

## Nematodes, Figs and Wasps

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Certain *Ficus* spp. are dependent on wasps for pollination. The invading wasps usually shed their wings on entering a fig through the ostiole; and during attempted or successful egg deposition, transfer pollen to the female flowers and then die. A gall forms around each egg, and within the gall develops a male or a female wasp. Male wasps are the first to emerge from galls, and they then fertilize the female wasps before the females emerge. After emergence from the galls, the female wasps escape from the fig via the ostiole and fly to developing figs where the cycle is repeated. Many species of nematodes mature and reproduce within figs, and are transported to figs by pollinating wasps.

The literature revealed no reference to nematodes within the fruit of fig trees, but Thorne (3) and Nickle (2) refer to the work of Gasparrini (1), who recorded a nematode *Schistonchus caprifici* (Gasparrini 1864) Cobb, 1927, carried by the fig-pollinating wasp *Blastophaga psenes* L.

Many *Ficus* spp. grow in Rhodesia, and the majority are considered to be indigenous. Fruit has been examined from the following species: *Ficus capensis* Thumb.; *F. sycomorus* L.; *F. burkei* (Miq.) Miq.; *F. ingens* (Miq.) Miq.; *F. sonderi* Miq.; and *F. welwitschii* Warb. All are uncultivated African figs indigenous to Rhodesia except for *F. welwitschii*. Nematode- and wasp-infested figs were present on every bearing tree examined, and in no case have nematodes been found in the absence of wasps or vice versa.

Figs from seven non-African cultivated *Ficus* spp., including species grown as ornamentals, for shade and for fruit, did not reveal the presence of nematodes or wasps. Figs are not produced commercially in Rhodesia, but are grown in private gardens for home consumption.

Several species of minute wasps were observed in many figs, and more than one

species were recorded within the same fig. Totals exceeding 40 dead wingless females, 400 winged females, and 200 male wasps were recorded from a single fig.

Male and female wasps in many stages of development were dissected from galls contained within figs, and, on one occasion, a male wasp and a female wasp were seen within one gall before the development of the escape hole. Male wasps frequently entered galls containing female wasps.

Wasp-infested figs always harbor nematodes, frequently in enormous numbers. As many as 50,000 nematodes, including at least eight species, were recorded from one fig. Nematodes were never found within the tissues of figs, but always actively moving over the interior surfaces.

Numerous active juveniles and mature adults, some ova and many dead adult nematodes frequently were observed within one fig. Sometimes the dead bodies of the larger nematode species were so numerous that they were clearly visible as a white opaque web on the interior surfaces and, particularly so, over the black dead bodies of wingless wasps.

The nematodes reproduce, live and die within the figs, and the dead bodies are not readily absorbed by the fig, nor do the bodies quickly decompose.

High numbers of female wasps of several species were trapped after they had escaped naturally from figs. Dissection of these wasps revealed the presence of nematodes. In certain species of wasps the nematodes were in a sub-ventral abdominal pouch, and in others they appeared to be between the abdominal folds. As many as 250 nematodes, including several species, were recovered from one wasp. Numerous galls containing female wasps were dissected from figs, and nematodes were found only in female wasps contained within galls that possessed fully or partly developed escape holes. It would appear, therefore, that nematodes can gain access to the female wasps in the galls, only during and after the development of the escape holes. Nematodes are thus able to transfer to female wasps while they are comparatively immobile.

Although high numbers of several species of large nematodes were observed within figs, no

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large forms were recovered from the winged wasps escaping from these figs. Many small juvenile forms, however, were recovered from such wasps, and we conclude that it is the juvenile stages which are wasp-transported.

Males and winged female wasps were kept immersed in water to permit the escape of nematodes contained within sub-ventral abdominal pouches, abdominal folds or carried externally on any part of the wasps. During this process the escaped nematodes were removed and the wasps were washed repeatedly with distilled water until escaping nematodes were no longer observed. On several occasions after this treatment, nematodes of more than one species were recovered from dissected wasps. It appeared that these nematodes were within the bodies of the wasps and could have been parasitic forms.

Several species of nematodes, particularly the larger ones, died within 30 min of their transfer from a fig to water, but remained alive and active much longer if placed in juice pipetted from the interior of figs or in the medium that results from washing the interior of figs with a small quantity of a sugar solution (45 g sugar/liter of water).

Figs of indigenous *Ficus* spp. on several occasions contained free fluid, and sometimes all the nematodes in such figs were dead. Whether the production of fluid within figs is due to the presence of high numbers of nematodes or whether any sort of fig pathology results from nematode presence is not known.

Limited investigations to date revealed that more than 20 species of nematodes inhabit figs, among which were five species with longish, knobbed spears belonging to the Superfamily Aphelenchoidea, four species of the Family Cyliandrocorporidae and several species in the Family Diplogasteridae.

The feeding habits of the different species

of nematodes are as yet unknown, but from the diversity of cephalic structures and feeding mechanisms, they must be quite varied.

Quite a diversity of cuticular embellishment or ornamentation is present on many of the nematodes found within figs. Such features include fine to very coarse transverse annulation, longitudinal annulated ridges (Diplogasteridae), longitudinal frills or fins which are as wide as the nematode body (Cyliandrocorporidae), thin to thick cuticle, structures around the female anus, mucrons, small longitudinal and laterally situated prominences near the posterior end of the body (Aphelenchoidea) and, in most cases, tails which are filiform or sharply pointed.

Investigations of the high degree of specialization, both in the figs and in the wasps, by so many species of nematodes from widely divergent groups should add materially to existing knowledge in several aspects of nematology. The nematode species in figs are many in number and are probably undescribed. The pollinating wasps have never been investigated in Rhodesia, and it is quite probable unknown species are involved. Furthermore, much remains to be learned about the many *Ficus* spp. indigenous to the country.

This introductory paper is presented in the hope that a group, or a number of individuals, will wish to participate with the authors in future investigations.

#### LITERATURE CITED

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