

XXVII. Pollen-Eating Flies. By A. W. BENNETT, M.A., B.Sc.,
F.L.S.

[Read Dec. 3, 1873.]

THE reading of the paper entitled, "Do Flies eat Pollen?" before the Scientific Committee of the Royal Horticultural Society on Dec. 7, 1872,* called forth the suggestion from the Rev. M. J. Berkeley that it would be desirable to ascertain whether the pollen-grains are actually digested by the insect, or whether they pass through its intestinal organs unchanged. It was then too late to prosecute the enquiry during that season; but in the course of the present autumn I have made some further experiments. My hunting-ground was, as before, the "Compositæ" bed in the herbaceous department of the Royal Botanic Society's gardens, and the species examined chiefly the same as before, *Eristalis tenax* and *Syrphus clypeata*, both belonging to the family of Syrphidæ. As before, I found in almost every case the stomach perfectly loaded with pollen-grains, all presenting the form characteristic of plants belonging to the order Compositæ, though varying considerably in size, indicating probably that they belonged to several different species of *Aster*. The bodies of the common house-fly and of other Diptera belonging to the family Muscidæ, which were also captured browsing on the Asters, were in most cases entirely destitute of pollen, in other cases a few solitary grains were found, probably accidentally sucked up with their liquid food through the proboscis.

A more careful examination under the microscope of the contents of the stomachs of the Syrphidæ showed the pollen-grains in every possible state of disintegration and digestion. It is clear that after remaining for a short time in the stomach, the coating of the pollen-grain (extine and intine) gives way, and the liquid contents of the grain are digested by the assimilating organs of the insect. Large accumulations of the coats or skins of the pollen-grains were found evidently on the point of being expelled from the intestines as indigestible exuvixæ, having then assumed a very deep orange colour. There can be no doubt, therefore, that to a large class of Diptera, pollen forms a not inconsiderable or unimportant article of food.

* See Journal of the R.H.S., n.s., vol. iv., p. 30.

Society will, for the future, guard against the continuance of the practice.

<i>Dracæna albicans.</i>	<i>Dracæna limbata.</i>
„ <i>amabilis.</i>	„ <i>longifolia.</i>
„ <i>angusta.</i>	„ <i>Macleayi.</i>
„ <i>Chelsoni.</i>	„ <i>Mooreana.</i>
„ <i>Cooperi.</i>	„ <i>nigrescens.</i>
„ <i>concinna.</i>	„ <i>nigrorubra.</i>
„ <i>Dennisonii.</i>	„ <i>magnifica.</i>
„ <i>gracilis.</i>	„ <i>pendula.</i>
„ <i>grandis.</i>	„ <i>pulchella.</i>
„ <i>Guilfoylei.</i>	„ <i>Wisemanni.</i>

VIII. Do Flies Eat Pollen? BY ALFRED W. BENNETT, M.A.,
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[Read December 7, 1872.]

AT a meeting of the Scientific Committee during the past season, the question was raised whether Diptera eat pollen, or whether they merely carry it away accidentally when searching for the nectar which is their ordinary food. Having ventured to express the opinion that certain Diptera, and especially some of the Syrphidæ, do feed upon pollen, I found this was not the view of the entomologists present, who expressed disbelief that insects provided only with a proboscis and no mandibles could obtain any food more solid than the juices of plants. In order to decide the question I this autumn captured a number of the Syrphidæ which on a sunny day swarm on the Compositæ bed at the Regent's Park Botanic Gardens, and subjected the contents of their abdomen to examination under the microscope, when I found them in several instances to contain considerable quantities, and in one to be absolutely loaded with pollen-grains, which were easily recognised as belonging to some Compositous plant, probably some one of the species of *Aster* then abundantly in flower. The flies examined belonged to two species of very different size—*Eristalis tenax* and *Syrphus clypeata*.

The exact mode in which flies use their proboscis in feeding upon pollen—although apparently unknown to English entomologists—has in fact been accurately described by Dr. Erm. Müller, of Lippstadt, in a discourse delivered to the General Assembly of the

Natur-historischen Verein für Rheinland und Westphalen in 1869* :—

“As to flies, it has been till now generally admitted that they are exclusively destined to fluid nutriment. But in the summer of 1867 I was somewhat surprised, while observing in my garden an *Eristalis tenax* upon a flower of *Enothera media*, to discover that it was eating the pollen. Resting upon its middle and hind legs, it thrust out its fleshy proboscis like an arm, seized a morsel of pollen with the two valves which terminate the proboscis, and tore it away from the anther. Since the pollen-grains of *Enothera* are tied together by elastic threads, that bit of pollen torn from the anther was attached to others by a band of threads, and the insect, in order to free its mouth from that inconvenient appendage, began to use its fore-legs. Raising both together towards its mouth, it seized between them the cordon of threads, and rapidly rubbing them one against the other, much as we do in washing our hands, succeeded in cutting the threads, and clearing them from its mouth and legs. Then it raised them again and seized the two valves of the proboscis, thoroughly cleaning them of pollen and the threads yet adhering to it; and in about three seconds the work of cleaning was complete. At the same time the valves of the proboscis, by rubbing against each other, had masticated the morsel of pollen, and had conveyed the single granules into the channel of the labium, whence they were pushed into the mouth. It had hardly finished cleaning its proboscis and eating the first mouthful of pollen, when it seized another portion, and repeated each and all the operations I have described. It was so intent upon its meal that I was able to observe it in the closest proximity without its manifesting the slightest fear.

