EFFECT OF METHYL BROMIDE FUMIGATION ON THE FUNGI ASSOCIATED WITH SEED COCONUTS[1]

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ABSTRACT

Four fungi, *Botryodiplodia theobromae, Pestalotia palmarum, Phoma* sp. and *Thielaviopsis basicola*-associated with seed coconuts were exposed to methyl bromide (MeBr) fumigation directly as well as after implanting them into seeds at different concentrations and exposure timings, critical to seed coconuts. The fumigation was carried out in air tight chambers at the Plant Quarantine and Fumigation Station, Cochin, and the fumigated cultures were transferred to fresh medium to study their viability. Observations on presence/absence of fresh growth on sub-culturing indicated that fumigation with MeBr at concentrations and exposure timings, critical for seed coconuts, is not sufficient to kill any of the four fungi.

INTRODUCTION

Methyl bromide (MeBr) is an effective fumigant against weed seeds, mites, insects, nematodes, etc., and generally recommended for fumigation of agricultural commodities as a quarantine measure at the port of entry and/or export (Anon, 1978; Eppo, 1974 and Pauline, undated). It is also effective against many soil borne plant pathogens, especially fungi, when the soils are treated under air tight conditions (Cronin, 1958; Gandy et al, 1976 and Zentmyer et al, 1949).

Zuñiga (1968) observed fungal growth in several opened seed coconuts and attributed reduction in percentage of germination to fungi presence. Many fungi harbouring in seed coconuts in various countries have also been reported (Joseph et al, 1979). *Leiosphaerella longispora,* a fungus earlier reported to be associated with lesions on collapsed fronds (Sivanesan et al, 1976) was also found on seed coconuts (Raju and Reddy, 1983). Though MeBr fumigation (at 2–3 lbs/1000 ft^3/2–3 hr) with or without a fungicidal dip is recommended as a quarantine treatment while exchanging coconut germplasm among countries (Pauline, undated), the exact effect of this treatment on the mycoflora of seed nuts is not known. This study was undertaken to find the effect of MeBr fumigation on the fungi associated with seed coconuts.

MATERIALS AND METHODS

Fumigation with methyl bromide (98% MeBr + 2% chloropicrin) in air tight chambers was conducted at the Plant Quarantine and Fumigation Station, Cochin. Two experiments were carried out to study the effect of MeBr fumigation on the fungi associated with seed coconuts.

In the first experiment, four fungi (viz. *Botryodiplodia theobromae* Pat., *Pestalotia palmarum* Cooke, *Phoma* sp. and *Thielaviopsis basicola* (Berk & Br.) Ferr. frequently associated with seed coconuts, were cultured, and with agar bits, were implanted into the husk of mature coconuts in holes made with cork borers. The cut husk was replaced and the surface was sealed with wax to prevent any direct exposure of the fungi to the gas. Five such seed nuts were used for each treatment.

The inoculated nuts were fumigated with MeBr at three concentrations and four exposure timings (40 g/m^3/5.0 hr, 80 g/m^3/2.5 and 5.0 hr and 160 g/m^3/2.5 hr), which did not affect the germination of seed coconuts. After fumigation, the fungal cultures were removed and transferred to fresh potato dextrose agar (PDA) to study the viability of each fungus. Observations on presence/absence of fresh growth were recorded 72 hr after subculturing. The experiment was repeated by chopping the husk on the top and bottom portions of the seed nuts to facilitate better penetration of the gas.

In the second experiment, all the abovementioned cultures on PDA slants were exposed directly to MeBr fumigation at the different concentrations and exposure timings used in the first experiment. After fumigation, survival of the cultures was tested by transferring small bits to fresh PDA plates. Presence or absence of fresh fungal growth was recorded. No attempt was made to test for survival of

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mycelium and spores separately. During the course of the experiment, the temperature of the fumigation chamber varied from 27 to 30 C.

RESULTS AND DISCUSSION

Observations on the presence or absence of fresh growth of different fungi on sub-culturing under different treatments are presented in Table 1.

Table 1.

Survival of fungi associated with seed coconuts after fumigation with methyl bromide (MeBr).

FUNGI	DIRECT EXPOSURE				IMPLANTED INTO THE HUSK			
	1	2	3	4	1	2	3	4
Botrydiplodia theobromae	+	+	+	+	+	+	+	+
Pestalotia palmarum	+	+	+	+	+	+	+	+
Phoma sp.	+	+	+	+	+	+	+	+
Thielaviopsis Basicola	+	+	+	+	+	+	+	(+)

+ Presence of fresh growth on sub-culturing.
(+) 2 out of 5 replications in one set did not show fresh growth

[1] 40 g/m^3/5.0 hr

[2] 80 g/m^3/2.5 hr

[3] 80 g/m^3/5.0 hr

[4] 160 g/m^3/2.5 hr

All the four fungi implanted into seed coconuts and fumigated at different concentrations and exposure timings grew well upon transfer to fresh medium, indicating that none of the fungi is sensitive to MeBr fumigation at the concentrations/exposure timings tested. There was no difference in colony diameter of the fungal growth under different treatments. In the case of *T. basicola*, two out of five replications of 180 gm concentration from the chopped nuts did not show presence of any fresh growth.

In direct exposure studies, all the four fungi on subculturing remained viable even after fumigation with MeBr at the concentrations and exposure timings mentioned earlier.

The results indicate that fumigation with MeBr at the specified concentrations and exposure timings, does not have any fungicidal action against the four fungi, either exposed directly or implanted in the seed coconuts. Higher concentrations and exposure timings reduced the germination percentage of seed coconuts.

Different fungi showed varying sensitivities to MeBr fumigation (Cronin, 1958; Gandy et al, 1976 and Zentmyer et al, 1949). The concentration x time products required to kill slow growing fungi were lower than those required for fast growing fungi (Gandy & Chanter, 1976). Dosages less than the specified were found to be unsatisfactory for control of some fungi in soils. Mai et al (1951) reported the ineffectiveness of MeBr against *Fusarium sambucinum* and *Corynebacterium sepadonicum* in *in vitro* studies.

Space fumigation with MeBr is a common practice in post-cropping disinfection of mushroom houses. Kohn (1962) reported that fumigation with MeBr at 4.12 lb/1000 ft^3(65.92 g/m^3) killed nematodes and mites, but many fungi survived fumigation. However, the duration of exposure time was not mentioned in his report. Gandy and Charter (1976), in their *in vitro* studies, tried two exposure timings of 18 and 36 hr, and specified the importance of exposure time, concentration of the gas and treatment temperature.

Eckert (1967) reported that chloropicrin and MeBr (halogenated hydrocarbons) are generally injurious to plant tissues at concentrations preventing decay. Carpenter and Gammon (1955) exposed *Gladiolus* corms and sclerotia of *Sclerotium rolfsii* simultaneously to fumigation with MeBr at rates of 3, 5, 7.5, 10, 15 and 20 lb/1000 ft^3/4 hr. While the germination of the corms was affected at concentration of 5 lb and above, the sclerotia of the fungus were affected only at 20 lb and not at lower concentrations.

SUMMARY

In the present study, under identical experimental procedure, it was observed that fumigation with MeBr at concentrations/exposure timings critical for seed coconuts was not sufficient to kill the fungi associated with seednuts. Hence, this suggests re-examination of the schedule of quarantine treatment in the export/import of seed coconuts, especially in view of the serious coconut diseases occurring in various countries.

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