BとCPVの混用によるマツカレハの防除

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SHORT COMMUNICATIONS

Control of *Dendrolimus spectabilis* with a Mixture of Cytoplasmic Polyhedrosis Virus and *Bacillus thuringiensis*[1]

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For control of the Pine Moth, *Dendrolimus spectabilis*, a cytoplasmic polyhedrosis virus (CPV) has been successfully used (KATAGIRI, 1969). As the CPV infection develops slowly and larval death does not begin to occur until 2 or more weeks after infection, rapid control of the pest by the CPV cannot be expected. The CPV is a very useful agent for long-term control, however, as mortality from the virus increases gradually and finally reaches a very high percentage level. Moreover, effectiveness of the virus depends largely on the pest population density and developmental stage (KOYAMA and KATAGIRI, 1967).

On the other hand, *Bacillus thuringiensis* kills the larvae in a few days (KATAGIRI and KUSHIDA, 1974). It also shows inhibitory effects on biting and stops feeding, resulting in good control for the short term.

To obtain an integrated effect in controlling the pest insect, these two agents were mixed and sprayed on a pine forest at the young larval stage. KRIEG (1971) reviewed the interactions between pathogens and mentioned some positive and some negative cases of interaction between viruses and *B. thruingiensis*, but no case of a combination of CPV and *B. thuringiensis* has yet been reported.

In the study, three concentrations of *B. thuringiensis* (Bactospèine; 2.5×10^7, 5×10^7, and 1×10^8 spores/ml), two concentrations of CPV (10^5 and 10^6 polyhedral inclusion bodies/ml) were prepared and handsprayed on the pine forests at Hachioji, Tokyo, at the rate of 400 l/ha. After spraying, three branches were chosen at random from each treated forest plot. Each branch was enclosed with cheese cloth. Fifty 4th-instar larvae, which had been reared indoors, were reared on each branch. For the unsprayed control plot, five branches were used. Mortality and the amount of feces were investigated at 1-week intervals.

Results are summarized in Tables 1 and 2. The CPV of 10^5/ml produced 13% mortality in 4 weeks after spraying. Death began at 2 weeks after spraying. That of 10^6/ml produced 68% mortality in the same period. On the other hand, *B. thuringiensis* of 10^8 spores/ml produced more than 66% mortality in a week and more than 85% in 4 weeks. That of 5×10^7 spores/ml also killed about 60% of the larvae in a week and a little more than 70% in 4 weeks. The mixture of both agents produced 60% mortality in a week and more than

Table 1. CUMULATIVE MORTALITY OF *D. spectabilis* AFTER SPRAYING OF *B. thuringiensis*, CPV, AND THE MIXTURE

Pathogen sprayed	Weeks after spraying			
	1	2	3	4
Unsprayed control	0.1±0.4%	0.3±0.6%	1.2±1.0%	1.4± 1.2%
B. thuringiensis				
2.5×10^7 sp[a]/ml	16.8±1.2	18.9±1.1	20.1±1.7	20.7± 2.0
5.0×10^7 sp/ml	58.6±3.6	65.4±2.1	69.8±4.6	71.4± 1.2
1.0×10^8 sp/ml	66.1±9.4	77.0±9.0	78.7±7.9	85.9±10.8
Mixture[b]	60.4±0.4	75.4±2.4	78.1±2.7	80.5± 2.7
CPV				
10^5 polyhedra/ml	0	0.2±0.7	5.0±2.1	13.0± 3.7
10^6 polyhedra/ml	0	4.0±3.3	25.9±1.7	68.1±11.3

[a] sp : spores.

[b] Mixture : 10^5 polyhedra and 5×10^7 spores/ml.

[1] Appl. Ent. Zool. **11** (4): 363—364 (1976)

Table 2. Weekly Change in Feces Weight after Spraying (g per Initial 100 Larvae)

Pathogen sprayed	Weeks after spraying			
	1	2	3	4
Unsprayed control	5.2±1.6 g	5.0±1.6 g	3.9±1.0 g	8.2±2.5 g
B. thuringiensis				
2.5×10^7 sp[a]/m*l*	2.2±0.7	5.6±2.8	3.5±1.6	10.1±5.2
5.0×10^7 sp/m*l*	0.9±0.6	2.0±1.5	1.0±0.6	2.5±2.6
1.0×10^8 sp/m*l*	0.7±0.3	1.0±0.8	1.0±1.0	1.0±0.8
Mixture[b]	1.2±0.3	2.0±0.4	1.2±0.5	1.6±0.4
CPV				
10^5 polyhedra/m*l*	7.1±2.5	5.4±2.2	3.8±1.5	6.7±4.3
10^6 polyhedra/m*l*	6.3±2.1	3.3±2.4	1.8±0.8	1.6±1.4

[a,b] See notes in Table 1.

80% in 4 weeks. The mortality from a mixture exceeds that from *B. thuringiensis* or CPV alone. Moreover, the mixture killed the larvae rapidly, mainly due to *B. thuringiensis*.

Feces weight was also decreased significantly in the *B. thuringiensis* and mixture plots. At CPV 10^5/ml plot, no reduction in feces weight was observed in 4 weeks, but at 10^6/ml plot a significant reduction was observed after 2 weeks. In the mixture plot, a sharp reduction in feces weight occurred immediately after treatment, and a continuous reduction due to increasing mortality was observed.

In conclusion, for short-term control of the caterpillars an integration of CPV and *B. thuringiensis* was found to be very effective.

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Mating Suppression of *Spodoptera litura* F. (Lepidoptera : Noctuidae) in Greenhouses by a Component of Its Sex Pheromone[1]

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The sex pheromone of *Spodoptera litura* F. has been identified as a mixture of (*Z,E*)-9, 11-tetradecadienyl acetate (compound A) and (*Z, E*)-9, 12-tetradecadienyl acetate (compound B) by Tamaki et al. (1973). The ratio of these components in the mixture was 9 : 1 when extracted from female abdominal tips. When a large quantity of either compound or the mixture in the ratio of 10 : 1 was evaporated, the mating of this species was strongly suppressed under field conditions (Yushima et al., 1975).

The present experiment was designed to investigate the effect of a single component of the sex pheromone on the mating of *S. litura* in green houses.

The experiment schedule for 1973—1976 and summarized results are shown in Table 1. In each experiment, a definite number of tethered females (Oyama, 1974) and the test compounds

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