“The quantity of pollen which an *Eristalis* can devour in this way is surprising. Upon making a section of one and examining the stomach, it appeared very large, and was full of a yellow substance which consisted of hundreds of thousands of pollen-grains. I have had since then many opportunities of observing the eating of pollen, not only in all the species of *Eristalis*, but also in the genera *Rhingia*, *Syrphus*, *Volucella*, and *Scatophaga*. This chewing of pollen alternates with sucking honey if the flowers have any, and I am of opinion that the singular structure of the proboscis of flies cannot be fully explained without taking into account its double function of sucking honey and eating pollen. In the Tipu-

* “American Naturalist,” July, 1871, p. 290.

larisæ, and also in those flies which do not eat pollen but live exclusively upon juices, for instance *Bombylius*, the two valves of the proboscis serve no other purpose than to protect and guide the sucking tubes; but in the flies which devour pollen, besides this function, there is also that of grinding the pollen, for which they have special adaptations, for the margins of the two valves at the point of union are transversely dentate with fine parallel bands of chitine. Probably the greater or less distance of these bands in different species is related to the different size of the pollen upon which they feed."

[Additional note, March 10, 1873.]

The subject has also recently been investigated by the well-known naturalist, Mr. Edward Newman, whose conclusions on this point are equally at variance with those of the majority of his brother-entomologists. He asserts unhesitatingly ("Entomologist" for Jan., 1873, p. 291, and for March, p. 336) that the ordinary food of *Eristalis*, as well as of many other Diptera, is pollen; "Masses of this and other solid substances being found in their stomachs undissolved and unaltered after passing through the entire length of the leathery and extensile promusci." Whether, however, the pollen-grains are entirely unaltered, or whether their liquid contents or "fovilla" is extracted for the nourishment of the insect, is a point which cannot at present be considered as decided, and which must form the subject of a future series of observations.

In a recent communication to the "Field," Mr. Newman thus describes the process, as observed by him, by which the Syrphidæ detach and devour the pollen of plants, which it is interesting to compare with the independent observations of Prof. Müller:—"*Eristalis tenax*, *pertinax*, and *sequax* are all greedy devourers of pollen, and all of them devour it in the same manner. They thrust their proboscis among the florets, separate the two spreading valves with which its extremity is furnished, grasp a cluster of pollen-granules, detach them from the flower, and swallow them. The operation of detaching the pollen-granules is not performed without some skill and exercise of ingenuity, for in many flowers the granules are united together by slender tenacious threads, which must be broken before the granules can be swallowed. This swallowing of the pollen is very obvious to the patient observer; the granules, a few at a time, ascend the leathery proboscis and thence descend into the stomach, which becomes gorged with them, and from which they may be extracted, after the insect is killed, in

a perfectly unaltered state. The yellow pollen-granules frequently impart their colour to the abdomen, more especially to its sides and under-surface. After the fly has swallowed a granule or mass of granules, it occupies several seconds in clearing its head from the granules, threads, and other impurities which still adhere to it—a process performed by its first pair of legs in a manner that strongly reminds one of a cat washing its face with its fore-paws.” Mr. Newman even goes so far as to suggest—though he does not assert this to be the case—whether these three species of *Eristalis* are not entirely destitute of the power usually attributed to them of imbibing the liquid honey of flowers. At all events, in a series of observations extending over two autumns, he has never detected them in the act.

The utility of this affection for pollen on the part of these very common and widely-distributed species of Diptera, in promoting the cross-fertilisation rather than the self-fertilisation of the flowers they frequent, is sufficiently obvious.

IX. Report of the Chiswick Board of Direction.

[Presented February 11, 1873.]

DURING the past season the work at Chiswick has been mainly directed towards the perfecting of the arrangements attendant on the alterations in the garden in the previous year. It was then reported that in consequence of timely, though not unusually copious rainfall, the valuable collection of fruit-trees had been removed with scarcely any loss. The late gloomy and rainy season was peculiarly favourable to the complete establishment of the transplanted stock, the deficiency of fruit being highly conducive to the same end.

Though there has been little opportunity for what may be more strictly considered as scientific investigation, important trials in a horticultural point of view have been carried on with respect to various objects of cultivation. Those on the different varieties of Kales and Peas were made under unusually favourable conditions. Both were very carefully examined, the latter including upwards of 200 reputed varieties, by the Fruit Committee, and the results in either case are recorded in the numbers of the Society's Journal recently published. In order that no dissatisfaction might arise as to