

Misinterpretations of Réaumur's Description of Small Flies*

by

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Introduction

René-Antoine de Ferchault, Seigneur de Réaumur (1683–1757) has been characterized the Leonardo da Vinci of his century (Théodoridès 1959). As literature on Réaumur is abundant (Torlais 1961, Rostand 1962, Gough 1973) we need not go into the details which led to giving him this title; we only wish to draw attention to his experiments and considerations in physics – Réaumur is still remembered because of his invention of a thermometer.

Entomologists, however, honour him more for his investigations on insects published in his widely known *Mémoires pour servir à l'histoire des insectes*, 6 volumes, Paris 1734–1742; a seventh volume was published as late as 1926 (W. M. Wheeler 1926). Réaumur's description of the insect to which we refer here is found in volume five (1740) pp. 61–63, accompanied by figures 7–14 on plate VIII. When studying the text (see below) without closer inspection of the figures one is easily led astray in determining the fly as *Drosophila*. This has proved to be a pitfall for several authors after Réaumur. Examination of the figures has led us to a different interpretation of what Réaumur described more than 200 years ago.

* Dedicated to Professor Hans Quarner on the occasion of his 60th birthday.

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The Text

La même raison qui nous a engagé à parler des mouches de Saint-Marc, nous détermine à dire ici quelque chose d'une espèce de mouches (Pl. 8, fig. 7) beaucoup plus petites. Elles sont extrêmement communes, elles paroissent dans toutes les Saisons de l'année. Nous avons oublié de les faire connoître dans le neuvième Mémoire, nous y suppléerons dans celui-ci; elles ne sont que de vrais mouchérons; elles sont plus petites que les plus petites tipules. Lorsque leurs ailes sont posées sur leur corps, à peine sont-elles aussi grosses qu'une grosse tête d'épingle. Avec une loupe, on s'assure pourtant de la classe à laquelle elles appartiennent; on reconnoît (Pl. 8, fig. 11 & 12) qu'elles sont de la première des classes générales, qu'elles n'ont qu'une trompe assés semblables à celle des mouches bleues de la viande, & qu'elles sont de la première des classes subordonnées à la classe générale, de celle des mouches à corps court.

Elles aiment l'espèce de lie de vin qui est déposée sur les tonneaux d'où on tire le vin avec un robinet; elles aiment le marc de raisin qui s'aigrit, & en général elles aiment les liqueurs qui ont été sucrées lorsqu'elles viennent à s'aigrir. Des pots où il y avoit eu du miel qui s'étoit aigri, parce qu'on n'avoit pas daigné le séparer des vers, des nymphes de mouches à miel, & de ces mêmes mouches qui avoient péri, soit dedans, soit dessus ce miel; des compotes de pommes de rambour qu'on avoit aussi laissé aigrir, m'ont fourni des mille milliers des mouches dont je veux parler. Elles avoient crû sous la forme de vers (Fig. 8 & 10), dans ces matières aigries, & par la suite elles y avoient paru avec des ailes. Quand on découvroit le compotier de verre dans lequel elles étoient nées, on voyoit des nuées de ces petites mouches s'envoler.

The same reason which led us to speak about the flies of Saint-Marc decided us to say something here about a much smaller species of flies (Pl. 8, fig. 7). They are extremely common and appear in every season of the year. We forgot to mention them in the ninth Memoir and therefore include them in this one. They are really only small flies and are smaller than the smallest tipulae. When their wings are folded on their bodies they are scarcely larger than a large pin head. However, with a magnifying glass one is assured of their classification; one recognizes (Pl. 8, fig. 11 & 12) that they belong to the first of the general classes, that their proboscis is only somewhat similar to that of the blowflies and that they belong to the first of the general subordinate classes – that of the short bodied flies.

They like the sort of wine dregs which are found on barrels at the place where wine is tapped; they like the souring residue of pressed grapes and generally they like sweetened liquids once they have turned sour. Pots of honey which had turned sour because one had not removed the worms or the nymphs of the honey-flies, and because some of the flies had died either in or on the honey as well as stewed Rambour apples which were permitted to turn sour supplied me with thousands and thousands of the flies I wish to talk about. They grew as worms (Fig. 8 & 10) in these acid substances and then appeared with wings. When one opened the compote dish in which they were born one saw clouds of those small flies fly away.

