GRAIN STORAGE FUNGI ASSOCIATED WITH MITES

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Studies were carried out to isolate fungi from various stored-grain mites. Mites recorded from samples of local grains were identified to be *Acarus siro* L., *Rhizoglyphus* sp., *Cheyletus* sp., *Suidasia medanensis* Oud., *Macrocheles* sp. and *Tydeus* sp. Seven genera and 18 species belonging to different groups of fungi were found to be associated with these mites. *Macrocheles* sp. carried more fungi, while *Acarus siro* L. carried less number of organisms than other mites.

Introduction

Mites and fungi under suitable conditions of temperature and moisture bring about a rapid deterioration of stored grains. Certain fungi, especially those belonging to the genus *Aspergillus*, are primarily responsible for much deterioration in stored grains, by producing germ-damaged wheat and other deleterious changes. The literature dealing with this has been adequately reviewed.[1–4] Fungi may also contribute to an increase in number of insects and mites by providing them suitable temperature and food.

Mites are important pests of stored products all over the world. They are responsible for the dissemination of various pathogenic fungi in stored food and seeds. Various workers have reported a close association between mites and fungi in deteriorating stored grain and other products.[5–8] They observed that some species of mites feed and thrive on certain fungi, whereas other species starve and die when exposed to the same or other kinds of fungi. Additional evidence of association between grain storage fungi and mites has come from laboratory studies.[9–12]

The present studies were undertaken to investigate the presence of fungi and mites in the local grains and also to study the association between them if any.

Materials and Methods

Several samples of stored grains obtained from various granaries were brought to the laboratory for investigation. The mites present in these samples were identified to be *Acarus siro* L., *Rhizoglyphus* sp., *Cheyletus* sp., *Suidasia medanensis* Oud., *Macrocheles* sp., and *Tydeus* sp. Different media namely, Czapek's–Dox agar, Sabourad agar, oat meal, lima bean and corn meal agar were selected to facilitate the growth of all types of fungi. Five adult mites from each species were then introduced into test tubes containing various media. Five sets of tubes were left uninoculated as controls. In another set of control experiment, the mites were surface-disinfected by two different methods: (1) the adult mites to be introduced in the medium were washed briefly in running water to which soap powder was added and shaken for 1 min in 1% solution of sodium hypochlorite to remove or kill external spores of fungi. This treatment caused no detectable injury to the mites, (2) by immersion in 0.5 solution of one part of mercuric chloride for 3 min. The mites were then rinsed in two changes of sterile distilled water, dried on filter paper and then introduced into the tubes.

The absence of air-borne fungus spores in the experimental area was checked by exposing uncovered nutrient agar tubes before and during transfers. All experiments were conducted at 85±2°F and 70%±3 R.H.

Presence of Storage Fungi within the Mites.—In order to determine whether the mites would transmit spores of storage fungi internally, adults of *Acarus siro* and *Rhizozlyphus* sp. were placed on pure culture of *Penicillium janthinellum* and *Aspergillus flavus* for 72 hr during which time they were observed to feed on the fungi. Mites were then dipped in sodium hypochlorite to rid them of any external contaminating spores and then cultured on malt-sugar agar. No fungi grew from outside of these surface-disinfected mites, but within 48 hr mycellium grew out from mouth and anal openings of nearly all of them. This indicated that viable inoculum of *Penicillium janthinellum* and *Aspergillus flavus* on which the mites had been feeding was present within the body of mites, but did not show whether viable spores voided in the excreta. To determine this, surface-disinfected mites were dissected under 30X magnification, the alimentary canal and its contents removed, examined microscopically and cultured on malt-salt or Czapek's agar containing 40% sugar.

Results and Discussion

Mites collected from various food samples were found to carry seven genera of fungi namely

Penicillium, *Aspergillus*, *Alternaria*, *Rhizopus*, *Rhinotrichum*, *Helminthosporium*, and *Cladosporium*. Among these genera *Aspergillus* and *Penicillium* dominated over all the fungi prevalent on various mites. *Penicillium janthinellum* and *Aspergillus flavus* were carried by all the 5 mites and frequency of their prevalence was comparatively higher than other fungi. *Alternaria tenuissima* and *Rhizopus nigricans* were found to be associated with *Cheyletus* sp. and *Tydeus* sp. *Macrocheles* sp. carried more fungi while *Acarus siro* less than other mites. Seven species of *Penicillium*, 5 species of *Aspergillus*, 2 species of *Helminthosporium*, 1 species of *Cladosporium* and *Rhinotrichum* were isolated from *Macrocheles* sp. *Rhinotrichum* sp. was isolated only from *Macrocheles* sp. The various genera and species of fungi isolated from grain-infesting mites, are shown in Table 1.

