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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 disease was not recorded under open field conditions the survey localities and in the growing seasons of 2007-2009. Under the protected agriculture conditions, the disease was recorded in all surveyed localities and in the above growing seasons. 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 and Kha) regions but it was not severely record at El-Giza region. However, the disease severity of bacterial spot disease of pepper increased with increasing the average of daily temperature and relative humidity. Also, the disease was more sever during growing season 2007-2008 than growing season 2008-2009، and that probably due to the changes in the climatic differences 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 in pepper and tomato production areas (Bouzar *et al.*, 1994). The disease was observed in several tomato and/or pepper production areas in Egypt (Abd El-Ghafar and Abd El-Wahab, 2001; Abd El-Ghafar and Mosa, 2001 and El-Meneisy, 2005). This disease may spread in several localities in Egypt, due to cultivation of different hybrids and cultivars of pepper and/or tomato seeds inspection from many foreign countries, where this disease is known to be seed borne and causes epidemics on pepper and/or tomato plants. Meanwhile, high relative humidity and warm temperature are favoured the development of this disease, when these plants grown under plastic sheet (Abd El-Ghafar and Abd El-Whab, 2001).

In the recent years, growing vegetables under protected cultivation in Egypt is expanding rapidly. The common types of protected in Egypt are the plastic low tunnels and the single Span plastic houses (El-Aidy, *et al* 2007).

Negligible differences were observed temperature between inside and outside of the screen-houses. Mean and maximum daily temperatures were 1 or 2-5^{o}C warmer inside than outside, respectively, while minimum temperatures were similar in both inside and outside. Plastic house maximum and minimum daily temperatures were 5 and 3 ^{o}C warmer than outside, respectively. There were negligible differences between relative humidity observed in the screen-houses and outside. Maximum and minimum daily relative humidity was up to 12 and 25% higher than outside, respectively (Medany *et al*., 2009).

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:-

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 different growing season during 2007-2008 to 2008-2009, at 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 randomly chosen and used as replicates. Approximately 250 plants were chosen randomly per plastic house (50 plants/row) or 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 calculated according to daily maximum and minimum temperature and relative humidity inside Pepper plastic house which recorded each 15 days, using hygrothermograph parameter which obtained from Central Laboratory for Agricultural Climate, ministry of Agriculture, Giza, Egypt.

2.2. Disease assessment:-

Disease incidence was recorded each 15 days through the period study on 250 plants/period (50 plants / row, where each plastic house containing five rows). Three plastic house/ locality were used as replicates through this study. Disease incidence was calculated as 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:

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

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:-

Severity of bacterial spot disease, at seven localities during three growing seasons 2007-2009 under open field conditions was recorded; the disease incidence was not recorded at any locality during this study. Under plastic house conditions, the disease was recorded in all tested localities. Bacterial spot disease of pepper severity observed during the period from November 2008 to April 2009 at a range from 14.7 to 33.3 %. During the period from November 2007 to April 2008 the disease incidence was moderate, with a range from 9.6 to 28.6 %. Meanwhile, the highest disease severity was recorded in El-Khatatba, El-Fayoum and El-Salhia regions, where disease severity was 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 Kha regions, at a range from 16.8 – 20.5, 10.9 - 16.4 and 10.0 - 15.1 %, respectively. The disease severity was less severe at El-Giza region, where 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 ٢٠٠٧-٢٠٠٩.

Location	Disease Severity (%)				
	Plastic House (1)		Open Field (2)		
	٢٠٠٧ -٢٠٠٨	٢٠٠٨ -٢٠٠٩	٢٠٠٧	٢٠٠٨	٢٠٠٩
El-Bosaily	16.8	20.5	0.0	0.0	0.0
El-Fayoum	23.3	٢٩.٣	0.0	0.0	0.0
El-Khatatba	28.6	33.3	0.0	0.0	0.0
El-Giza	9.6	١4.7	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) During the period from November to February.
(2) During 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 ٠.٠ to ٢٩.٦ and 0.0 to 16.6 %, respectively. It was also found that the disease was more sever during the growing season 2006-2007 than in the growing season of 2007-2008, to record ٠.٠ to ٢٩.٦ and 0.0 to 22.7 %, respectively.

It is recorded also that, severity of bacterial spot disease of pepper 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 2008-2009 and 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 2007-2008 and from 6.9 to 11.2 % in the growing seasons of 2007-2008 or from 6.9 to 11.2 % for growing seasons 2007-2008, in which the temperature 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).