Le corps & le corcelet de cette petite mouche sont jaunâtre. Ses yeux à rézeau sont d'un rouge qui n'est pas d'une belle nuance, mais qui fait pourtant qu'on les remarque plutôt qu'aucune des autres parties. Les ailes, qui ordinairement se croisent sur le corps, ont des couleurs d'iris. Inutilement ai-je cherché à voir les balanciers; mais il y a plus d'apparence que leur petitesse a contribué à me les cacher, qu'il n'y en a que la mouche en soit privée. Les antennes (Pl. 8, fig. 11 & 12a, a) sont à palette ovale & plate, comme celles des mouches à forme d'abeilles.

Je n'ai pu m'assurer si elles sont vivipares ou ovipares. Quoi qu'il en soit, leurs vers (Fig. 8 & 10) sont blanches & ont deux crochets parallèles l'un à l'autre en devant de la tête. En un mot, ces vers sont semblables, mais très en petit, aux vers de la viande. Comme ceux-ci aussi, lorsqu'ils sont en état de se transformer, ils se font une coque de leur propre peau (Fig. 9 & 13) dont ils se détachent, sans en sortir. Le bout antérieur & supérieur de la coque formée par cette peau, est un peu applati & terminé par deux cornes (Fig. 13c, c), qui probablement sont analogues à celles des autres coques cornues, & à celles des chrysalides cornues. Leur couleur est feuille-morte ou marron, elle est semblable à la couleur des coques des mouches de la viande; le bout postérieur de la coque a aussi deux especes de cornes (p,p).

Environ dix à douze jours après que l'insecte s'est transformé pour la première fois, il est en état de paroître avec des ailes; il détache la piece qui couvroit cette partie (Fig. 14d) de la coque nous avons dit être applatie; il soulève une piece plate, au bout de laquelle les cornes restent; enfin il sort ailé par cette ouverture.

The body and the breast of this small fly are yellowish. Its network-like eyes are not an especially pretty shade of red, but which makes one perceive them sooner than any other part. The wings which generally cross over the body are iridescent. In vain I searched for the balancers; but it seems that their smallness has contributed more to hiding them from me than that the fly should be deprived of them. The bases of the antennae (Pl. 8, fig. 11 & 12a, a) are oval and flat like those of bee-like flies.

I was unable to ascertain whether they are viviparous or oviparous. Whatever they may be, their worms (Fig. 8 & 10) are white and have two parallel hooks in front of the head. In other words, those worms resemble, in miniature, the meat-worms. Like the latter, they also transform their own skin into pupal cases (Fig. 9 & 13) from which they become detached without having to leave them. The anterior and upper part of the case, formed by this skin, is somewhat flattened and ends with two horns (Fig. 13c, c) which are probably analogous to those of other horned cases and to those of chrysalis with horns. Their colour is either that of dead leaves or chestnut and is similar to the colour of the meat-fly's case; also the posterior end of the case has two horn-like parts (p,p).

Approximately ten to twelve days after the first transformation the insect appears with wings; it detaches that part (Fig. 14d) of the case which we said was flattened; it lifts a flat piece at the end of which the horns are attached; finally the winged insect leaves through this opening.

