

THE RELATIONSHIP BETWEEN THE INCIDENCE OF BACTERIAL SPOT DISEASE OF PEPPER AND SOME ENVIRONMENTAL FACTORS

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ABSTRACT

Bacterial spot caused by *Xanthomonas campestris* pv. *vesicatoria* is an important bacterial diseases of pepper and tomato. The present work was planned to record the disease incidence under protected agriculture and open field conditions in different localities of Nile Delta. Also to study the relationship between environmental factors (average daily temperature and relative humidity) and disease severity. The results showed that the open fields were free from the disease during the growing seasons of 2007-2009. Under the protected agriculture conditions, the disease was shown in all surveyed localities. The highest disease severity was recorded in El-Khatatba, El-Fayoum and El-Salhia regions, while it was moderately shown at El-Bosaily; Gazera-El-Dhab, Kha and El-Giza region. However, the disease severity on pepper increased with increasing the average of daily temperature and relative humidity. The disease was sever in the growing seasons 2007-2008 and less in 2008-2009 seasons and this phenomena probably due to the change in the climate between the two different seasons.

Keywords: Pepper, Bacterial spot, *Xanthomonas campestris* pv. *vesicatoria*, protected agriculture, Environment.

INTRODUCTION

Bacterial spot disease of pepper and tomato caused by the bacterium *Xanthomonas campestris* pv. *vesicatoria* causes significant losses when warm temperatures and rainy weather occur (Jones *et al.*, 1991). The disease was recorded worldwide on pepper and tomato. (Bouzar *et al.*, 1994). The disease was observed in several tomato and/or pepper cultivated areas in Egypt (Abd El-Ghafar and Abd El-Wahab, 2001; Abd El-Ghafar and Mosa, 2001 and El-Meneisy, 2005). The spread of disease may spread in several localities in Egypt, may due to cultivation of different hybrids and cultivars of pepper and/or tomato seeds imported from a number of foreign countries. This disease is known to be seed borne and could be epidemics on pepper and/or tomato plants. Meanwhile, high relative humidity and warm temperature are favoured the development of this disease, on plants grown under plastic sheets (Abd El-Ghafar and Abd El-Whab, 2001).

Growing vegetables under protected cultivation in Egypt is expanding rapidly in formes of low tunnels and single Span plastic houses. It was observed by Medany *et al.*, 2009 that the difference in both temperature and relative humidity between the protected Agriculture and open fields ones reach 5°C and 25% RH.

The present work was carried out to study disease incidence in different localities of Nile Delta, under protected agriculture and open field conditions and to record the relationship between environmental factors (temperature and relative humidity) and severity of bacterial spot disease on pepper plants.

MATERIALS AND METHODS

1. Disease incidence (DI):-

Severity of bacterial spot disease of pepper was recorded in seven localities i.e. El-Bosaily; El-Fayoum, El-Giza; El-Khatatba, El-Salhia, Gazara-El-Dahab and Kaha in three successive growing season 2007, 2008 and 2009, covering two periods /season. The first period was from November to February, under plastic house conditions and the second period was from June to September, under open field conditions. Four plastic houses or five square (10x10m.) / Feddan of open fields were used in this investigation. Approximately 250 plants were growing in the plastic house (50 plants/row) or in each square to assess disease incidence and severity. Disease severity was assessed based on the disease rating scale from 0 to 5 as described by Mc Carter (1992).

2. Enviromental factors and disease severity:-

2.1. Meletological data:-

These experiments were carried out in Kaha and El-Khatatba regions, for two successive seasons 2007-2008 and 2008-2009, through the period from November to April. Average temperature and relative humidity were daily recorded for 15 days using hygrothermograph instrument belongs to the Central Laboratory for Agricultural Climate, Ministry of Agriculture, Giza, Egypt.

2.2. Disease assessment:-

Disease incidence was recorded ones each 15 days throughout the period of study. Disease incidence was recorded according to the the following:(a) Average total lesions number per leaf, where three leaves were randomly selected from each plant and (b) Disease index (%) according to the disease rating scale from 0 to 5, where 0= no disease, 1= isolated lesions but no defoliation and 5= numerous large and rapidly expanding lesions and severe defoliation (McCarter, 1992). Disease index (DI) was calculated by the following formula:

$$DI = \frac{\sum R.t}{5 \times N} \times 100$$

Where, t =number of plants with the same disease severity scale R (R = 0-5)
N = total number of inoculated plants

Data were statistically analyzed using the (F) test and the value of LSD (P 0.05) was calculated according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Disease incidence:-

During the growing seasons 2007, 2008 and 2009, the disease severity (DS) of the bacterial spot disease was significantly high on pepper plants grown under the protected condition and nil in the open fields.