Air temperature is usually increased by 3.3 to 11.1 ºC 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 19.55-28.25ºC 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. Where there was negative correlations between the temperature and RH (Ravikumar and Khan, 2001). Bacterial spot disease of pepper and tomato causes significant loss, particularly in warm and humid environments (Ravnikar *et al.,* 2001). The environment presents a potentially important medium for both survival and transmission of plant pathogenic bacteria (Agrios, 2005). Mc Innes *et al.* (1988) found that the present of bacteria with aerosol can be detected using an air sampler in tomato fields (*X. campestris pv. vesicatoria* and *Pseudomonas syringae* pv. tomato). 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 recorded the humidity as the most important factor 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 as well as affecting a number and activities of the pathogen. Moisture, temperature and activities of the humans in terms of cultural practices are important environmental factors on the development of planet disease epidemics (Agrios, 2005). 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 (Sigee, 1993 and Agrios, 2005).

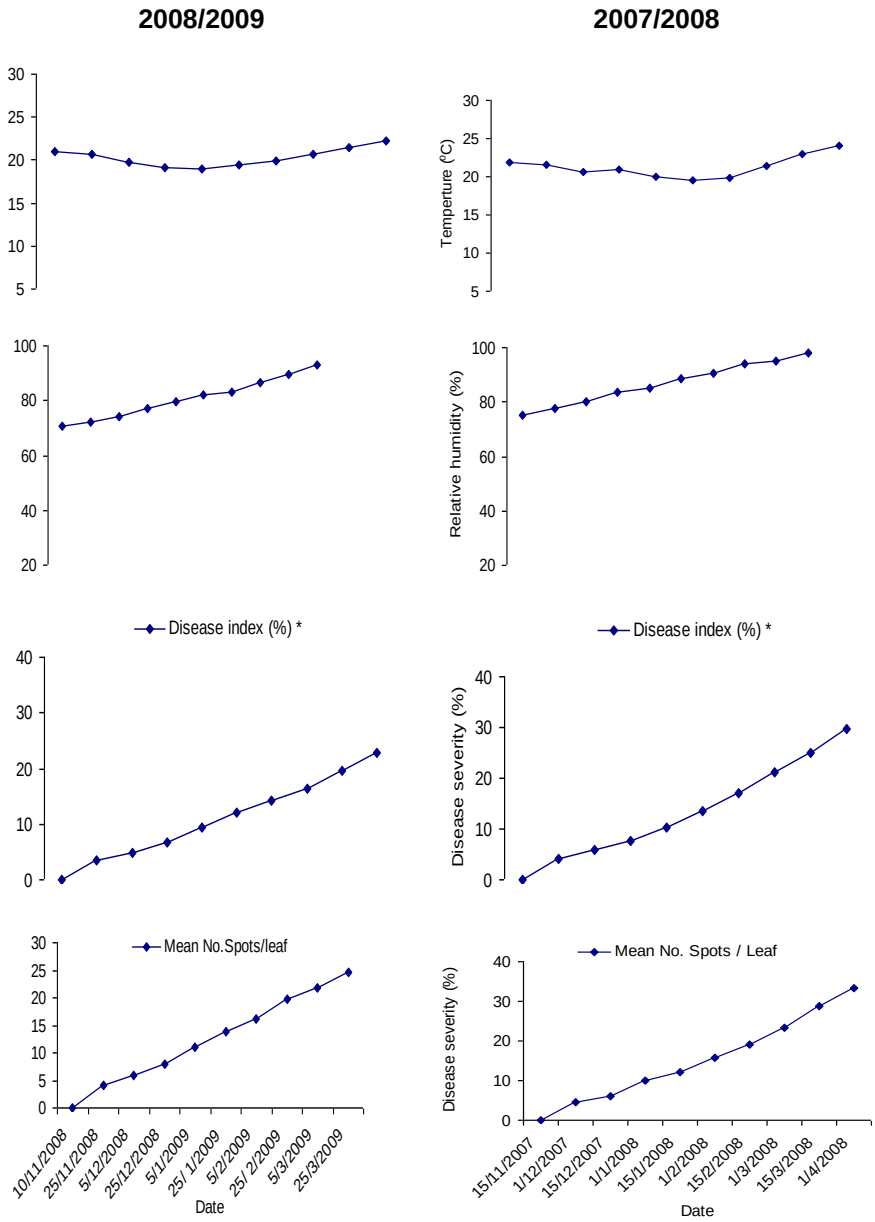

Fig (1):- Influence of temperature and relative humidity on severity of bacterial spot disease of pepper, under protected agriculture conditions, at El-Khatatba region, during the period from November 2007 to April 2009.