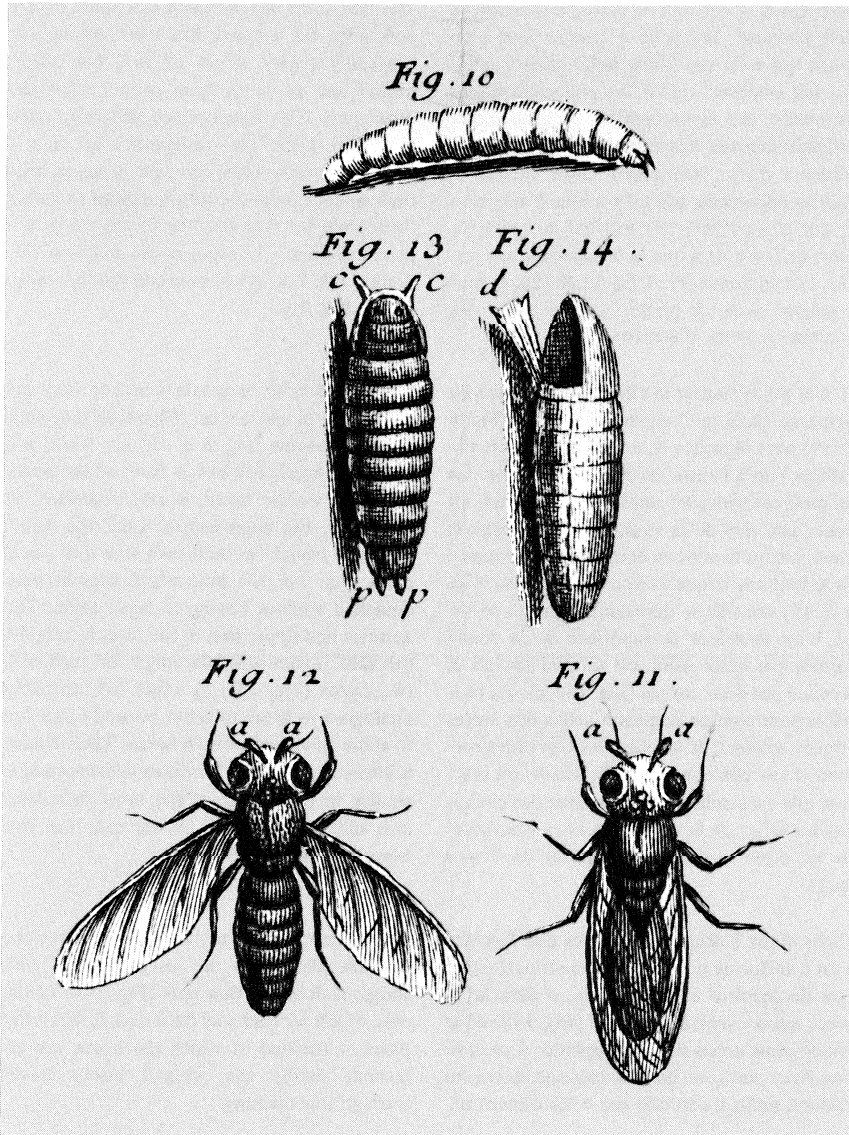


Figure 1. Enlargements of figures 10–14 from plate VIII in Réaumur's *Mémoires pour servir à l'histoire des insectes*, V, 1740. The engraver was J. B. Haussard (cf. Vollmer 1923) who also engraved plates for Louis Joblot (cf. Müller 1976a).

