

✓ *Drosophila* fauna of Nagarhole, South India, including
description of a new species (Diptera : Drosophilidae)

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Abstract. *Drosophila* collections made using traps baited with fermenting bananas from Nagarhole (Western Ghats) yielded a total of 15 species including a new species, *Drosophila nagarholensis*. Majority of the *Drosophila* trapped belonged either to the *melanogaster* or *immigrans* species groups of the subgenera *Sophophora* and *Drosophila* respectively. The sympatric association and ecological dominance of the members of the two species groups are discussed. The external morphology and internal structures of the new species are described. Its taxonomic status and relationships are presented.

Keywords. *Drosophila* fauna; Diptera; taxonomy.

1. Introduction

The Drosophilidae is a large family of acalyprate flies of worldwide distribution. Indian subcontinent with its diverse climatic and varied physiographic conditions provide large number of natural environs for colonisation by Drosophilidae. The genus *Drosophila* is large and more than 1300 biologically valid species have been described (Bock and Parsons 1978). However only about 85 species have been recorded from India (Prakash 1979). Many natural environs await exploration for a comprehensive knowledge of the *Drosophila* species inhabiting the subcontinent. Recent intensive field work carried out especially in the Western Ghats (Prakash and Reddy, 1978a, b, 1979a, b) revealed that the rain forests and swampy regions of this mountainous terrain harbour contain many known *Drosophila* species in addition to several new species. This has prompted the authors to explore the *Drosophila* fauna of the forests of Nagarhole (Western Ghats). It is a game sanctuary located about 75 km to the south-east of Mysore, at an altitude of 775 m above the sea level having an annual rainfall of 1610 mm. The vegetation is of a tropical moist deciduous type. The details of the collection record along with the description of the new species, *Drosophila nagarholensis*, are presented in this paper.

2. Materials and methods

Drosophila collections were made during the south-west monsoon in August 1978, in five sites, 5 km apart in the forested area. The conventional method of using fermenting banana baits, a technique successful for most Indian species of the subgenera *Sophophora* and *Drosophila* was used. Baiting was carried out at sites close to streams with considerable wet rotting litter on the ground. To estimate the relative abundance of *Drosophila* species, equal number of traps (ten) were used at each site. Two days after the exposure of the bait, they were collected in the cooler hours of the day. The collected flies were etherised, categorised and the number of each species was recorded. The individual females that could not be identified were isolated and allowed to breed in separate vials containing standard wheat-cream agar medium. The progeny obtained from such single gravid females was used for detailed morphological, anatomical and cytological studies to assign them to respective groups. Camera lucida drawings of parts of the new species were made.

3. Results and discussion

A total of 1576 flies were trapped consisting of 15 species representing three subgenera, viz., *Sophophora* Sturtevant, *Drosophila* Fallen and *Scaptodrosophila* Duda. The collection records summarised in table 1 indicate that some sites are richer than others both in species and number of flies trapped. This was expected since the sites differ from one another in certain macroenvironmental factors such as the nature of vegetation, moisture content, etc. For instance the diversity of species and the number of flies captured in sites 2, 3 and 4 were much higher because of their sheltered locations with decomposing leaves and moist surroundings, presumably providing more ecological niches for *Drosophila* species. The number of species captured in sites 1 and 5 was much lower as they were at a considerable distance from the moist surroundings without decomposing organic matter on which *Drosophila* species feed. Of the 15 species collected, only three viz., *D. malerkotliana* Parshad and Paika, *D. nasuta* Lamb and *D. neonasuta* Sajjan, and Krishnamurthy, formed the bulk in almost all sites, perhaps indicating greater ecological versatility of these species. The remaining species were found less frequently at some sites only.

The majority of the species collected either belonged to the *melanogaster* species group of the subgenus *Sophophora* or to the *immigrans* species group of the subgenus *Drosophila*, indicating the sympatric association and ecological dominance of the members of these two species groups. However, certain other species, such as *D. repleta* Woolaston, *D. mundagenesis* Sajjan and Krishnamurthy and *D. meijerei indicus* Rajeswari and Krishnamurthy were also found in small numbers. The members of the *melanogaster* species group in particular were dominant in the collections which conform to the earlier findings of Reddy and Krishnamurthy (1974), Prakash and Reddy (1978a, 1979a) and with the suggestion of Bock and Wheeler (1972), who regarded the Indian subcontinent and South-East Asia as the general area of origin of both the *melanogaster* and *immigrans* species groups. The finding of a new species (*D. nagarholensis*) in this area, and five other new

Table 1. Distribution of different species of the genus *Drosophila* in Nagarhole (Western Ghats), South India.