In 2008 growing season DS recoded 14-33.3% while in 2007 it recorded 9.6-28.6%.

The highest DI was shown at El-Khatatba, El-Fayoum and El-Salhia regions, where it recorded 28.6 - 33.3; 23.3 - 29.3 and 23.0 - 26.8 %, respectively. The disease severity was moderately shown at El-Bosaily; Gazera-El-Dhab and Kaha regions, to record 16.8 – 20.5, 10.9 - 16.4 and 10.0 - 15.1 %, respectively. The disease severity was less severe at El-Giza region while it recorded 9.6 - 14.7 %, (Table, 1).

Table (1): Comparison study between severity of bacterial spot disease of pepper under protected agriculture (plastic house) and open field conditions, at different localities of Nile Delta, during growing seasons 200^Y-200^Λ.

Location	Disease Severity (%)				
	Plastic House (1)		Open Field (2)		
	200 ^Y -200 ^Λ	200 ^Λ -200 ^Δ	200 ^Y	200 ^Λ	200 ^Δ
El-Bosaily	16.8	20.5	0.0	0.0	0.0
El-Fayoum	23.3	29.3	0.0	0.0	0.0
El-Khatatba	28.6	33.3	0.0	0.0	0.0
El-Giza	9.6	14.7	0.0	0.0	0.0
El-Salhia	23.0	26.8	0.0	0.0	0.0
Gazirat El-Dahab	10.9	16.4	0.0	0.0	0.0
Kaha	10.0	15.1	0.0	0.0	0.0

LSD (5%)

Locality 1.4

Season 1.0

Interaction 1.8

(1) The period from November to February.

(2) The period from June to September.

Environmental factors and disease severity:

The effect of the temperature and relative humidity on the disease severity of bacterial spot disease of pepper was recorded in the two selected regions, under protected agriculture conditions. The disease was more severe at El-Khatatba region than Kaha region, to record ranges of 0.0 to 29.6 and 0.0 to 16.6 %, respectively. It was also found that the disease was more severe during the growing season 2006-2007 than in the growing season of 2007-2008, to record 0.0 to 29.6 and 0.0 to 22.7 %, respectively.

It is also found, severity of the disease increased by increasing both temperature and relative humidity. In El-Khatatba region, the disease increased from 13.5 to 29.6 % in the growing seasons of 2007, 2008 and from 9.5 to 22.7 % in the growing seasons of 2008 and 2009.

