

## THE INFLUENCE OF CERTAIN INSECTICIDES ON THE EFFICACY OF SOME FUNGICIDES AGAINST BLACK ROT DISEASE ON COTTON

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### Abstract

*Alternaria* spp., *Fusarium* spp. and *Helminthosporium* spp. were found to be the essential fungi causing black rot on cotton plant. Under laboratory conditions, it had been found that *Alternaria* spp. had high tolerance to fungicides namely propineb, cuproxate, mancozeb, metalaxyl-mancozeb and s-haris more than the other two fungi. *Alternaria* spp. was chosen as an experimental fungus. The effects of metalaxyl-mancozeb and propineb on the fungus were the best, followed by mancozeb and s-haris, while cuproxate failed to inhibit the spore germination at the field recommended rate (FRR). Insecticides; cyfluthrin, profenofos, cypermethrin, deltamethrin, methomyl-dimilin, chlorpyrifos, tiodicarb, fenpropathrin and fenvalerate, had no/or neglected effect on the fungus *Alternaria* spp. on the basis of  $LC_{50}$  values. Mixing these insecticides with the above fungicides gave best results in case of mancozeb, s.haris and metalaxyl-mancozeb, respectively, while in case of propineb the efficiency was reduced.

### INTRODUCTION

Cotton plants are attacked with certain fungi which cover the leaves with a black layer causing black rot disease. Heavy infection gives the field the appearance of being covered with a dust. Fungi also attack cotton bolls and prevent boll opening which may result in quantitative and qualitative reduction of the crop. At the same time, leaves and bolls of cotton are attacked with worms.

Both fungi and insect must be controlled by using certain fungicides and insecticides at the same time. It is better to obtain best control for fungi and insects in one application, minimizing time, money and effort. Ibrahim *et al.* (1976) reported that combination of dithane  $m_{45}$  with the insecticides endosulfan or fenthion were effective in controlling powdery mildew, leaf blight (*Alternaria sesami*), *Aphis gossypii* and *Asphondylia sesami*. Atia (1996) found that mixing fungicides karathane, rubigan, afugan or bayleton with the insecticide actellic, increased their efficacy against powdery mildew of cucumber, except bayleton. On the other hand, the effect of combination of certain insecticides with fungicides on the biological activity of insecticides indicated

that fungicides antracol, ridomil-mancozeb, s.haris and dithane m<sub>45</sub> were considered as only additive effect when mixed with the tested insecticides, except in case of antracol/sumicidin, s.haris/curacron and dennate, and dithane m<sub>45</sub>/curacron, dennate and larvin where antagonistic effect was evident (Shaaban 1993).

The objective of the present investigation was to determine the effect of certain insecticides on the efficacy of tested fungicides used to control black rot disease of cotton.

## MATERIALS AND METHODS

**Isolation and identification of fungi:** Cotton leaves were collected from infected fields in Behera and Sharkia Governorates. Fungi on leaves were isolated, purified and identified.

**Fungicides used:** According to the isolated fungi, five fungicides were chosen. Serial concentrations for each fungicide were prepared in water at ppm according to the active ingredient (a.i.) as follows:-

Antracol (propineb) 70% WP at 10, 15, 25, 50 and 100, caproxate (tribasic copper sulfate) 19% FL at 75, 150, 300, 600, 1200, dithane m<sub>45</sub> (mancozeb) 80% WP at 10, 25, 50, 100 and 200, ridomil-mancozeb (8% metalaxyl + 64% mancozeb) WP at 5, 10, 15, 25 and 50, and s-haris (22% sulfur + 2.2% tri-basic copper sulfate + 9% zineb) at 100, 150, 200, 250, and 500. The fungicides were tested against fungi. LD<sub>50</sub> was calculated for each fungus (Finney 1971).

**Insecticides used:** Nine insecticides were chosen from the recommended compounds which are used to control leafworm, *Spodoptra littoralis* as well as bollworms *Pectinophora gossypiella* and *Earias insulana*. Insecticides and their field recommended rates (FRR) per 400 liters water were : baythroid (cyfluthrin) 5% EC at 750 ml, curacron (profenofos) 72% EC at 750 ml, cymbush (cypermethrin) 10% EC at 600 ml, dec-is (deltamethrin) 2.5% EC at 750 ml, dennate (27% methomyl + 4% dimilin) FL at 1000 ml, dursban (chlorpyrifos) 48% EC at 1000 ml, larvin (thiodicarb) 80% DF at 500 gm, meothrin (fenpropathrin) 20% EC at 750 ml and sumicidin (fenvalerate) 20% EC at 600 ml. Three concentrations, one, half and quarter of the FRR of each insecticide were prepared in suitable amounts of water to evaluate their effect on the spore germination of the selected fungus. LC<sub>50</sub> was calculated for each insecticide as mentioned before.

