

## X. FIG WASPS

For the pollination of their flowers, plants of the genus *Ficus* are absolutely dependent upon the activity of small insects, the "fig wasps" (Hymenoptera Chalcidoidea, family Agaonidae). Consequently, no account of *Ficus* can be exhaustive without considering the entomological data. On the other hand, the fig wasps can only develop in the gall flowers of the fig receptacle. Consequently again, in the evaluation of the data on fig wasps, great stress should be laid on the botanical evidence. These statements may serve as ample justification for the appearance of an entomologists' notes in this botanical bulletin.

Since 1960 I am working through a large collection of Indo-malayan and Papuan fig wasps, mainly consisting of the collection made by Dr. J. van der Vecht at Bogor, and material sent by Dr. E. J. H. Corner from various parts of Malaya, Indonesia, Papua, and Melanesia. As the study of the fig wasps is still in its analytical stage, progress is slow, but the results are promising.

As mentioned before, the fig wasps develop in the gall flowers of the fig receptacle. The winged female wasps, after having been fertilized by the wingless males, leave the figs and carry the pollen to the young receptacles of the same *Ficus*-species. In the monoecious figs (e.g. the banyans), the wasps find, in the same receptacles where they bring the pollen to the stigmata, young gall flowers in which they lay their eggs. The male flowers in the receptacles are not mature before these eggs have developed into a new generation of wasps. In dioecious figs, the pollinating wasps die in the female receptacles and do not reproduce, for want of gall flowers. The wasps that find the gall receptacles are of no immediate use to the *Ficus*, because they meet no female flowers to be pollinated. Part of their progeny, however, will again act as pollinating agents, when the male flowers of the gall receptacles are ripe to give pollen.

In such a mutualistic symbiosis, of which neither of the components is self-supporting, it is not astonishing that the relation between fig and fig wasps is obligatory and specific. There seem to be some exceptions to this rule, in as much some species of wasps show more geographical variability than does the host *Ficus*. There is also a record of one and the same species of wasp serving two forms of *Ficus*. On morphological grounds, these forms are supposed to be specifically distinct. Yet, they are closely related, and sometimes hybridize.

From the comparison of the botanical and entomological classifications another interesting rule emerged: related

figs have related pollinators, and related fig wasps inhabit the receptacles of related species of Ficus.

For the larger groups (sections of the genus *Ficus*, genera of the Agaonidae) this parallelism is very convincing. In the smaller groups it is less clear, as the relationships within the series are intricate and multidimensional. At present, Dr. Corner and myself are checking the data on section *Sycocarpus* and the Agaonid genus *Ceratosolen*. In general, we find a rather good fit, but many details deserve closer examination, and in some groups we need more host records. Unfortunately, our material - rich as it is - is far from complete. There are many species of *Ficus* from which the pollinators are not yet known. In fact, I estimate that less than one quarter of the Indo-malayan fig wasp species have been described up till now; another quarter is awaiting description in our collection. For the collecting of the remaining half I venture to solicit for the help of the readers of this bulletin, and I give some practical hints to the collecting of the insects<sup>1)</sup>:

1. The insects are small, 1-2 mm long, and must be captured in containers. They must be allowed to get out of the flowers.

2. Unripe figs, with immature insects, are useless and from ripened figs the insects may have escaped. This can be seen by inspecting the orifice of the ripe fig: the insects bite an exit-hole about 1 mm in diameter through or near the orifice (a lens may be needed to detect the hole).

3. Select nearly ripe figs (beginning to soften or to colour up). Place them in a collecting tube on a piece of filter paper and plug with cotton-wool. Put the end of the tube towards the light, to attract the insects away from the plug. The wasps will hatch in a few days.

4. After the wasps have emerged, pour in 70% alcohol, and close with cork. The male insects often remain in the fig. In large figs, an opening should be cut in the wall to admit alcohol. It is best to put in a plug of cotton-wool or paper to prevent the figs from moving and breaking the insects.

I may stress the necessity of documented host records, as it is the symbiosis between plant and insect that makes the study of figs and fig wasps such a fascinating and - I think - important chapter in biology.

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1) These notes are taken from a mimeographed guide to the collecting of fig insects, by J. van der Vecht & E. J. H. Corner.