

## PARASITIC FUNGI AS A MORTALITY FACTOR OF SPIDERS

Several times during arachnological studies in Panama I found dead spiders covered with fungi. As the notes which record fungi attacking spiders are scattered and few in number, my observations are reported here in detail.

The field studies were carried out in Panama (Province of Panama) at three locations: On Pipeline Road near Gamboa; on Cerro Galera, a hill at the Pacific coast near Arraijan; on the road from El Llano to Carti, km 13. The first two areas represent typical tropical moist lowland forest, the third premontane moist forest. In Panama, there is a distinct seasonality with a dry season (January to April), and a wet season (May to December). Annual rainfall is more or less restricted to the wet season and amounts to 2000-3000 mm per year. Fungus-covered spiders were found only from August to October, i.e. in the second and wetter part of the wet season, though field-work was carried out during the whole year.

Immature specimens of the deuteromycete *Nomuraea*, probably *N. atypicola* (Yasuda), were found on the araneids *Argiope argentata* (F.) (three observations), *A. savignyi* Levi (one observation) and *Nephila clavipes* (L.) (two observations). A compact white mycelial stroma was observed on the opisthosoma of the spiders but fruiting structures (conidiophores) were lacking (Fig. 1). Fungal colonies are initially white but typically become purple as a powdery spore bloom develops. The heavy overgrowth of a mucoraceous fungus ("bread mould") is characteristic of recently invaded or badly dried immature (= non-mummified) specimens (Evans, pers. comm.). On the araneid *Eriophora fuliginea* (C. L. Koch) and an unidentified web building spider (one observation each) the fungus overgrowth was also immature but could tentatively be identified as the *Granulomanus* state of a *Gibellula* sp. (Deuteromycetes).

All araneids were found hanging with their legs in a relatively normal position on the hub of the orb web. The web, however, was always reduced to a silken platform with a network of irregular threads, similar to the moulting webs of orbweavers (Fig. 2). Because old spiders build orb webs of increasing irregularity but never without sticky spiral (Nentwig, unpubl.) this web type indicates that the fungi probably did not attack a dead spider but rather killed a living one. The period between infection and death of the spider must have been at least two days to enable the spiders to build this specific type of web. It is not possible that these webs represented real moulting webs since no exuviae were found and all the spiders were full-sized adult females.

An overview of insect-parasitism among fungi has been presented by Madelin [1968, pp. 227-238, *In*: The Fungi (G. Ainsworth and A. Sussmann, eds.). Academic Press, New York, Vol. 3]. Most ectoparasites are Laboulbeniales (Ascomycetes), only a few dozen are Deuteromycetes, most records originate from tropical and subtropical countries. These include the *Nomuraea* (= *Spicularia*) and *Gibellula* species which are mentioned here and are well-known to parasitise spiders [Samson and Evans 1977, Proc. Konink. Nederland. Akad. Wet., Amsterdam, ser. C, 80(2):120-133]. Further records of fungi which infect spiders include *Engyodontium* species (Hyphomycetes) (Gams, De Hoog and