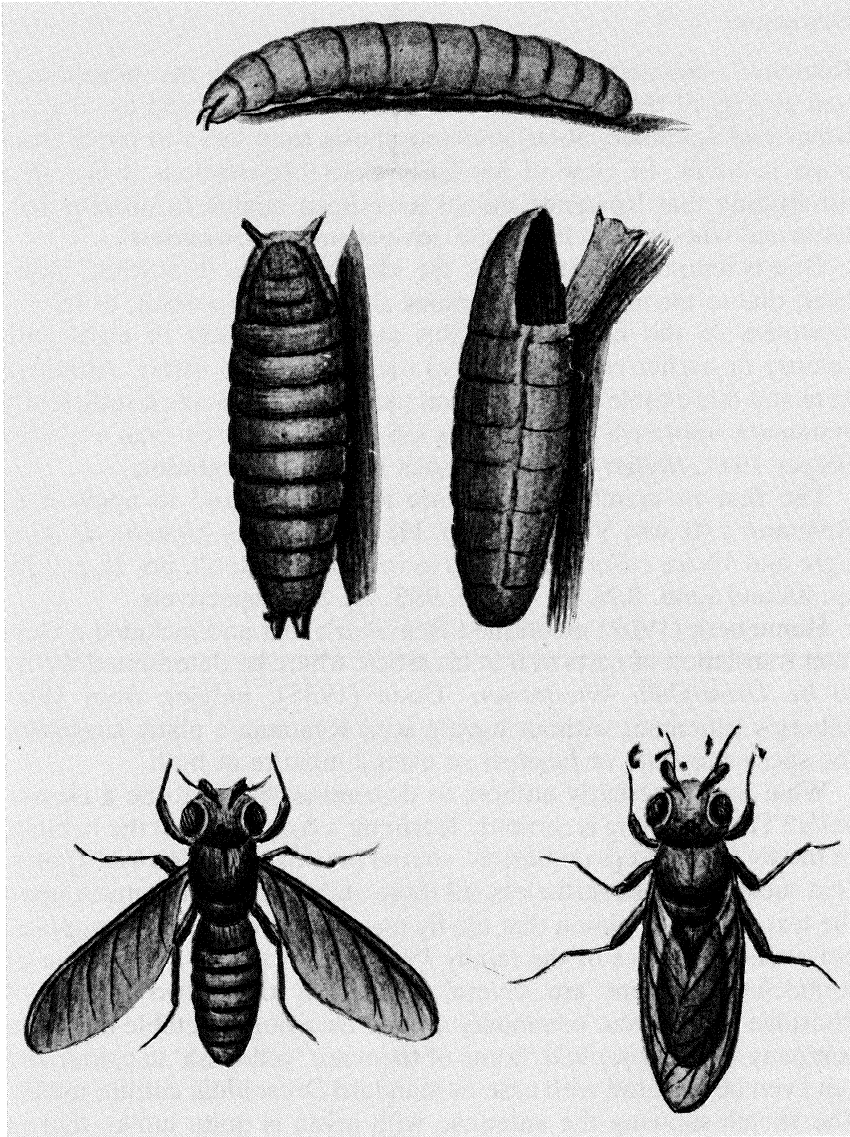


Figure 2. Enlargements of the original pencil drawings serving as pattern for the engravings. They are ascribed to Mademoiselle du Moutiers, Réaumur's draughtswoman, and preserved under Ms. 1901 (vol. 2) in the Bibliothèque Centrale of the Muséum National d'Histoire Naturelle in Paris (reproduced with permission).

Discussion

Réaumur's description offers a number of details on the morphology and biology of these flies. We learn about size, body and eye colour, wings and antennae, about metamorphosis from larva to pupa, from pupa to adult. In view of his fairly exact observations it is rather astonishing that Réaumur should have been unable to observe halteres and whether the flies were 'viviparous' or 'oviparous'.

One is tempted to determine the identity of the fly further. However, due to incomplete descriptions and, more important, to the inexactness of the illustrations (this applies generally to eighteenth century or earlier representations) one is often led astray. Although here and there some old description permits one to make a sufficiently systematic approach to identifying a family, a genus or even a species (Peyer 1947, Müller 1976a, b) much is left to speculation.

The first to search the literature for a name and to apply it to Réaumur's fly was Vallot (1802). He named it *La Mouche du Vinaigre* and *Musca cellaris* and cited as references: Geoff. ins. II, p. 536, sp. 85 and Linn. S.N. ed. XII, p. 993, sp. 87, respectively.

Henneberg (1902) mentioned Réaumur's text and included a German translation of parts of it in his article where he determined the fly to be *Drosophila fenestrarum*. Duda (1935), judging from Henneberg's statement without having seen Réaumur's plate, suggested the species *fasciata* or *funnebris* or even a mixture of both.

What led those early authors to determine the fly to be a *Drosophila*? The first thing is certainly Réaumur's description of the habitats of the fly (wine dregs on barrels, soured pots of honey, stewed apples, acid substances); nevertheless, all these authors relied too much upon the text. It is our opinion that the fly may not have been a *Drosophila*, but rather a species of the family Phoridae, probably a *Megaselia* or *Aphiochaeta*. There are several species of these two genera of Phoridae which occur commonly around decaying vegetable matter in company with *Drosophila*. Some of them are 'yellowish' in colour and can even be cultured with ease on standard *Drosophila* culture media. The sketch showing the antennae with arista is quite unlike that of *Drosophila* but is very much like that of some phorids; cf. figures 2, 3 and 7 on page 235 in Curran (1965). The sketch showing the wings is also quite unlike the *Drosophila* type; it is surprising that even with a

handlens of minor magnification the characteristic venation of a *Drosophila* wing can be discerned. We do not know much about Réaumur's magnifying glasses and microscopes but Daumas (1953) reported that the French optician and microscope constructor Alexis Magny (1712–ca. 1777) counted Réaumur among his clients. Magny's microscopes are said to have enlarged from 400 to 1000 times.

Although it is known that there was a woman, Mademoiselle du Moutiers, who did much of the drawings and even made some of the observations (Torlais 1938), one should not blame her for inexact representations: quite possibly she saw and figured a phorid wing. From Curran's book (his figures 6, page 235, and 12, 13 on page 236) can be seen examples of wing venation which look very much like those of Réaumur's plate. Furthermore Réaumur's description of the puparium and of the eclosion of the adult fly is like that of phorids, not like that of *Drosophila*.

Schmitz (1929) ascribed the first scientific account of a phorid to Scopoli (1723–1788) who on page 349 of his *Entomologia carniolica* (1763) described a *Musca festinans*. Schmitz did not mention Réaumur – neither did Borgmeier (1968) – but in his third chapter stated:

Man ist berechtigt, jede in einem oder beiden Geschlechtern geflügelte Diptere ngattung zur Familie der Phoriden zu zählen, wenn der Flügel das charakteristische Phoridengeäder besitzt. Bis jetzt ist kein einziges Dipteron mit wirklich echten Phoridenflügeln bekannt geworden, das nicht auch hinsichtlich aller übrigen Organisationsmerkmale in den Familienkreis der Phoriden zwanglos hineinpasste.