It was also observed that *Acarus siro* and *Rhizoglyphus* sp. feed voraciously on *Penicillium janthinellum* and *Aspergillus flavus*. The infection of these fungi in stored grain may very well be checked by these mites. *Acarus siro* and *Rhizoglyphus* sp. (Fig. 1) were found to carry viable spores externally as well as internally. Excreta taken from both the mites yielded either *Penicillium janthinellum* or *Aspergillus flavus* colonies or both.

In conclusion, mites not only carry spores of storage fungi on the outside of their bodies, but also in their digestive tracts and faecal matters. In this way they are greatly responsible for transmission of storage fungi.

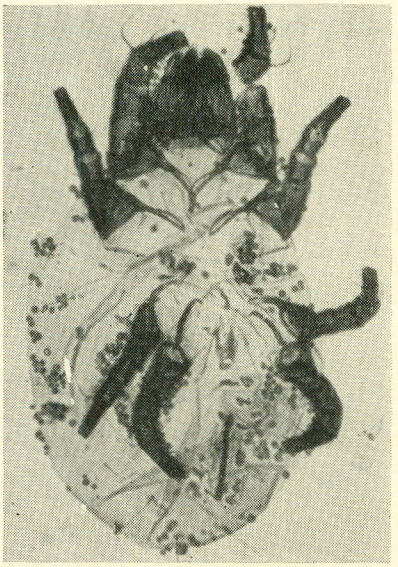

Fig. 1.—*Acarus siro* L. Body covered with spores.

TABLE 1.—VARIOUS FUNGI ISOLATED FROM DIFFERENT STORED GRAIN MITES.

Mites	Fungi Isolated
Macrocheles sp.	*Penicillium janthinellum* Biourge
	Penicillium funiculosum Thom
	Penicillium oxalicum Currie et Thom
	Penicillium cyclopium Westl.
	Penicillium implicatum Biourge
	Penicillium purpurogenum Stoll
	Penicillium pururrescens (Sopp) Raper et Thom.
	Aspergillus flavus Link
	Aspergillus niger Van Tieghem
	Aspergillus ruber (Bremer) Thom et Raper
	Aspergillus terreus Thom
	Aspergillus luchuensis T. Inui
	Helminthosporium anomalum Gilman & Abbott
	Helminthosporium nodulosum (Berk. et Curt.) Sacc.
	Rhinotrichum sp.
Cheyletus sp.	*Penicillium janthinellum* Biourge
	Aspergillus flavus Link
	Aspergillus niger Van Tieghem
	Alternaria tenuissima (Fr.) Wiltshire
	Rhizopus nigricans Ehrenberg
Tydeus sp.	*Penicillium janthinellum* Biourge
	Aspergillus flavus Link
	Aspergillus niger Van Tieghem
	Alternaria tenuissima (Fr.) Wiltshire
	Alternaria sp.
	Rhizophus nigricans Ehrenberg
Suidasia medanesis Oud.	*Penicillium janthinellum* Biourge
	Penicillium sp.
	Aspergillus flavus Link
	Aspergillus niger Van Tieghem
	Alternaria sp.
	Cladosporium sphaerospermum Penz
Acarus siro L.	*Penicillium janthinellum* Biourge
	Aspergillus flavus Link.

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References

1. N.S. Agarwal, C.M. Christensen and A.C. Hodson, J. Econ. Entomol., **50**(5), 659 (1957).
2. C.M. Christensen, Bot. Rev., **23,** 108(1957).
3. C.M. Christensen, Cereal Chem., **32,** 107 (1955).
4. G. Semeniuk, American Association of Cereal Chemists (St. Paul 1, Minnesota, 1954).
5. R.N. Sinha and H.A.H. Wallace, Ann. Entomol. Soc. Am., **50**(6),1170(1966).
6. R.N. Sinha and E.A.R. Liscombe and H.A.H. Wallace, Can. Entomologist, **94,** 542(1962).
7. R.N. Sinha, Proc. Entomol. Soc. Manitoba, **18,** 51(1962).
8. R.N. Sinha, Can. Entomologist., **93,** 609 (1961 a).
9. D.A. Griffiths, A.C. Hodson and C.M. Christensen, J. Econ. Entomol., **52**(3), 514(1959).
10. M.E. Solomon, Ann. Appl. Biol., **33,** 280 (1946).
11. Z.S. Rodionov, Uch. Zap. Mosk. Gos. Univ., No. 42 Zool., 141(1940).
12. R.N. Sinha, Acarologia, **6,** 372(1964).