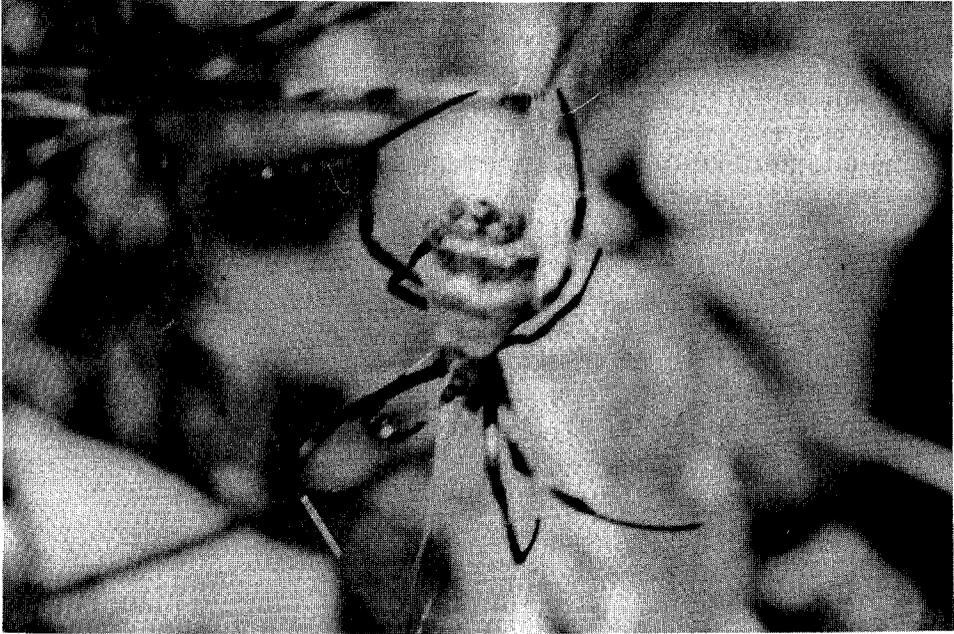


Fig. 1.—A dead *Argiope argentata* (Araneidae) covered with the white mycelial stroma of the deuteromycete *Nomuraea* cf. *atypicola*.



Fig. 2.—The web of a dead *A. argentata*, infected by *N. cf. atypicola*, is reduced to a silken platform and irregular suspension threads.

Samson 1984, Persoonia, Leiden, 12:135-147) and the ascomycete *Cordyceps* sp. which had been found on dead linyphiids on the arctic island Jan Mayen (Bristowe 1941, The comity of spiders, London, The Ray Society, vol. 2:332-333). In India, the endoparasitic deuteromycete *Beauveria alba* has been found in a theridiid (Chandrashekhar, Suryanarayanan and Narasimham 1981, Curr. Sci., Bangalore, 50:248). Apart from the last two cases, none of the several dozen records in the mycological literature mentioned here gives an identification of the spiders, with the exception of one reference to an ant-mimicking Salticidae by Samson and Evans (1977) and one reference to an "Opilionid spiders" by Gams et al. (1984). It is possible that the exposed posture of the araneids mentioned here facilitates infection by airborne fungus spores. This indicates perhaps that entomophagous fungi are an important mortality factor among spiders, especially web building species in the tropics.

I thank Dr. H. C. Evans, Commonwealth Mycological Institute, Kew, England, for the identification of the fungi and for helpful comments.

**Wolfgang Nentwig**, FB Biologie-Zoologie, Universität, D-3550 Marburg, Federal Republic of Germany.

*Manuscript received July 1984, revised August 1984.*

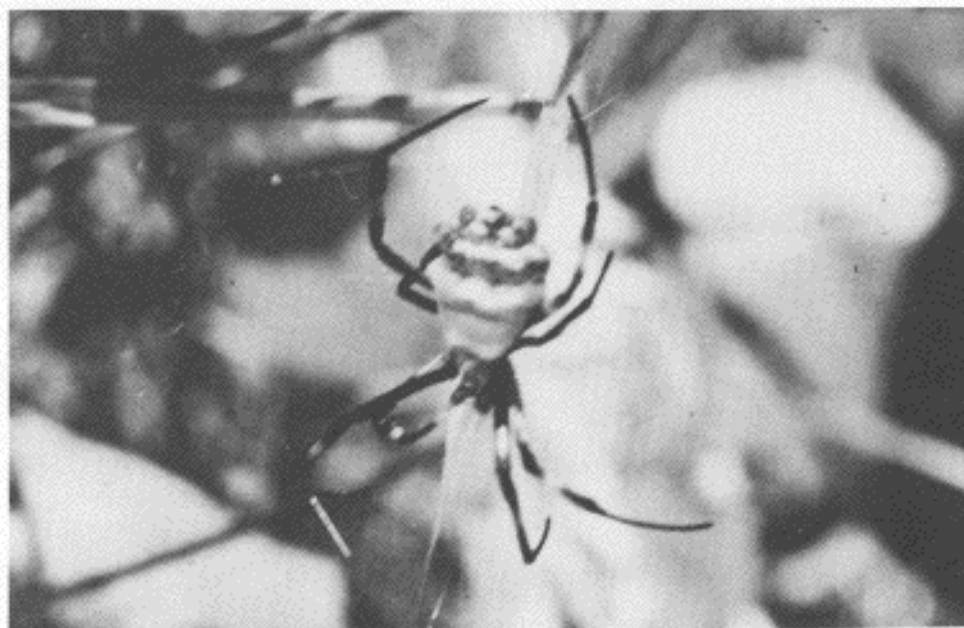


Fig. 1.—A dead *Argiope argentata* (Araneidae) covered with the white mycelial stroma of the deuteromycete *Nomuraea cf. atypicola*.



Fig. 2.—The web of a dead *A. argentata*, infected by *N. cf. atypicola*, is reduced to a silken platform and irregular suspension threads.