

hydrotropism, phototropism, and anemotropism. If time permitted, a consideration of that extensive realm of insect behaviour included within the category of instinctive behaviour would be desirable, but we must content ourselves with the knowledge that this type of behaviour is the result of reflex responses to the various types of tropisms.

Chemotropism is the reaction to stimuli of a chemical nature perceived through the olfactory sense. Inasmuch as odour is undoubtedly the most important factor in the environment of insects the significance of this tropism is evident. The chief objects of animal or plant life, are feeding and reproduction, and in the search for food or for the sexes, or in oviposition, chemotropism plays a predominant part. The sexual chemotropism of insects, particularly among the Lepidoptera, has long been a familiar phenomenon to entomologists. But it is in their response to chemical stimuli as affecting the search for food and oviposition that we find a tropic reaction that has untold possibilities in its practical application.

The vital functions of search for food and oviposition are closely associated. The female insect deposits its eggs on substances best suited for the nourishment of the larvæ. The females of *Pieris rapæ* and *P. brassica* select the leaves of cruciferous plants, attracted thereto by the mustard oils, a group of glucosides present in these plants, as shown by the experiments of Verschaffelt. The same investigator showed that the larvæ of the sawfly *Priophorus padi* (L.) Thomas, which feeds on the foliage of certain rosaceous plants, are probably attracted by a glucoside, amygdaline. The chemotropic reactions on the part of carrion beetles, and to excrement on the part of coprophagus Coleoptera and Diptera, are well known. Howlett induced *Sarcophaga* to oviposit in a bottle containing scatol, a decomposition product of albuminous substances; and he stimulated the oviposition response in *Stomoxys calcitrans* by means of valerianic acid. Richardson's recent work on the oviposition response of the house-fly, in which flies were induced to oviposit in response, apparently, to an attraction of ammonia in conjunction with butyric and valerianic acids, opens up suggestive lines of investigation. Barrows finds that the positive reaction of *Drosophila* to fermenting fruit is due in a large measure to amyl, especially ethyl alcohol, acetic and lactic acid and acetic ether.

While the aforementioned cases, which might be multiplied, illustrate the chemotropic responses of insects in so far as they affect the oviposition response, that is, the search for food as affecting the future larvæ on the part of the ovipositing female, there is the large class of chemotropic reactions which affect only the adult without reference to the progeny. An illustration of this class is afforded by the investi-