

Comments on the proposed conservation of usage of *Drosophila* Fallén, 1823 (Insecta, Diptera)

(Case 3407; see BZN 64: 238–242)

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The proposition of Van der Linde et al. (BZN 64: 238–242) to maintain the name of *Drosophila melanogaster* has two consequences. The first is the loss of the name ‘*Sophophora*’ through synonymy with *Drosophila*. The second is the loss of identity of the current genus *Drosophila* (s.s.). To justify their proposition Van der Linde et al. (BZN 64: 238–242) emphasized the role of *D. melanogaster* in science and weakened the taxonomical significance of *Drosophila* (s.l.) and *Drosophila* (s.s.) that they proposed to split. In my opinion their arguments are oversimplified or not justified. The species of *Drosophila* (s.s.) have also played a major role in science and the classification is not as messy as it is suggested. I think the proposed nomenclatural change would be more detrimental for science than the simple elevation of *Sophophora* to the genus rank.

What is the colloquial meaning of *Drosophila*?

As indicated in the application, the genus *Drosophila* was established by Fallén (1823) to include twelve species. But the scientific renown of *Drosophila* was acquired later, at the beginning of the 20th century, when several species became study material for biological research and particularly for genetics. It is worth noting that the *Drosophila* model has never been restricted to only one species and more than 200 species of *Drosophila* have been cultured for laboratory research. Today most of the species under study are provided by stock centres, the Tucson and the Ehime centres being the two most important. Despite the name ‘*Drosophila* stock centres’ both provide species of other genera. The Tucson *Drosophila* Species Stock Center (<http://stockcenter.arl.arizona.edu/>) provides subcultures of approximately 240 different *Drosophila* species. These include species of *Chymomyza*, *Hirtodrosophila*, *Samoaia*, *Scaptodrosophila*, *Scaptomyza*, *Zaprionus* as well as the Hawaiian ‘*Drosophila*’. The Ehime *Drosophila* stock centre (<http://kyotofly.kit.jp/cgi-bin/ehime/index.cgi>) maintains 400 strains of 50 species and distributes these genetic resources to *Drosophila* researchers worldwide. These too include *Colocasiomyia*, *Chymomyza*, *Hirtodrosophila*, *Scaptodrosophila* and *Zaprionus*. Thus it is clear that, for geneticists, the name ‘*Drosophila*’ does not mean specifically *D. melanogaster* but the family DROSOPHILIDAE (and so includes *D. melanogaster*). Fly geneticists used to refer to the model species as ‘*melanogaster*’ instead of ‘*Drosophila*’ because the research community is aware that many species are used as study material. Research is also carried out on *albomicans*, *ananassae*, *immigrans*, *indianus*, *kikkawai*, *mojavensis*, *virilis* and, whichever genus individual species belong to, all are considered to be ‘*Drosophila*’. This usage suggests that, even under the name of *Sophophora melanogaster*, the species will still be considered as a ‘*Drosophila*’ and the term can be used in the titles and keywords of future publications. We should also note

that 'drosophila' (without initial upper case and not italicized) would be more appropriate.

The extent of paraphyly in *Drosophila*

The paraphyly of the voluminous genus *Drosophila* has been recognized for decades, and by numerous authors, for example Throckmorton (1975) in his phylogenetic analysis. Nonetheless, the only work to really address the question was the cladistic study by Grimaldi (1990). This contribution was so important that the classification it established for drosophilid species has remained fundamentally unchanged ever since. However, he admitted that a definitive, comprehensive study of relationships between subgenera and species groups in *Drosophila* remained to be done.

Van der Linde et al. (BZN 64: 238–242) mentioned Hawaiian '*Drosophila*' as a clade within *Drosophila* (s.s.), however this situation has not been fully accepted. Grimaldi (1990) grouped those species in the genus *Idiomyia* Grimshaw, 1901 and he suggested that calling *Idiomyia* (s.l.) '*Drosophila*', despite the morphological evidence to the contrary, would be 'diluting the diagnosis of the genus *Drosophila*, as a monophyletic group, of biological meaning.' Moreover the Hawaiian '*Drosophila*' are generally recognized to be the sister group of the genus *Scaptomyza*. Therefore it would be illogical to downgrade the Hawaiian '*Drosophila*' but not *Scaptomyza* under the genus *Drosophila*. Despite some unfounded contestation the Hawaiian '*Drosophila*' were considered to belong to *Idiomyia* by Grimaldi (1990) and are still classified in this way in Bachli's database (<http://taxodros.unizh.ch/>). Therefore, the monophyletic genus *Drosophila*, as defined by Grimaldi (1990), consists of only three major clades: *Sophophora* and the *immigrans-tripunctata* and *virilis-repleta* radiations of the subgenus *Drosophila*.

Today there are good arguments to upgrade *Sophophora* to generic status, particularly thanks to the meticulous work of M.J. Toda and his team (e.g. Hu & Toda, 2001). Moreover, the results of their morphological analyses are also supported by molecular data. Nevertheless, this does not justify disruption of the subgenus *Drosophila* as there is no morphological analysis indicating its paraphyly and most molecular analyses fail to resolve the branch order in this part of the phylogeny.