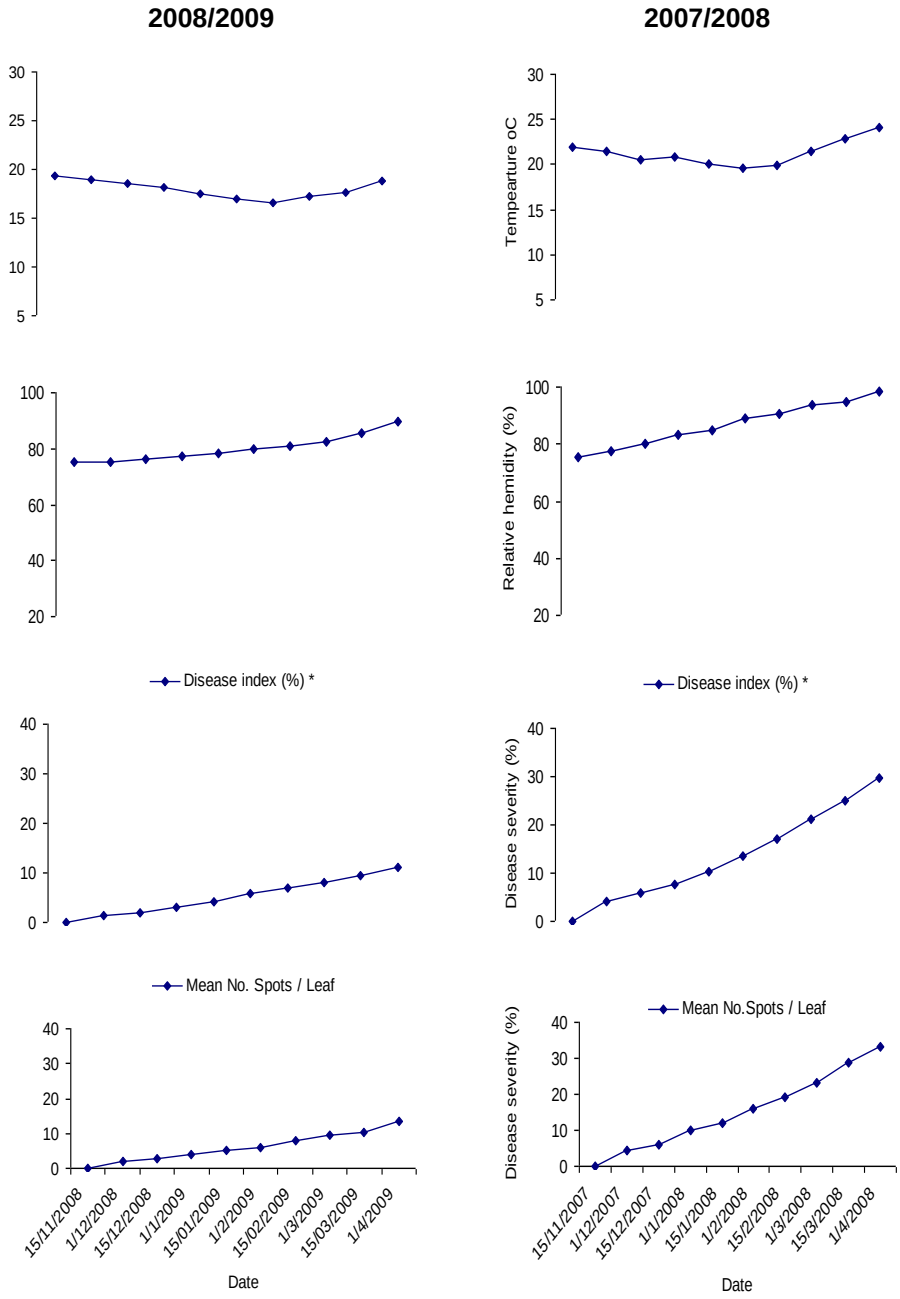

Fig. (2):- Influence of average temperature and relative humidity on severity of bacterial spot disease of pepper, under protected agriculture conditions, at Kaha region, during the period from November 2007 to March 2009.