2007/2008

2008/2009

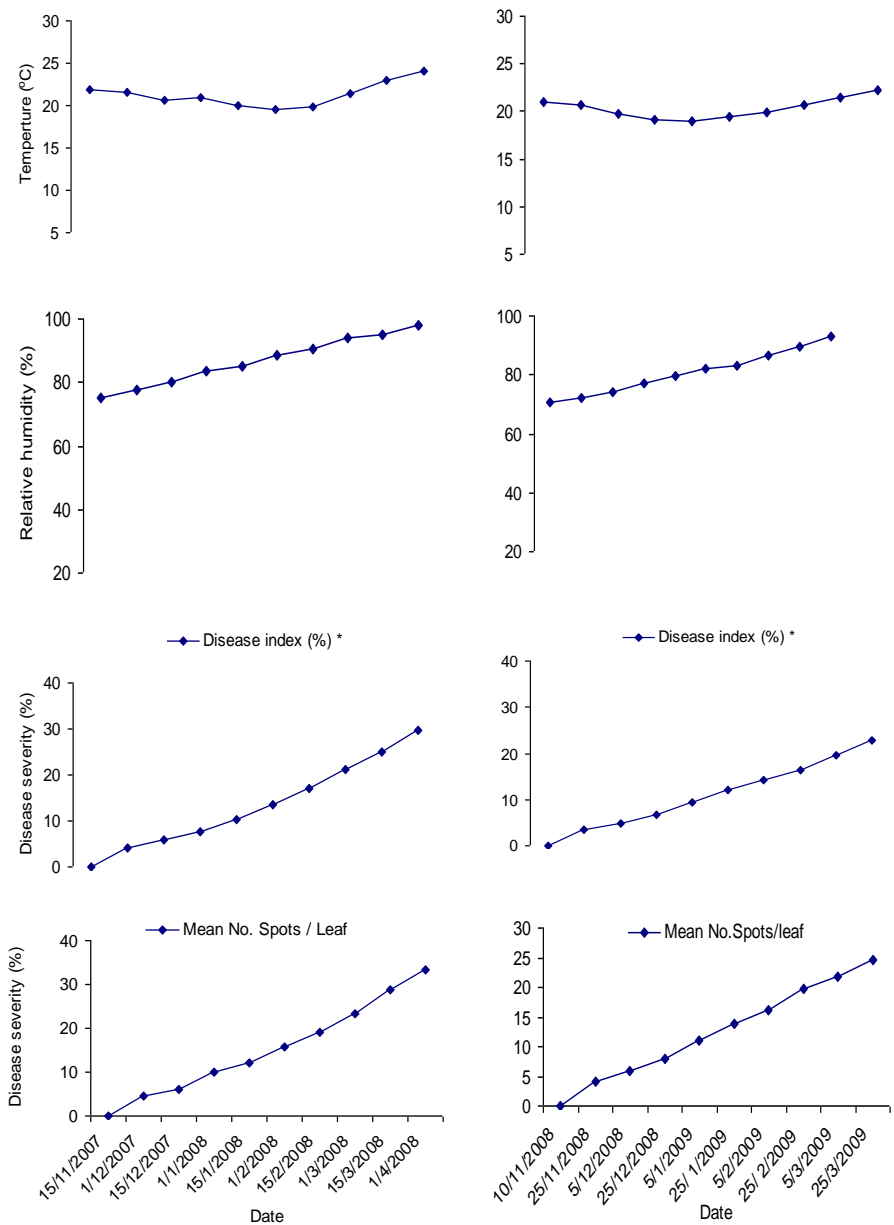


Fig (1): Influence of temperature and relative humidity on severity of bacterial spot disease of pepper, under protected agriculture conditions, at El-Khatatba region, during the period from November 2007 to April 2009.

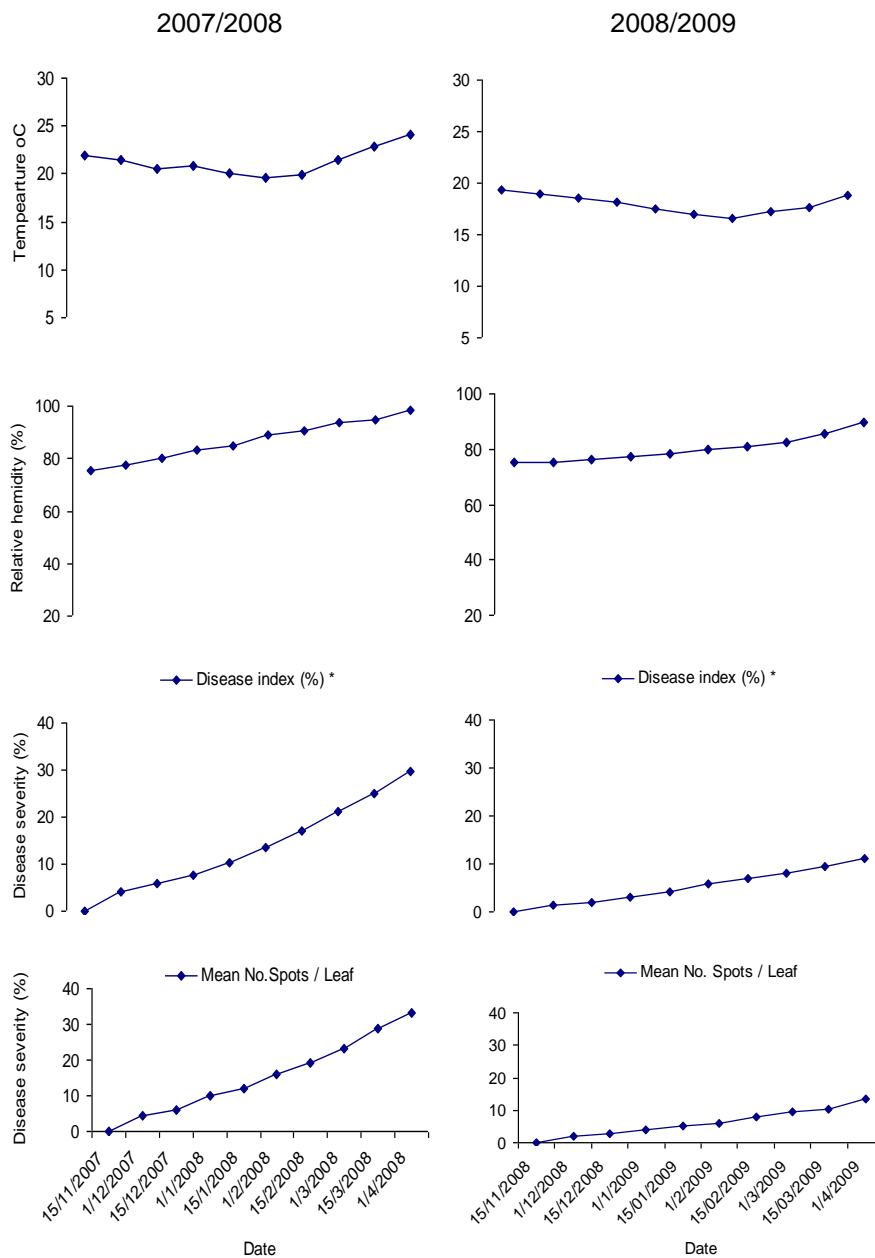


Fig. (2): Influence of average temperature and relative humidity on severity of bacterial spot disease of pepper, under protected agriculture conditions, at Kaha region, during the period from November 2007 to March 2009.