Species	Site					Total
	1	2	3	4	5	
Subgenus: <i>Sophophora</i>						
<i>D. takahashii</i> Sturtevant	..	12	24	16	5	57
<i>D. eugracilis</i> Bock and Whooler	..	18	30	5	1	54
<i>D. bipectinata</i> Duda	4	26	3	34	..	67
<i>D. malerkotliana</i> Parshad and Paika	62	227	81	118	61	549
<i>D. punjabiensis</i> Parshad and Paika	12	16	18	14	5	65
<i>D. jambulina</i> Parshad and Paika	5	35	34	32	19	125
<i>D. kikkawai</i> Burla	..	14	19	7	..	40
<i>D. mysorensis</i> Reddy and Krishnamurthy	..	9	18	12	..	39
<i>D. anomelani</i> Reddy and Krishnamurthy	5	14	22	41
<i>D. nagarholensis</i> , sp. nov.	1	5	7	3	..	16
Subgenus: <i>Drosophila</i>						
<i>D. nasuta</i> Lamb	19	95	91	56	36	297
<i>D. neonasuta</i> Sajjan and Krishnamurthy	..	42	50	69	42	203
<i>D. repleta</i> Wollaston	..	3	4	1	..	8
Subgenus: <i>Scaptodrosophila</i>						
<i>D. mundagenesis</i> Sajjan and Krishnamurthy	..	1	5	1	..	7
<i>D. meijeri indicus</i> Rajeswari and Krishnamurthy	..	5	1	1	1	8
Total	108	522	407	369	170	1576
No. of species per site	7	15	15	14	8	

species described by Prakash and Reddy (1977, 1978b, 1979a, b) from other parts of Western Ghats, belonging to the *melanogaster* species group further supports the suggestion of Bock and Wheeler (1972).

4. Species description

230-24 ✓ 4.1. *Drosophila (Sophophora) nagarholensis*, sp. nov.

4.1a. *Types*: *Holotype* ♂: Nagarhole (Western Ghats), Karnataka, India, 12. viii. 1978, H. S. Prakash and G. Sreerama Reddy. *Paratypes* 7 ♂♂ and 8 ♀♀: same data as holotype. The holotype and some paratypes are deposited in the Department of Zoology, University of Mysore, Manasagangotri, Mysore. Other paratypes also deposited in the Department of Biology, Tokyo Metropolitan Uni-

vorsity, Setagaya-ku, Tokyo, Japan, and in the Zoological Survey of India, Calcutta.

4.1b. *Distinguishing features*: Abdominal pigmentation; wing indices (low *C*-index); greatest width of cheek 0.1 times greatest diameter of eye; third costal section with heavy setation on basal half; number of arisal branches (5/3); sex-comb pattern; vestigial spermathecae; non-serrate posterior gonapophyses.

4.1c. *Description*: *Body length*. Male 2.2 mm; female 2.5 mm. *Head* ♂ and ♀. Arista with 8 branches (5/3) including terminal fork. Front yellow. Antenna light yellow. Greatest width of cheek 0.1 times greatest diameter of eye. Carina narrow. Palpi light yellow with two straight bristles. Orbital bristles in the ratio 2 : 1 : 2. Inner verticals longer, outer verticals small, three-fourths length of inner. Ocellar triangle brown and shiny with a pair of long ocellar bristles. Eyes red.

4.1d. *Thorax* ♂ and ♀. Brownish yellow. Acrostichal hairs in 6 rows, regularly placed. Ratio anterior: posterior dorsocentrals 0.6. Scutellum light brown. Anterior scutellars convergent, posterior scutellars crossed. Sterno-index 0.6. Prescutellars absent.

