ECONOMIC IMPORTANCE OF DIPTERA

J. R. MALLOCH, UNIVERSITY OF ILLINOIS

No other order of insects equals the Diptera in diversity of habits in larval and imaginal stages. Many of the families are largely beneficial, but unfortunately the good done by them is counterbalanced by the injury inflicted by others. The essentially phytophagous families, that is those families of which the great majority of the species feed upon plants, are very greatly outnumbered by those that are scavengers or predaceous or parasitic. If we exclude those that are fungivorous, only four families remain that can be classed as even preponderatingly phytophagous—Cecidomyiidae, Trypetidae, Agromyzidae, and Chloropidae; a few of these are predaceous. It must be borne in mind that a phytophagous species is not necessarily injurious from the economic standpoint, as many species feed upon and keep in check noxious plants and may therefore be regarded as beneficial.

It is but a step from the phytophagous to the scavenging habit, and in Drosophilidae we find species that may feed upon Cruciferae, mining the leaves, or in sap exuding from trees and in vegetable refuse. A great majority of the scavengers, however, rarely feed upon living plants, the only other exception being those that are fungivorous. There are eight families that may be considered as essentially fungivorous—Macroceridae, Bolitophilidae, Platyuridae, Mycetophilidae, Sciaridae, Platypezidae, Phoridae, and Drosophilidae. Many of the Sciaridae occur in decaying vegetation, while the habits of Phoridae are remarkably diverse, some being true entoparasites.

The scavengers belong to more than a score of families. In Muscidae all the species are scavengers; but in some other families, Anthomyiidae, for example, we find phytophagous and inquiline species, though these are greatly in the minority and the family is essentially one of scavengers. The Sarcophagidae include some species that are true entoparasites, but the great majority are feeders upon decaying animal and vegetable matter. The scavengers are in the great majority of cases really beneficial, transforming dead animal and vegetable matter into such forms as can be utilized by growing

plants. In reducing the bulk of putrefying substances, which, absorbed by the growing larvae, is transformed into the bodies of the resultant imagines, they remove what is noxious to man. It is chiefly when scavengers such as the common house fly contaminate our food by contact, after feeding on foul substances which are impregnated with disease germs, that there is real danger from these insects. Rarely the screw-worm fly and some of the flesh-flies deposit their eggs or larvae in wounds, either on man or on animals, and in this manner produce serious ulcerations; and the larvae of the former has been known to cause the death of persons by penetrating the brain, which it entered by way of the nasal passages. The flesh-flies and some other groups sometimes cause myiasis in man, the larvae finding their way into the stomach with food in which the flies have deposited their eggs or larvae and which has not been prepared for consumption by judicious cooking, or carefully examined so as to exclude infested portions.

We may class as true parasites nine families, some of which, as Tachinidae (*sens. lat.*), Dexidae, and Pipunculidae, are highly beneficial, and others, as Gastrophilidae, Hippoboscidae, and Oestridae, are distinctly injurious. The parasites of this order destroy many injurious species of insects, and, next to the parasitic Hymenoptera, constitute the most important check upon their increase.

Another group of highly beneficial species is that containing the predaceous forms. Two of the families which are to some extent beneficial in the larval stage—Tabanidae, and Culcidae in part—are injurious as imagines, turning their attention from insect larvae, on which they chiefly prey in the earlier stage, and giving it largely to mammals, including man. This radical change of habit is, however, exceptional, as nearly all other predaceous families in this and other orders feed upon insects in both the larval and imaginal stages. Many Syrphidae are aphidophagous as larvae, the greater portion of the species being scavengers, while the imagines are flower-frequenters.

The aquatic families, with the exception of the Sciomyzidae and Ephydridae, which are in large part aquatic, belong to the Orthorrhapha. With the exception of the Mycetophilo-

idea, which contains five families, the Oligoneura, which contains the Cecidomyiidae, and the families Bibionidae and Scatopsidae, all the families in the Nematocera are aquatic either wholly or in large part. The aquatic species in the Brachycera are contained in five families—Leptidae, Stratiomyiidae, Tabanidae, Empididae, and Dolichopodidae. As already indicated in the foregoing general discussion, the larvae of some of these families are predaceous and may justly be considered beneficial; the others feed upon algae and decaying vegetable matter, and while their presence in water that is intended for drinking purposes is undesirable, it is not necessarily harmful unless the vessel containing them is small and they are numerous enough to foul the water, either with excreta or exuvia. With the exception of some Chironomidae and Culicidae there are few species that frequent reservoirs or cisterns, most of them preferring lakes, ponds, or streams.

My information regarding the habits of the order in general leads me to the conclusion that as a whole their beneficial and injurious activities practically offset each other. The fact that there are injurious species which cause great recognized damage, such as the malarial and other disease-breeding mosquitoes and the Hessian fly, very largely outweighs in the mind of the uninitiated the benefits—few of which are apparent except to a student of the Diptera—that are directly or indirectly due to the presence of other forms. With advance in a knowledge of the biology of the insects of this order will come a realization that their injurious and beneficial effects are practically balanced.