**The mixtures of fungicides and insecticides:** Three concentrations of each fungicide were mixed with the FRR of each insecticide and tested against the selected fungus. The effect of insecticides on the efficacy of each fungicide were estimated by calculating the differences between the inhibition percentages of the fungal spore germination in case of fungicide alone and in the mixture.

Spore germination technique was used in all of the above experiments (Horsfall 1956).

## RESULTS AND DISCUSSION

**Isolation and identification of fungi:** Identification of the pure cultures of fungi obtained from the infected cotton leaves showed that the dominated fungi were *Alternaria* spp., *Fusarium* spp. and *Helminthosporium* spp. They were repeated in numeral cultures. This result indicated that the three fungi were the essential organisms for causing black rot disease on cotton plant. A sample from each fungus was taken as a test organism to determine the efficacy of tested fungicides.

**Effect of fungicides:**  $LC_{50}$  was calculated for each fungicide to obtain a standard measure for comparison. It is shown that *Fusarium* spp. failed to germinate on any concentration used for all compounds, while *Helminthosporium* spp. succeeded to give limited germination at the presence of cuproxate and s-haris. On the other hand *Alternaria* spp. has a high tolerance to the tested compounds in comparison with the other two fungi, Table 1.

Table 1. The  $LC_{50}$  of the tested fungicides.

Fungicides	$LC_{50}$ (in ppm) against the fungi		
	<i>Alternaria</i> spp.	<i>Helminthosporium</i> spp.	<i>Fusarium</i> spp.
Antracol	29.17	8	-
Cuproxate	654.90	56.30	-
Dithane M45	43.80	-	-
Ridomil MZ	12.00	-	-
S-Haris	378.00	103.00	-

According to these results, *Alternaria* spp. was taken as an experimental fungus in the next experiments.

Data in Table 2 indicated that ridomil-mancozeb and antracol proved to be the most effective compounds against *Alternaria* spp. either at LC<sub>50</sub> or at their concentrations which completely inhibited the spores germination, followed by dithane m<sub>45</sub> which gave better results. This is in agreement with many other reports in the literatures by Fadl et al (1987), Sinha and Prasad (1991), Choulwar and Datar (1992) and Abd El-Gawad (1997). On the other hand, cuproxate failed to inhibit the spore germination of *Alternaria* spp. at FRR *in vitro*, for that, it was discarded from the next experiments. Reasonable control was obtained by S-haris.

Table 2. Effect of tested fungicides on *Alternaria* spp.

Fungicides	FRR (ppm) a.i.	LC <sub>50</sub> (ppm)	Conc. Completely inhibited spore germination (ppm)
Antracol	2100	29.17	50
Cuproxate	750	654.90	1200
Dithane M45	200	43.80	200
Ridomil MZ	1800	12.00	50
S-Haris	930	378.00	500

**Fungicidal activity of insecticides:** On the basis of LD<sub>50</sub> values tested insecticides had no effect on the fungus *Alternaria* spp. except decis, Dursban and sumicidin which had limited effect.

The LC<sub>50</sub> of all of them were near or more than the field recommended concentrations, Table 3. This results gave an indication that when fungicides and insecticides were mixed, the effect of the mixture was not due to the insecticide alone, but there are another reasons caused increase or decrease the efficacy of fungicide due to the addition of insecticide.

Table 3. LC<sub>50</sub> of tested insecticides on *Alternaria* spp.