In 1845 Dufour presented a description of an insect which he called *Drosophila reaumurii*, apparently believing that it was identical to the one discussed by Réaumur. Dufour's publication obviously remained unknown to Henneberg and Duda, and even in more recent bibliographic reference books no hint at Dufour's article can be found. Our attention was drawn to Dufour's article by Unwin (1907) who seems to be the only one to have cited Dufour's study on *Drosophila reaumurii* up to Sturtevant (1921) and Wheeler (1959). It is not possible for us to determine Dufour's fly, since he unfortunately did not show an adult one. If it should be considered a *Drosophila* it is certainly not the species described by Réaumur; this also seems evident from Dufour's delineation of a thorax "vix rufescente" as well as from the different biotopes: Dufour found the larvae between skins of a

large, rotten onion. Dufour himself denied any conformity with other *Drosophila* species quoted by his entomological predecessors.

Drosophila reaumurii must, therefore, remain a *species incertae sedis*, and cannot with certainty be assigned to the Drosophilidae.

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REFERENCES

- Borgmeier, T., (1968) "A catalogue of the Phoridae of the world (Diptera, Phoridae)", *Studia Entomologica* 11, pp. 1-367.
- Curran, C. H., (1965) *The families and genera of North American diptera*, Woodhaven, New York.
- Daumas, M., (1953) *Les instruments scientifiques aux XVII^e et XVIII^e siècles*, Paris.
- Duda, O., (1935) "Drosophilidae". In *Fliegen palaearkt. Reg. VI₁* (58 g) (Ed. E. Lindner), pp. 1-118, Stuttgart.
- Dufour, L., (1845) "Histoire critique des métamorphoses de la *Drosophila reaumurii*, et description de la larve de la *Drosophila maculata*", *Mém. Soc. Roy. Sci. Agricult. Arts, Lille*, pp. 201-208.
- Gough, J. B., (1973) Réaumur, René-Antoine Ferchault de. In *Dictionary of Scientific Biography* (Ed. C. G. Gillespie) 8, pp. 327-335, New York.
- Henneberg, W., (1902) "Essigfliegen (*Drosophila fenestrarum* Fall. und *funebri* Fabr.)", *Dt. Essigind.* 6, pp. 333-336 und 341-344.
- Müller, G. H., (1976a) "*Drosophila*: eine Beschreibung aus dem Jahre 1754", *Genetica* 46, pp. 503-509.
- Müller, G. H., (1976b) "*Drosophila*: a contribution to its morphology and development by W. F. von Gleichen in 1764", *J. nat. Hist.* 10, pp. 581-597.
- Peyer, B., (1947) "An early description of *Drosophila*", *J. Heredity* 38, pp. 194-199.
- Rostand, J., (ed.) (1962) *La vie et l'oeuvre de Réaumur*, Paris.
- Schmitz, H., (1929) *Revision der Phoriden*, Berlin und Bonn.
- Scopoli, G. A., (1763) *Entomologia carniolica*, Wien.
- Sturtevant, A. H., (1921) *The North American species of Drosophila*. Carnegie Inst. Wash. Publ. 301, 150 pp.

- Théodoridès, J., (1959) "Réaumur (1683–1757) et les insectes sociaux", *Janus* 48, pp. 62–76.
- Torlais, J., (1938) "Réaumur fondateur de l'entomologie", *Hippocrate* 6, pp. 129–142.
- Torlais, J., (1961) *Réaumur, un esprit encyclopédique en dehors de l'Encyclopédie*, Paris.
- Unwin, E. E., (1907) "The vinegar-fly (*Drosophila funebris*)", *Trans. Ent. Soc. Lond.* Part 1, pp. 285–302.
- Vallot, J. N., (1802) *Concordance systématique, servant de table de matière à l'ouvrage de Réaumur, intitulé: Mémoires pour servir à l'histoire des insectes*, Paris.
- Vollmer, H., (ed.) (1923) *Allg. Lexikon bild. Künstler von der Antike bis zur Gegenwart* 16, p. 149.
- Wheeler, M. R., (1959) "A nomenclatural study of the genus *Drosophila*", *Univ. Texas Publ.* 5914, pp. 181–205.
- Wheeler, W. M., (ed.) (1926) *The natural history of ants*. From an unpublished manuscript in the archives of the Academy of Paris, New York.