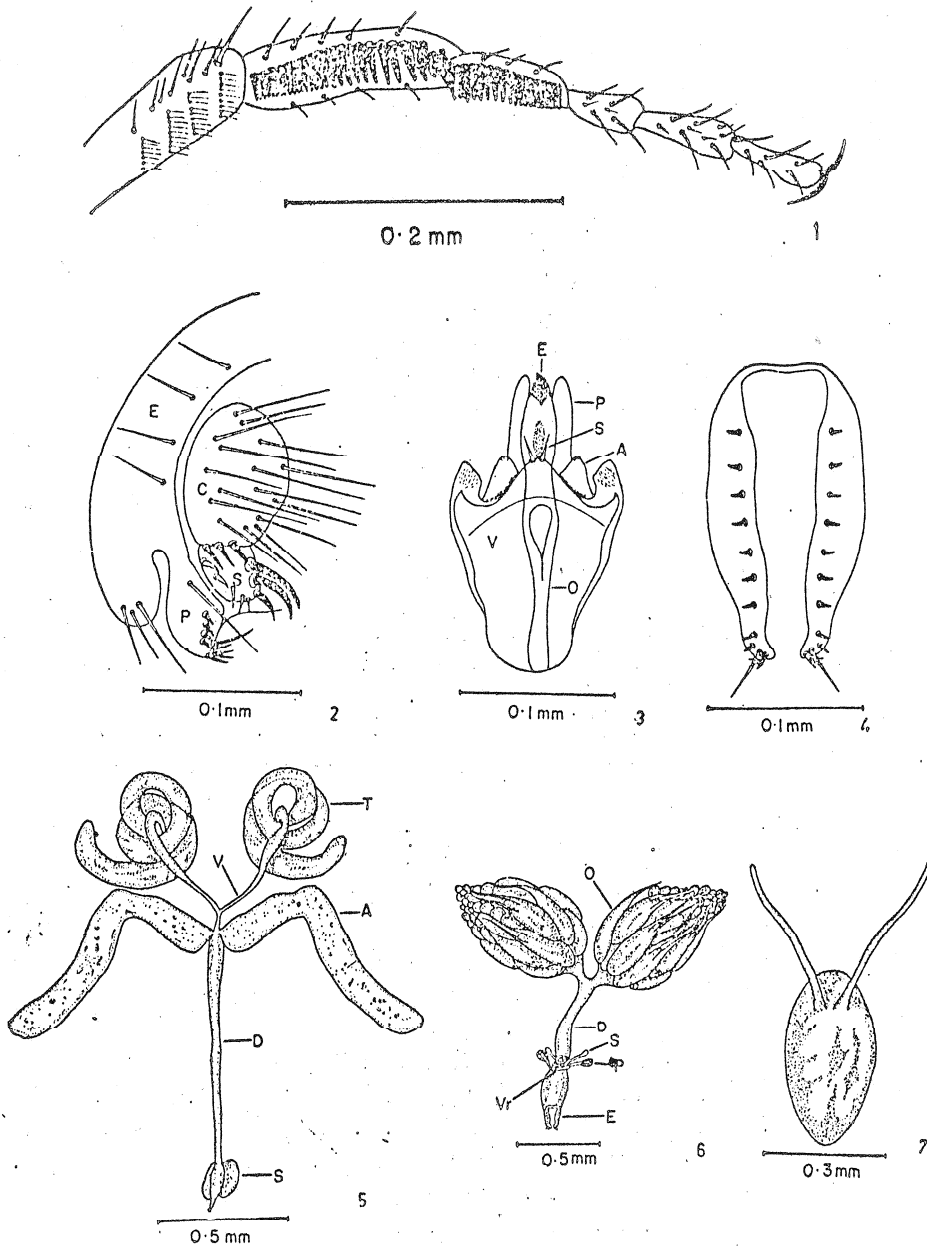
4.1e. *Legs*. Preapical bristles on all tibiae; apicals on 1st and 2nd tibiae. Sex-comb of male (figure 1) longitudinal along entire lengths of metatarsal and second tarsal segments. Metatarsal comb consisting of about 30 teeth, smaller basally, longer distally, the distal 2 displaced from axis of remaining teeth. Comb on second tarsal segment with about 20 teeth, longer basally and smaller distally.

4.1f. *Wings* ♂ and ♀. Dusky. *C*-index, 1.8; 4*V*-index, 2.6; 5*X*-index, 1.5; *M*-index, 0.9 (wing indices calculated after Böck, 1976). 3rd costal section with heavy setation on basal 0.5. Wing lengths 1.7 mm (male); 2.0 mm (female).

4.1g. *Abdomen* ♂ and ♀. Tergites of female yellowish with very broad apical bands. First 5 tergites of male similar to those of female, remainder of male tergites shiny black.

4.1h. *Periphallic organs* (figure 2). Epandrium (genital arch) broad dorsally and laterally; toe with few bristles. Primary and secondary surstyli present. Primary surstylus (primary clasper) with lateral row of about 4-5 strong pointed teeth and cluster of strong ventromedial teeth, 1 elongate and slightly curved. Secondary surstylus partially separated from cerci (anal plate), with 2 large curved black medial teeth above and 1 smaller similar tooth below, and row of smaller bristles along ventral and lateral borders becoming larger laterally; 3 larger bristles present dorsally. Cerci with about 16 bristles.

