & Kurokawa, 1957
repleta Wollaston, 1858
testacea Von Roser 1840
brachynephros Okada, 1956
lacertosa Okada, 1956 (new record)
trisetosa Okada, 1966 (new record)

Subgenus *Dorsilopha* Sturtevant
busckii Coquillett, 1901

D. prashadi, *D. biarmipes*, *D. emulata*, *D. brunettii*, *D. suzukii indicus* and *D. tristipennis* have been omitted from the key on pp. 57–8.

The authors are grateful to Professor T. Okada, Tokyo Metropolitan University, Tokyo, Japan for his help in confirming the identifications as well as for critically going through the descriptions of the species. Thanks are also due to the State C.S.I.R.(U.P.) and the U.G.C. for extending financial assistance.

References

Burla, H., 1954, Distinction between four species of *melanogaster* group, "*Drosophila séguyi*", "*D. montium*", "*D. kikkawai*" sp. nov. and "*D. auraria*" (Drosophilidae, Diptera). *Rev. Brazil. Biol.* **14** : 41–54.

Gupta, J. P., 1969, A new species of *Drosophila* Fallen (Insecta: Diptera: Drosophilidae) from India. *Proc. Zool. Soc. Calcutta* **22** : 53–61.

Harrison, R. A., 1954, Some notes on the additions to the Drosophilidae (Diptera) of Samoa and Fiji. *Trans. R. ent. Soc. Lond.* **105** : 97–116.

Kikkawa, H. & Peng, F. T., 1938, *Drosophila* species of Japan and adjacent localities. *Japan. J. Zool.* 7 : 507–52.

Lamb, C. B., 1914, Reports of the Percy Sladen Trust Expedition, Diptera. *Trans. Linn. Soc. Lond.* (2) **16** : 307–72.

Okada, T., 1956, *Systematic study of Drosophilidae and allied families of Japan.* Tokyo.

—— 1964, Drosophilidae (Diptera) of South-east Asia collected by the Thai–Japanese Biological Expedition 1961–62. *Nature and life in South-east Asia*, **3** : 439–66.

—— 1966, Diptera from Nepal. Cryptochaetidae, Diastatidae and Drosophilidae. *Bull. Br. Mus. (nat. Hist.) Ent.* Suppl. **6** : 1–129.

Smart, J., 1945, *Drosophila subobscura* Collin: descriptive notes on the species with comments on its nomenclatural status (Dipt.). *Proc. R. ent. Soc. Lond.* (B) **14** : 53–56.

Wheeler, M. R. & Takada, H., 1964, Diptera: Drosophilidae. In: *Insects of Micronesia* **14**(6) : 163–242.

(Manuscript received 19th December, 1968)

Subgenus *Dorsilopha* Sturtevant

Dorsilopha Sturtevant, 1942, *Univ. Texas Publ.* **4213** : 28. Type: *Drosophila busckii* Coquillett, 1901.

Yellow body with longitudinally striped mesonotum; preapicals evident only on hind tibia; egg with 4 filaments; longest axis of eye exceedingly oblique to body axis.

Drosophila (Drosilopha) busckii Coquillett, 1901

Drosophila busckii Coquillett, 1901, *Ent. News* **12** : 16.

Habitat.—Many males and females were collected from Chakia forest and Nainital by net sweeping over decaying fruits and vegetations.

Distribution.—Cosmopolitan.

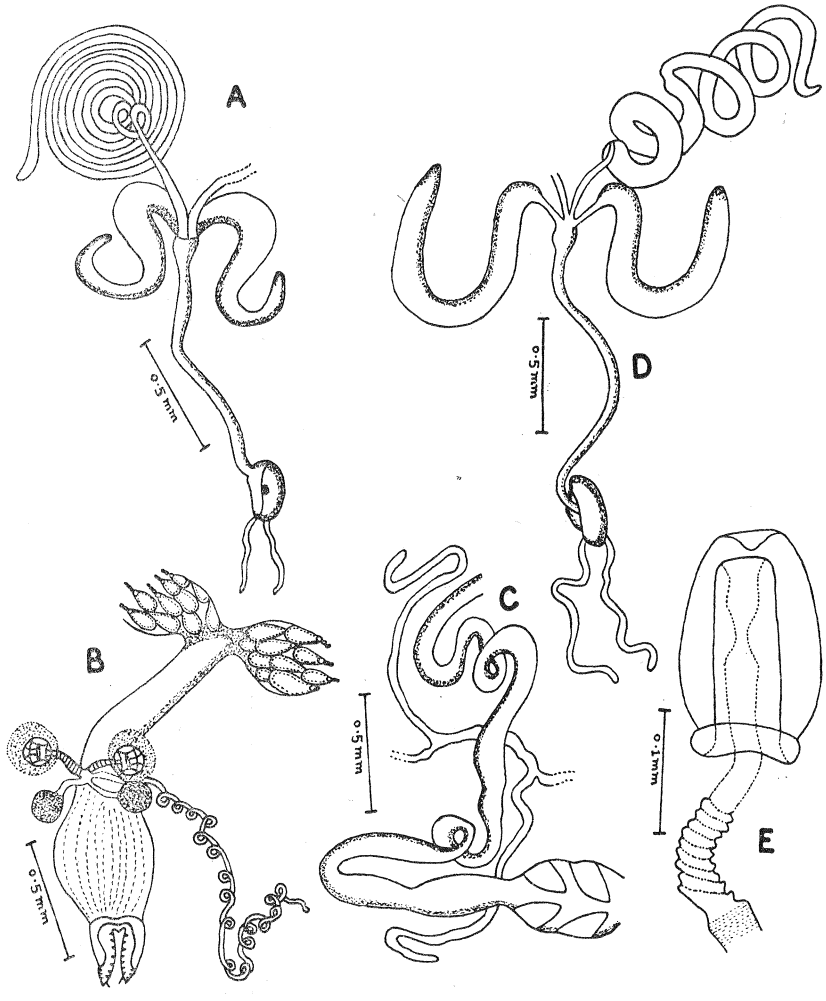

FIG. 6.—(A–C) *Drosophila nasuta* Lamb. A, male reproductive organs; B, female reproductive organs; C, proximal intestine. D, *Drosophila immigrans* Sturtevant, male reproductive organs. E, *Drosophila lacertosa* Okada, spermatheca.

A LIST OF *Drosophila* SPECIES SO FAR KNOWN FROM INDIA

Species described from India.

(*Species described as new in the present paper are marked with an asterisk.*)

Subgenus *Sophophora* Sturtevant

prashadi Brunetti, 1923
biarmipes Malloch, 1924
emulata Ray-Chaudhuri & Mukherjee, 1941
brunettii Ray-Chaudhuri & Mukherjee, 1941