That may be due to the increase in climatic change while the temperature increased from 19.6 to 24.1 and from 19.0 to 22.3°C and the relative humidity increased from 88.8 to 98.2 and from 79.4 to 92.8 %, respectively. In Kaha region, the disease increased from 6.5 to 16.6 % in the growing seasons of 2007 and 2008 and from 6.9 to 11.2 % in the growing seasons of 2007 and 2008 or from 6.9 to 11.2 % for growing seasons 2007 and 2008. The temperature recorded increased from 17.6 to 20.5 and from 16.6 to 18.8 °C and relative humidity increased from 83.9 to 94.7 and from 80.9 to 89.7 %, respectively (Fig., 1 and 2).

Since air temperature is usually increased by 3.3 to 11.1 °C inside enclosed row covers at midday, depending on the type of tunnel and materials used (Sharma, 2006), the greenhouse condition including, high humidity and wind-free provides an ideal environment for the development of many foliar diseases (Bewley, 1923). The maximum disease incidence of the bacterial spot of tomato recorded approximately 58% in seedlings at a temperature ranged from 19.55-28.25°C while the relative humidity (RH) was 95%. There was a significant correlation between disease severity and RH. No disease incidence was observed during the summer months, and because there is a negative correlation between temperature and RH (Ravikumar and Khan, 2001), bacterial spot disease of pepper and tomato causes a significant loss, particularly in warm and humid environments (Ravnikar *et al.*, 2001). The environment presents an important medium for both survival and transmission of plant pathogenic bacteria (Agrios, 2005). Timmer *et al.* (1987) investigated the survival of compatible and incompatible pathovars of *X. Campestris* on leaves of tomato plants under a variety of conditions and found that humidity was playing as an important factor on the epiphytic survival of the bacterium.

The compatible pathovars of *X. campestris* were growing well on detached and attached leaves of tomato at high relative humidity (90-95%). The environment may affect the availability, growth stage, succulence and genetic susceptibility of the host cells as well as affecting the number and the activities of the pathogen. Moisture, temperature and human activities in terms of cultural practices are important in the development of plant disease epidemics. The effect of temperature on the development of particular disease depends on particular host-pathogen interaction. Moisture like temperature influences the initiation and development of infection of plant diseases (Sigeo, 1993 and Agrios, 2005).

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العلاقة بين حدوث مرض التبقة البكتيري في الفلفل وبعض العوامل البيئية

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لوحظ انتشار مرض التبقة البكتيري في الفلفل في مصر في الآونة الأخيرة وخاصة تحت ظروف الزراعة المحمية. وقد أجريت هذه الدراسة بغرض تحديد مدى انتشار هذا المرض تحت نظم الزراعة المختلفة في مصر وعلاقته ببعض الظروف البيئية (المتوسط اليومي لدرجة الحرارة والرطوبة النسبية). ومن أهم النتائج المتحصل عليها أن هذا المرض لم يسجل تحت ظروف الحقل المفتوح (خلال الفترة من يونيه حتى سبتمبر) خلال فترة الحصر في كل المناطق والمواسم الزراعية (٢٠٠٧- ٢٠٠٩)، بينما لوحظ وجود هذا المرض تحت ظروف الزراعة المحمية خلال العروة الخريفية (الفترة من نوفمبر حتى فبراير) في مناطق الحصر وخلال سنوات الدراسة. وقد كانت شدة المرض مرتفعة في مناطق الخطاطبة والفيوم والصالحية في حين انه ظهر بدرجة متوسطة في مناطق البوصيلي وقها وجزيرة الذهب وبدرجة منخفضة في منطقة الجيزة. ومن ناحية أخرى وجدت علاقة موجبة بين شدة المرض و المتوسط اليومي لدرجة الحرارة والرطوبة النسبية حيث ازدادت شدة المرض مع زيادة درجات الحرارة والرطوبة النسبية بالصوبة وكان المرض أكثر شدة في منطقة الخطاطبة عن منطقة قها وذلك خلال موسم ٢٠٠٧-٢٠٠٨ مقارنة بموسم ٢٠٠٨-٢٠٠٩، وقد عزى ذلك الى زيادة اختلاف العوامل البيئية في تلك المناطق في موسمي الزراعة.

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