

# Perspectives

## Anecdotal, Historical and Critical Commentaries on Genetics

*Edited by James F. Crow and William F. Dove*

### It Really Is Not a Fruit Fly

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There is a reference in Aristotle to a gnat produced by larvae engendered in the slime of vinegar. This must have been *Drosophila*.

A. H. STURTEVANT (1965)

IN a recent essay titled "Talking about the Genome," the distinguished historian of recent science, Horace Freeland JUDSON (2001), made an incisive and cogent plea for scientific language precision. He concludes, ". . . for ourselves and for the general public, what we require is to get more fully and precisely into the proper language of genetics." The timeliness and verity of this admonition is not arguable. In parallel, there is also a need for precision in animal and plant nomenclature, both vernacular and scientific. As concerns nomenclature, inadvertently, Professor Judson fails to follow his own advice, no doubt because he is a historian, not a biologist. Pictured in his essay is an adult male fly whose description reads: "The fruit fly: *Drosophila* mutants are the cornerstone of the language used in genetics." Because more than one thousand species of the genus *Drosophila* have already been identified, taxonomic precision dictates that this fly be precisely designated a *Drosophila melanogaster* male.<sup>1</sup> I argue further that there is great ecological variation among the numerous *Drosophila* species, vitiating the common name of fruit fly attached to *D. melanogaster* or any other *Drosophila* species. In the scientific literature and in textbooks, all *Drosophila* species should be referred to by their scientific, not their common, name.

Since Meigen in 1830 first described *D. melanogaster*, the numerous *Drosophila* species identified can be loosely separated into two groups. One group, the cosmopolitan or ecologically generalist species, includes 10–12 species. Their geographical distribution is intimately linked to human habitation,<sup>2</sup> and they were dis-

paragingly called garbage species by the eminent evolutionist, Theodosius Dobzhansky. The endemic (or ecologically specialist) species constitute the second group; their distribution is circumscribed by their hosts, and they include ~1600 species (POWELL 1997). This division boils down to where the *Drosophila* female lays her eggs! Insect taxonomists, describing the cosmopolitans, have carefully spelled out their breeding sites. IMMS (1925) in his textbook stated that they are "prevalent about flowing sap, decaying fruit, cider presses, vinegar factories, etc. where they are attracted by certain byproducts of fermentation." Similarly, SEGUY (1950, p. 366) in his *La Biologie de Diptères* states, "The *Drosophilids* are small flies attracted to moisture and light which seek odorous substances and fermenting and putrefying materials" (translated from the French). Finally, Comstock, the dean of American entomology teachers, described *Drosophilids* in his 1924 textbook as "pomace flies; one of the pomace flies, *Drosophila melanogaster* . . . is widely used in laboratories in the study of heredity" (COMSTOCK 1924, p. 484).

The inadequacy of "fruit fly" becomes obvious when the biology of endemic species is examined. For many endemic *Drosophila* species, their habitat and breeding sites are unclear or unknown. Dobzhansky spent three decades investigating the population genetic structure of *D. pseudoobscura* in the Sierra Nevada of California without successfully identifying the breeding site(s) of this species. However, where the breeding sites of endemic species have been identified, their locations belie the designation fruit fly. Two examples suffice. At least two species of *Drosophila* whose hosts are West Indian land crabs have been described by CARSON and WHEELER (1968). As they described for one species, "*D. endobrachia* oviposits around the eyes of the crab; first instar larvae move between the third maxillipeds and thence into the gill chambers. Following a lengthy so-

<sup>1</sup> Curiously, the captions to the fly parts are in German.

<sup>2</sup> An extreme example of the association of a cosmopolitan species with human habitation is the finding by BRNCIC and DOBZHANSKY (1957) of *D. funebris* in two vegetable and fruit stores in Punta Arenas, Straits of Magellan. A few *D. funebris* were found even farther south.

TABLE 1

Common names of *D. melanogaster* in general genetics texts and treatises 1911–1945

Author	Date of publication	Common name
CASTLE	1911	Pomace fly
BATESON	1913	Pomace fly
WALTER	1914	Pomace fly
CONKLIN	1922	Pomace fly
CASTLE	1923	Small fruit fly/vinegar or pomace fly
MORGAN <i>et al.</i>	1925	Vinegar fly
SHULL	1925	Fruit fly
JONES	1925	Fruit fly
SINNOTT and DUNN	1925	Vinegar fly
BABCOCK and CLAUSEN	1927	Vinegar fly
ALTENBERG	1928	Fruit fly
BAUR	1930	Fruit fly (Fruchtflye)
SNYDER	1934	Small fruit fly or vinegar fly
JENNINGS	1935	Fruit fly
STURTEVANT and BEADLE	1939	No common name
WADDINGTON	1939	Fruit fly
GUYENOT	1945	Vinegar fly (Mouche de Vinaigre)

jour there, they move to the peribuccal region and then drop off and pupate in soil or sand.” This *Drosophila* species can hardly be called a fruit fly! Noteworthy, too, is *D. pachea*, a cactophyllic species that breeds on the stems of senita cactus in the Sonora desert. This fly survives because, as reported by HEED and KIRCHER (1965), the larvae require a cholesterol metabolite furnished only by the host cactus. The same cactus does not support the growth of other cactophyllic species. Thus, *D. pachea* is also not a fruit fly. For a detailed description of the diverse ecology of endemic species, see POWELL (1997).