Van der Linde et al. (BZN 64, pp. 238–242) argue that various genera are positioned within *Drosophila* (s.l.). In fact these genera are positioned between *Sophophora* and *Drosophila* (s.s.), or between the Hawaiian '*Drosophila*' and the radiations of *Drosophila* (s.s.), but there is no strong evidence that any such genera intercalate between the *immigrans-tripunctata* and *virilis-repleta* radiations. If molecular analysis eventually suggests the paraphyly of *Drosophila* (s.s.) it would be necessary to study the morphology more deeply. As far as is known, however, the genus *Drosophila* is monophyletic once the subgenus *Sophophora* is removed (Grimaldi, 1990; Hu & Toda, 2001).

What would be the impact of the nomenclatural change on the classification?

As mentioned above, paraphyly in *Drosophila* arises mostly from the inclusion of the subgenus *Sophophora*. This problem in systematics is easily resolved by upgrading *Sophophora* to generic rank. This change would affect the names of only the 332 species currently classified within *Sophophora*, including *Drosophila* (S.) *melanogaster*

which would then be called *Sophophora melanogaster*. Stability would be maintained for the remaining *Drosophila* species, which are considered to be monophyletic. Van der Linde et al. (BZN 64: 238–242) propose retaining the binomen *Drosophila melanogaster* on the grounds of convenience. In that situation the subgenus *Sophophora* will become synonymous with *Drosophila* and the names of all 332 species in *Sophophora* will consequently become *Drosophila*. However, the names of all 817 species currently in the subgenus *Drosophila* will also have to change, as they do not belong to the same clade as *Sophophora*. Moreover, 78 species that had no subgeneric affiliation in the former *Drosophila* genus will stay in the new genus. Therefore, the *Sophophora* subgenus, previously defined as a monophyletic group, will now be mixed together with numerous species with which it probably has no affinity.

What would be the impact on scientific research?

The first research purpose for *Drosophila* was as a model in evolutionary biology, and this led naturally to the study of numerous species. As the majority of *Drosophila* species cultured were from the subgenera *Sophophora* and *Drosophila*, the literature of the 20th century involves the continuous comparison of the two lineages. This comparison disappears if *Sophophora* is synonymised with *Drosophila* (s.s.). Most new students of *Drosophila* systematics have to learn from the literature and the major changes proposed will render their task particularly difficult. The proposed nomenclatural change would also be more detrimental than its alternative for retrieving information from databases. It is worth noting that 642 taxa are represented under the genus *Drosophila* in sequence database according to the NCBI Entrez Taxonomy Homepage. With one click in the database, *Sophophora* could be moved to the genus level beside *Drosophila* but the proposed changes require *Sophophora* to be eliminated and reindexing of every one of the 456 taxa included in *Drosophila* (s.s.). Again reclassifying stocks at the different stock centres will be more difficult under the proposed nomenclatural change than the simple elevation of *Sophophora* to genus rank.

Changing *Drosophila melanogaster* to *Sophophora melanogaster* would have no impact as the model is routinely used and accepted in the scientific community and will never be abandoned. A change to *Sophophora melanogaster* would not be the end of the world for *melanogaster* geneticists but the proposed alternative might be so for others. For the stability of numerous branches of science (including systematics) the elevation of *Sophophora* to generic rank is preferable to the nomenclatural change proposed. A change in the status of *Sophophora* is likely to be relayed instantaneously through Flybase (<http://flybase.bio.indiana.edu/>) and major scientific journals. In consequence it would be promptly learnt by all researchers, whereas the alternative would have less media-penetration and the period of misuse and confusion would be consequently longer. It is worth noting that the Blast function of Flybase indicates *D. melanogaster* as being in the subgenus *Sophophora* and that most *melanogaster* geneticists must therefore be aware of its present classification. Geneticists should recognize that science is never static and thus, as an integral part of science, neither is systematics. Furthermore, if *D. melanogaster* is considered so sacred by geneticists, they should be less reticent to accept *S. melanogaster* in honour of the outstanding pioneer of genetics, A.H. Sturtevant, who established *Sophophora*.

Additional references

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We oppose the application to conserve the usage of *Drosophila* in the sense of *melanogaster* Meigen. This proposal seeks the endorsement by the Commission of a particular classification and classification paradigm, whereas the preamble of the Code asserts the freedom of taxonomic thought or action.

While the stated purpose is the conservation of usage, the proposal in fact seeks to establish by that a new and as yet undefined concept of *Drosophila*. Today *Drosophila* is accepted as a large genus of flies, containing a number of species of importance to genetics. The most widely known species is *Drosophila melanogaster* Meigen. The proposal declares that the current concept of *Drosophila* is ‘paraphyletic’ and thus ‘violates modern systematic practice’. That practice is cladistics or Hennigian systematics. For followers of ‘evolutionary’ systematics, (Mayr, 1942; Simpson, 1944) or phenetics (Sneath & Sokal, 1973), paraphyletic taxa are acceptable. Then there are issues of the utility of large and small taxa (i.e. lumping vs splitting). We feel strongly that the Commission should not be endorsing one classification paradigm over another.

In an identical situation, some workers (Reinert et al., 2004) have split the large genus *Aedes*. According to their classification, the widely used name *Aedes aegypti* (Linnaeus) for the yellow fever mosquito has become *Stegomyia aegypti*. This change has not caused major nomenclatural instability, in fact the changed combination has ensured that people can distinguish between their modern classification and the old obsolete classification. Nomenclature will inevitably change to reflect progress and improvements in classification. If we wanted true nomenclatural stability in the sense