4.1i. *Phallic organs* (figure 3). Aedeagus hirsute, narrowed subapically. Basal apodeme not projecting beyond fragma. Anterior gonapophyses (anterior parameres) large, triangular, with minute apical sensilla. Posterior gonapophyses (posterior parameres) long, slender, non-serrate, reaching tip of aedeagus. Caudal margin of novasternum with median convexity, laterally with fine hairs and apically with a pair of submedian spines,



Figures 1-7. *Drosophila (Sophophora) nagarholensis*, sp. nov. 1. Fore leg of male showing sex-combs. 2. Periphallallic organs: C = cerci; E = epandrium; P = primary surstylus; S = secondary surstylus. 3. Phallic organs: A = anterior gonapophyses; E = aedeagus; O = basal apodeme of aedeagus; P = posterior gonapophyses; S = submedian spine of novasternum; V = ventral fragma. 4. Egg guide. 5. Male reproductive organs: A = accessory gland; D = anterior ejaculatory duct; S = ejaculatory bulb; T = testes; V = vas deferens. 6. Female reproductive organs: D = oviduct; E = egg guide; O = ovary; P = paraovaria; S = spermatheca; Vr = ventral receptacle; 7. Egg.

- 4.1j. *Egg guide* (figure 4). Light brown, with about 12 teeth and a subterminal hair.
- 4.1k. *Internal structures*. Testes (figure 5) yellowish with 3 coils. Accessory glands transparent and large. Ejaculatory bulb globular. Spermathecae (figure 6) vestigial, paraovaria large, ovoid, ventral receptacle long, tightly coiled. Malpighian tubules two pairs, free.
- 4.1l. *Egg filaments* (figure 7). 2 long slender filaments, not flattened apically.
- 4.1m. *Pupae*. Anterior spiracle with about 8-9 branches.
- 4.1n. *Chromosomes*. Somatic metaphase of female larval neuroblast cells reveal 2 pairs of V's, a pair of dots and a pair of rods, while in those of the males, one of the rods is replaced by a short Y-chromosome. The polythene chromosome complement consists of 5 long arms and a short arm radiating from the chromosome centre.

4.1o. *Distribution*. India: Western Ghats: Karnataka: Coorg District.

4.2. *Taxonomic status*

The presence of a coiled ventral receptacle, posterior pair of malpighian tubules which are free, eggs with 2 filaments and the banding pattern of the abdomen place this species in the subgenus *Sophophora*. Such characters as the presence of sex-combs; peripheral organs with well-developed epandrium, cerci and a pair of surstyli with teeth (setigerous clasper); phallic organs with anterior and posterior gonapophyses; long-coiled ventral receptacle; spiral testes and non-skipping larvae permit its inclusion in the *melanogaster* species group. Further, the presence of yellowish abdominal tergites with distinct apical bands; sex-combs of male longitudinal along entire lengths of the metatarsus and second tarsal segment; nature of secondary surstylus with curved black median teeth, and hirsute aedeagus justify its inclusion in the *montium* subgroup (Bock and Wheeler 1972).

4.3. *Relationships and remarks*

Okada (personal communication) has pointed out that the new species resembles *D. punjabiensis* Parshad and Paika and *D. jambulina* Parshad and Paika, but differs from them in details. On comparison it is found that the new species resembles the above species in the general colouration of the body and in the general features of the male genitalia, but it differs from them in other morphological characters such as the pattern and number of teeth in the sex-combs, number of arisal branches (5/3), wing indices (low C-index), 3rd costal section with heavy setation on basal half, greatest width of cheek/greatest diameter of eye, and vestigial spermathecae. In addition, the new species resembles *D. agumbensis* Prakash and Reddy in the pattern of sex-combs and general features of male genitalia. However, it distinctly differs from *D. agumbensis* in the nature of abdominal banding pattern in males, number of arisal branches, wing indices and in having non-serrate posterior gonapophyses. The combination of characters such as sex-comb pattern, abdominal pigmentation in male, wing indices (low C-index), number of arisal branches, greatest width of cheek/greatest diameter of eye, third costal sec-

tion with heavy setation on basal half, vestigial spermathecae and non-serrate posterior gonapophyses are unique to this species and are not found together in any other known species of the *montium* subgroup.

The species can be cultured in the laboratory with standard wheat-cream agar medium. The specific name *Drosophila nagarholensis* is coined after Nagarhole from where it was collected for the first time.

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