Insecticides	FRR (ppm)	LC <sub>50</sub> (ppm)
Baythroid	93.75	102.33
Curacron	1350.00	3195.25
Cymbuch	150.00	363.08
Decis	46.88	33.11
Dennate	775.00	2382.11
Dursban	1200.00	870.96
Larvin	1250.00	1364.77
Meothrin	375.00	338.84
Sumicidin	300.00	199.53

$$\text{FRR (PPM)} = \frac{\text{Amount of formulated compound in ml or g/feddan} \times \% \text{ of a.i.} \times 1000}{\text{volume of used water L/feddan}}$$

**Fungicidal activity of fungicides / insecticides mixtures:** Data in Tables 4 & 5 indicated that when fungicides were mixed with insecticides different results were obtained. The efficacy of dithane m<sub>45</sub> was raised at concentrations 25 and 50 ppm remarkably by mixing with all insecticides used (100% inhibition of the germination of spore). The same result was obtained in case of s-haris at the concentrations 200 and 250 ppm. The efficacy of ridomil-mancozeb was improved when it was mixed with insecticides especially at 25 ppm, while at the concentration 15 ppm, results differed from mixture to other. The high concentrations of the three above fungicides which were very effective against the fungus, their mixtures with insecticides did not give any change in efficacy. These results are in general agreement with data obtained from studies of fungicides/insecticides combination by Ibraham *et al.* (1976), Shaaban (1993) and Atia (1996).

On the other hand, it is interesting to notice the highly reduction in the efficacy of the fungicide antracol by mixing with insecticides, in spite of its best control when it was used alone. This may be due to chemical or biological incompatibility. Therefore, antracol must be discarded when the tested insecticides would be used.

The explanation of all above results were mentioned by Dubois (1961). If two pesticides are applied on an insect, it is assumed that one may interfere with the activation of the other, or with its detoxication reduction, or with both reactions. Antagonism would occur in the first case, synergism in the second, and additive effect in the third, depending on the degree of interference with the different reactions.

Results of the present work indicate that fungicides and insecticides can be mixed together and applied to control more than one pest in one application. Moreover, the laboratory results indicate that there is a probability to reduce the fungicides application rate when mixed with insecticides. Therefore, further researches are needed to determine the suitable pesticides which can be used in combination and available to apply.

Table 4. Inhibition percentages of spore germination of *Alternaria* spp. by tested mixtures of insecticides at FRR, and fungicides in ppm.

Fungicides (ppm)	Inhibition percentages of spores germination														
	Antracol			Dithane M45			Ridomil-Mancozeb			S-Haris					
	15	25	50	25	50	100	15	25	50	200	250	500			
Insecticides	71.50	87.25	100.0	30.75	53.75	88.25	54.50	81.00	100.0	25.25	44.50	100.0			
Baythroid	31.75	42.75	53.50	100.0	100.0	100.0	68.75	78.25	90.75	100.0	100.0	100.0			
Curacron	79.75	88.25	100.0	100.0	100.0	100.0	93.75	100.0	100.0	100.0	100.0	100.0			
Cymbuch	23.25	47.25	79.50	100.0	100.0	100.0	85.00	100.0	100.0	100.0	100.0	100.0			
Decis	86.25	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0			
Dennate	26.25	43.25	72.25	100.0	100.0	100.0	100.0	100.0	100.0	72.00	98.00	100.0			
Dursban	44.75	76.25	83.75	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0			
Larvin	33.75	58.75	57.50	100.0	100.0	100.0	100.0	100.0	100.0	92.00	100.0	100.0			
Meothrin	50.00	62.00	80.00	100.0	100.0	100.0	65.00	81.50	100.0	100.0	100.0	100.0			
Sumicidin	62.50	75.00	76.65	100.0	100.0	100.0	76.75	84.75	100.0	92.75	100.0	100.0			

Table 5. Percentages of increase or decrease the efficiency of fungicides by mixing with insecticides.

Fungicides (ppm)	Percentage of increase or decrease the efficacy														
	Antracol			Dithane M45			Ridomil-Mancozeb			S-Haris					
	15	25	50	25	50	100	15	25	50	200	250	500			
Insecticides	71.50	87.25	100.0	30.75	53.75	88.25	54.50	81.00	100.0	25.25	44.50	100.0			
Baythroid	-93.75	-44.50	-46.50	+69.25	+46.25	+11.75	+14.25	-2.75	-9.25	+74.75	+55.50	0.00			
Curacron	+8.25	+1.00	0.00	+69.25	+46.25	+11.75	+39.25	+19.00	0.00	+74.75	+55.50	0.00			
Cymbuch	+48.25	-40.00	-20.50	+69.25	+46.25	+11.75	+30.50	+19.00	0.00	+74.75	+55.50	0.00			
Decis	+14.25	+12.75	0.00	+69.25	+46.25	+11.75	+45.50	+19.00	0.00	+74.75	+55.50	0.00			
Dennate	-45.25	-44.00	-27.75	+69.25	+46.25	+11.75	+45.50	+19.00	0.00	+46.75	+55.50	0.00			
Dursban	-26.75	-11.00	-16.25	+69.25	+46.25	+11.75	+45.50	+19.00	0.00	+74.75	+55.50	0.00			
Larvin	-37.75	-29.50	-42.50	+69.25	+46.25	+11.75	+45.50	+19.00	0.00	+74.75	+55.50	0.00			
Meothrin	-21.50	-25.25	-19.25	+69.25	+46.25	+11.75	+2.00	+19.00	0.00	+74.75	+55.50	0.00			
Sumicidin	-9.00	-12.25	-23.25	+69.25	+46.25	+11.75	+22.25	+19.00	0.00	+67.50	+55.50	0.00			

