

CHEMICAL CONTROL OF XANTHOMONAS CAMPESTRIS PV. VESICATORIA IN INOCULATED PEPPER FIELDS IN ISRAEL

M. Azaizeh and Y. Bashan \*

Department of Plant Pathology and Microbiology, The Hebrew University of Jerusalem, Rehovot, Israel.

**Key words:** Pepper, *Capsicum annuum*, Bacterial scab of pepper, *Xanthomonas campestris* pv. *vesicatoria*, Chemical control

Introduction

Bacterial scab (leaf spot) of pepper is an important pepper disease in Israel; damage to pepper crop may reach up to 44% of the yield (1). For the last 3 decades spraying leaves with copper compounds was used as a means of reducing the population of the pathogenic bacteria and delaying its spread. However, similarly to other bacterial diseases (3) only a partial control has been obtained. The purpose of this study was to test different products of copper compounds and fungicides and to find an optimum spraying schedule for controlling of bacterial scab of pepper in the field.

Methods

Pepper plants cvs. "Ma'or" and "Zahov-Naharia" were planted in Brown alluvial soils and Terra rosa soils in the Yizreel Valley. Experiments were carried out in a randomized block design with five replicates. Each plot consisted of 90 plants in 3 rows, 10 m each (3 plants/m, 60 cm between rows). The field was sprinkle irrigated once a week with 15 mm water. The following chemical products were applied as foliar sprays weekly (350 l/ha) using "Lehavot" sprayer: (a) bacteriocides - Copric hydroxide (Kocide 101, 77% a.i.; Kocide Chem. Corp. Houston, Texas); Copper oxychloride (Coprox 50, 87% a.i.; Machteshim, Beer Sheba); 0.5% CuSO<sub>4</sub> + 0.1% Biofilm surfactant, Chemtixon, Haifa; Bordeaux mixture, 3.6g CuSO<sub>4</sub> in 30 ml H<sub>2</sub>O + 3.6g Ca(OH)<sub>2</sub> in 365 ml H<sub>2</sub>O; (b) fungicides - Mancozeb (Manzidan w.p., 80% a.i.; Machteshim, Beer Sheba); Captan (Marpan, 50% a.i.; Machteshim, Beer Sheba); Maneb (Manebgan, 50% a.i.; Agan, Ashdod). Inoculum preparation, inoculation of plants, rate of diseases development and assessment of disease index (D.I.) were as previously described (2). The D.I. categories were 0=not diseased, 3=more than 10 spots per leaf counted on the upper 4 mature leaves of each plant.

Results and Discussion

Most of the bacteriocides and fungicides tested decreased the disease development in the field (Table 1) as compared with untreated controls. When copric hydroxide was tested under partial mist conditions (5 s mist every 30 min) at 540, 810, 1350 and 1620 g/ha the D.I. was 0.54, 0.33, 0.24 and 0.21, respectively, as compared with D.I. of 1.48 of untreated plants. In addition, copric hydroxide was the most efficient compound in the field. Copric hydroxide (at concentrations of 1080-1620 g/ha was phytotoxic to young plants (up to 6 true leaves) [data not shown]. Application of copric hydroxide as close to infection or irrigation time with subsequent weekly sprayings caused the most efficient disease arrestment as compared with treatments at symptom appearance or non-treated inoculated plants (Table 2). Based on the current work, it seems that weekly sprayings with copric hydroxide will give the most beneficial results. Since copper treatments are expensive and pepper plants become more resistant after flowering (2) there is no need for further spraying after this stage. It is concluded that only by using a carefully planned spraying schedule, mainly with copric hydroxide or copper oxychloride bacterial scab epidemics can be delayed.

\* Present address: Department of Plant Genetics, The Weizmann Institute of Science, Rehovot 76 100, Israel.

Table 1: Chemical control of bacterial scab in the field by weekly spraying of various bacteriocides and fungicides.

Products	a.i. conc. (g/ha)	Disease Index			
		Autumn 1981		Spring 1982	
		D.I. after 47 days	D.I. increase 14 days later	D.I. after 67 days	D.I. increase 14 days later
Copric	540	-	-	2.20b	0.61
hydroxide	810	-	-	1.42bc	0.51
	1080	-	-	1.93b	0.55
	1350	0.82b*	0.29	1.34c	0.49
	1620	-	-	1.41bc	0.35
Copper	915	-	-	2.05b	0.59
oxychloride	1525	1.40b	0.43	1.5bc	0.37
Captan	1750	1.54b	0.68	-	-
Maneb	2625	1.90ab	0.98	-	-
CuSO <sub>4</sub>					
+ surfactant	1750	1.48b	0.55	-	-
Bordeaux					
mixture	1750	1.40b	0.39	-	-
Mancozeb	4200	1.95ab	0.79	-	-
Untreated	-	2.85a	1.11	3.0a	1.27

\* Numbers followed by different letters in the same column differ significantly at P=0.05.

Table 2: Control of bacterial scab of peppers with weekly spraying with copric hydroxide at different intervals after inoculation (1350 g/ha/spray).

Time of spraying	No. of sprayings	Diseases index*	D.I. increase 20 days later**
Autumn 1981			
Immediately after inoculation	7	0.74c**	0.15
At symptom appearance	4	2.31b	0.57***
Inoculated only	-	3.00a	0.13
Spring 1982			
A day before inoculation	7	1.17c	0.33
Immediately after inoculation	6	1.34c	0.49
At symptom appearance	4	2.06b	0.93
After irrigation	6	1.44c	0.58
Inoculated only	-	3.00a	1.23

\* Scale 0-3; \*\* Numbers followed by different letters (at each season separately) differ significantly at P=0.05;

\*\*\* Disease reached maximum level 7 days after first indexing.

#### References

1. Azaizeh, M., Bashan, Y. & Okon, Y. (1983). *Phytoparasitica* 11, 204 (Abstr.)
2. Diab, S., Bashan, Y. & Okon, Y. (1982). *Phytoparasitica* 10, 183-191.
3. Yunis, H., Bashan, Y., Okon, Y. & Henis, Y. (1980). *Plant Disease* 64, 937-939.

#### Acknowledgements

We thank Professor Y. Okon and Mr. Y. Avivi for criticism of the manuscript. This study was supported by grant No. 823/026 from the Ministry of Agriculture, Israel and by grant No. I-214-80 from the United States Israel Agricultural Research and Development Fund (BARD).