IMPACT OF METHYL BROMIDE ON NEMATODE COMMUNITIES

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While the negative impact of methyl bromide on the atmosphere is widely known, and adverse effects to soil ecosystem are anticipated, little documentation has shown the magnitude of impact of methyl bromide on soil health. Some characteristics of a healthy soil include high biological diversity, high stability, ability to maintain the flow of nutrient cycling, suppression of soil pests and pathogens, and improvement of plant health. Nematodes have been promoted as good bioindicators for soil health. The objective of this study was to evaluate the impact of methyl bromide on nematode communities as an indicator for its effect on soil health.

Experiments were conducted at the University of Florida, Gulf Coast Research and Education Center, Bradenton, Florida. Soils were either not treated or fumigated with 400 lb/A of a mixture of 67% methyl bromide and 33% chloropicrin on 3 October 2001. Treatments were arranged in a randomized complete block design with 4 replications. All plots were covered with white plastic mulch until 1 November 2001, when mulches were removed, and soil was collected from each plot. Nematodes were extracted from a 100-cm^3 soil subsample using a modified sieving and centrifugal flotation procedure. All nematodes were identified to genus level and counted under an inverted microscope. Only data on each nematode trophic group as % of total nematodes, nematode richness (number of different genera per sample), diversity (Simpson, 1949), and maturity index (MI) were reported here. MI is an index developed to analyze nematode fauna based on the life strategies (colonizers and persisters) of nematodes in a c-p scale of 1 to 5 (Bongers, 1990), where c-p 1 is an excellent colonizer, and c-p 5 is a good persister.

At one month after treatment, methyl bromide increased % of bacterivores but reduced all other trophic groups significantly ($P \leq 0.05$; Table 1). Omnivores and predators were reduced to levels that were near or at an undetectable level (Table 1). Among genera in the bacterivorous group, only genera in Rhabditidae were increased in methyl bromide plots ($P \leq 0.05$), whereas other bacterivores with c-p scale of 2 were reduced by methyl bromide treatment ($P \leq 0.05$). Low fungivore to bacterivore ratio (F/B) and high maturity index (MI) in methyl bromide treated plots, indicate that the nematode community was dominated by bacterivores, an anticipated nematode community structure under highly disturbed conditions. Nematode richness was reduced tremendously followed by a reduction in diversity in plots treated with methyl bromide (Table 1). All of these indicators demonstrated that the soil food web became highly disturbed and unstable. The resulting community lacks predators that can prey on plant-parasitic nematodes and on grazers in the hierarchy in the nutrient cycling channels that can improve mineralization of soil nutrients after bacterivores and fungivores. The consequence of methyl bromide

treatments on nematode communities appears to be an indicator of a poor soil health. Further studies are investigation on the ability of damaged nematode communities to recover over time.

Table 1. Effects of methyl bromide treatment on nematode community indices in Bradenton, FL.

Index	Control	Methyl bromide
% bacterivores	59.79[a]	90.07 *[b]
% fungivores	15.28	20.36 *
% herbivores	20.36	1.62 **
% omnivores	1.03	0.05 ***
% predators	1.09	0 *
F/B[c]	0.28	0.05 *
Maturity index	1.97	1.11 **
Richness	24.00	8.00 **
Diversity [d]	10.13	2.42 **

[a] Means are average of 4 replications.
[b] Means followed by *, ** and *** indicate significant different between methyl bromide and the control treatment at $P \leq 0.05$, 0.01 and 0.001, respectively according to analysis of variance based on untransformed values or square root transformed $\sqrt{(x+0.5)}$ values (for % fungivores, % omnivores, and % predators).
[c] F = fungivores, B= bacterivores.
[d] Diversity is calculated by $1/\lambda$ where λ is Simpson index of dominance (Simpson, 1949).

Reference

Bongers, T. 1990. The maturity index: an ecological measure of environmental disturbance based on nematode species composition. Oecologia 83: 14-19.
Simpson, E.H. 1949. Measurement of diversity. Nature 163: 668.