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## تأثير بعض المبيدات الحشرية على كفاءة بعض المبيدات الفطرية المستخدمة في مكافحة مرض العفن الأسود في القطن

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قسم بحوث المبيدات الفطرية والبكتيرية والنيماتودية - المعمل المركزي للمبيدات - مركز البحوث الزراعية - الدقى - الجيزة.

تصاب نباتات القطن بمرض العفن الأسود في نفس الوقت الذي تصاب فيه بديدان الورق وديدان اللوز وقد أجري هذا البحث - معمليا لدراسة تأثير المبيد الحشري علي كفاءة المبيد الفطري في خليط منهما، ومدى إمكانية مكافحة المرض والحشرة بهذا الخليط في عملية واحدة. تم عزل وتنقيه مجموعة من الفطريات من أوراق قطن مصابة بالمرض أحضرت من حقول قطن في محافظتى البحيرة والشرقية وكان نوع الترناريا، ونوع فيوزاريوم، ونوع هيلفمنشو سيوريم هي السائدة والمكررة في هذه العزلات.

أختبرت بعض المبيدات الفطرية المستخدمة ضد هذه الفطريات وجهز من كل مبيد سلسلة من التركيزات أجري اختبارها علي كل فطر، ثم حسب التركيز القاتل لـ ٥٠٪ من أعداد جراثيم كل فطر، ووجد أن أقل الفطريات تأثرا بهذه المبيدات كان فطر الترناريا، وبناء علي ذلك تم اختياره لاجراء التجارب التالية.

وقد رتب المبيدات الفطرية المستخدمة حسب تأثيرها علي فطر الترناريا تنازليا كالآتي : ريدوميل مانكوزيب، وانتراكل يليها دايتين م ٤٥ وحارس إس، بينما فشل كوبروكسات - بأعلي تركيز استخدم في المعمل (تركيز الحقل) في منع أنبات جراثيم الفطر، ولذلك استبعد هذا المبيد الفطري من تجارب الخلط.

أختبرت مجموعة من المبيدات الحشرية الموصي بها في مكافحة ديدان الورق وديدان اللوز : بايثرويد، كوراكرون، سيمبوش، ديسيس، دينيت، دورسيان، لارفن، ميوترين وسوميسيدين. وتم اختبار ثلاث تركيبات من كل مبيد (الحقلي، نصف وربعه) علي جراثيم فطر الترناريا ولوحظ عدم وجود تأثير لها أو تأثيرها محدود، وبناء علي ذلك استعملت تركيبات الحقل في تجارب الخلط.

استخدمت ٢ تركيبات من كل مبيد فطري بمفردها للمقارنة وفي خلاط - كل خليط به تركيز من المبيد الفطري وتركيز الحقل للمبيد الحشري، وأجري اختبارها علي جراثيم الفطر الترناريا ووجد الآتي:

ارتفعت كفاءة دايتين م ٤٥ بدرجة عالية في خلاط كل المبيدات الحشرية يليها ريدوميل مانكوزيب وحارس إس، بينما أنخفضت كفاءة انتراكل بدرجة كبيرة نتيجة الخلط.

تشير نتائج هذه الدراسة الي إمكانية خلط بعض المبيدات الفطرية مع بعض المبيدات الحشرية واستخدام الخليط في مكافحة مرض العفن الأسود في القطن وديدان الورق وديدان اللوز في عملية رش واحدة كما تعطي هذه النتائج مؤشرا بتخفيض معدلات استخدام المبيدات الفطرية مع الحصول علي نتائج مكافحة مرضية للمرض.