Why did the common name fruit fly supersede vinegar or pomace fly? This is especially puzzling since real fruit flies, *e.g.*, the Mediterranean fruit fly, the Oriental fruit fly, and other members of the family Tephritidae, attack unblemished fruit and in heavy infestations cause serious economic damage. In contrast, even if present in enormous numbers, *D. melanogaster* is innocuous and of no economic importance. One can only speculate. To the layperson’s unsophisticated eye, commonplace *Drosophilae* hovering over a display of fruit in a market or a fruit bowl, evoke “fruit fly,” not “vinegar fly” and certainly not “pomace fly.”

Some insight into the evolution of “fruit fly” as the common name of *D. melanogaster* can be seen by surveying textbooks and treatises of general genetics. The accompanying table lists chronologically those books published immediately after T. H. Morgan’s 1910 publication on the genetics of the white eye color mutation

in *D. melanogaster* (MORGAN 1910). The table is self-explanatory; however, there are some puzzles. Why did Castle change his common name usage? Did pomace fly usage disappear because vinegar fly was used by Morgan, Bridges, and Sturtevant in their “Mutants of *Drosophila*”? Among 13 textbooks published after 1945, with one exception all use fruit fly as the common name. SRB and OWEN (1952) use no common name. Noteworthy is the finding that even the Entomological Society of America has been seduced. Its list (STOETZEL 1989) of common names of insects assigns small (sic!) fruit flies to the Drosophilidae and other fruit flies to the Tephritidae. Yet some Hawaiian *Drosophila* species are larger than Tephritids. No large fruit flies are listed! However, where fresh fruits are economically important crops and their insect pests an ongoing potential menace, the words fruit fly have an ominous connotation. An unambiguous distinction must be made between real fruit flies (the Tephritidae) and the quasi-fruit flies (the Drosophilidae). In California, for example, fruit fly raises the spectre of the Mediterranean fruit fly, a demonstrated and feared menace to a number of fruit crops and thereby to the economy. The fear engendered in California by the words fruit fly is illustrated by the following anecdote. When George Beadle moved from Yale to Cal Tech, he drove a station wagon carrying stocks of *Drosophila*. Before entering California, all vehicles had to be inspected. Beadle was asked by the agriculture inspector what was in the vials he was transporting. When he replied ‘*Drosophila*’, the inspector asked, ‘What is that?’ He answered, ‘Oh, you know, fruit flies!’ Whereupon the stocks were immediately confiscated.

Accordingly, in a survey of California insects, the distinction between the real fruit flies, the Tephritidae, and the quasi-fruit flies, the Drosophilidae, is made explicitly (POWELL and HOGUE 1979). The given common name of the latter is pomace or vinegar flies.

Should common usage override biological precision? This question is not unlike the dilemma posed to grammarians by common usage. Is, for example, the widespread grammatically incorrect command “lay down” acceptable instead of the correct “lie down”? Common usage accepts “lay down”; language precision mandates “lie down”! (Of course, a properly trained dog will obey either command.) For the layperson, it is fine to let journalists and like professionals writing in the popular press call *D. melanogaster* a fruit fly. For the professional biologist, however, no inclusive common name for the myriad of *Drosophila* species distributed over diverse habitats suffices: not fruit fly, not vinegar fly, not pomace fly. Recognizing this inadequacy, Sturtevant invariably referred to members of the genus as *Drosophila*! (Note the epigraph.)

I am indebted to a number of people for advice and criticism in the preparation of this narrative. Jeff Powell made cogent suggestions and corrections; Lynn Kimsey identified the current insect taxonomy;

Alexandra Dove provided the Beadle anecdote; Chuck Langley uncovered Aristotle's *History of Animals*; and Mark Grote made sense of conops with his knowledge of Greek and his library search; Diane Chave with infinite patience and perseverance produced the ultimate text, following numerous revisions and changes. The opinions and conclusions are, however, solely mine.

*Note added in proof.* On reading the epigraph, some prodding colleagues insisted that a complete narrative must include exactly what Aristotle wrote (in translation). A computer search (by Chuck Langley) turned up Aristotle's *History of Animals* and a sentence in book 5, section 19, as follows: "The conops comes from a grub engendered in the slime of vinegar." This is Sturtevant's statement, and *conops* was translated as *gnat*. Delving further into Aristotle's discourse (with linguistic help and library research by Mark Grote), conops turns up in several places, and it is clear that Aristotle was confused. A sentence in book 4, section 8 reads: "conops will not eat anything sweet, only sour or acidic." This and the epigraph led the French translator, Pierre Louis, to conclude that conops is confused with a vinegar fly. Describing insect mouth parts, Aristotle wrote that flies are able to draw blood, and conops pricks with its tongue. Further confusion is found in book 1, section 16, where it is stated that flies copulate and come from larvae, but conops does not even copulate. If conops is a mosquito, copulation would be almost impossible to observe, since it occurs in the midst of a mating swarm. The consensus among linguists and translators is that conops is best translated as mosquito, but gnat is not wrong because the English linguistic separation between the two occurred only around 1900. Finally, it should be noted that the Latin cognate of conops is *conopeum* or bed with a mosquito net, from which stems the English word canopy.

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