REFERENCES

Abd El-Ghafar,N.Y. and H.M.A. El-Wahab (2001). Bacterial spot of tomato in Egypt and its control. Egypt. J. Appl. Sci., 16:13-29.

Abd El-Ghafar, N. Y. and A.A. Mosa, (2001). Integrated between biological and chemical treatment to control bacterial spot disease of tomato. Egypt . J. Phytopathol., 29:33-45.

Agrios, G.N. (2005). Environment effects on the development of infections plant disease. In: *plantpathology* (Agrios, G. N. ed), Elsevier Academic Press, London, pp.357-384.

Baker, K. F. and Linderman, R. G., (1979). Unique features of the pathology of ornament plants. Annu. Rev. Phytopathol. 17: 253 – 277.

Bewley, W. F., (1923). Diseases of glasshouse plants. Benn, London.

Bouzar, H.; J. B. Jones; R. E. Stall; N. C. Hodges; G.V. Minsavage; A. A. Benedict and A.A. Alvarez (1994). Physiological, chemical, serological and pathogenic analyses of a worldwide collection of *Xanthomonas campestris* pv*. vesicatoria* strains. Phytopathology 84:663-671.

El-Aidy, F.; A. N. El-Zawely; N. M. Hassan and M. El-Sawy (2007). Effect of plastic tunnel size on production of cucumber in delta of Egypt. Appled Ecology and Environmental Research 5: 11 – 24.

El-Meneisy,A.Z.A. (2005). Studies on foliar bacterial diseases of tomato. M.SC. Theises, Fac. Agric. Ain Shams University Cairo, Egypt, 132 p.

Jones, J. B.; J. P. Jones; R. E. Stall and T. A. Zitter (1991). Bacterial spot. in: *Compendium of tomato disease*. The American Phytopathological Society, St. Paul, Mensit National, 73 p.

McCarter, S. M.(1992). Effect of bactericide treatment on bacterial spot severity and yield of different pepper genotypes and on population of certain insects. Plant Dis., 76:1042-1045.

McInnes, T.B., R. D. Gitaitis; S.M. McCarter; C. A. Jaworsk and S. C. Phatah (1988). Airborne dispersal of bacteria in tomato and pepper transplant fields. Plant Dis., 72:575-579.

Medany, M. A.; M. K. Hassanein and A. A. Farag (2009). Effect of black and white nets as alternative covers to sweet pepper production under greenhouses in Egypt. ISHS Commission Protected Cultivation, Working Group for Protected Cultivation in Mild Winter Climates. Vol. (1).

Ravikumar, M.R. and A.N.A. Khan (2001). Influence of weather parameters on the incidence of bacterial spot of tomato. Indian Journal of agricultural Research 35:60-62 (c.f. Review of Plant pathology 81: 8714.

Ravnikar, M.; T. Demsar and T. Dreo (2001). Laboratory diagnosis of bacterial spot on tomato and pepper. Proceedings of the 5th Slovenian Conference on Plant Protection, Catez ob savi, slovenia, 6-8 March. (c.f. Rev. Plant Pathol. 81: 1242).

Sharma, P. D. (2006). Effect of environment on disease development. In: *Plantpathology* (Sharma, P. D. ed.), Alpha Science International Ltd., Oxford, U.K., PP 6.2-6.10

Sigee,D.C. (1993). Plant pathogenic bacteria in the environment. In: *Bacterial Plantpathology: cell and molecular aspect* (Sigee D.C. ed),Cambridge University Press, London, U.K., PP 77-106

Steel. R.G.D. and J.H. Torrie (1980). Principlas and procedures of statistics 2th ed., Mc Grow. Hill, New York, U.S.A.

Timmer, L.W.;J. J. Marios and D. Achor (1987). Growth and survival of Xanthomonads under conditions non conducive to diseas development. Phytopathology 77:1341-1345.

العلاقة بين حدوث مرض التبقع البكتيري في الفلفل وبعض العوامل البيئية

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لوحظ إنتشار مرض التبقع البكتيري في الفلفل في مصر في الآونة الأخيرة وخاصة تحت ظروف الزراعة المحمية. و قد أجريت هذه الدراسة بغرض تحديد مدى انتشار هذا المرض تحت نظم الزراعة المختلفة فى مصر وعلاقته ببعض الظروف البيئية (المتوسط اليومى 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. حيث سجلت شدة هذا المرض في مناطق الخطاطبة والفيوم والصالحية في حين كان تسجيله بدرجة متوسطة في مناطق البوصيلى وقها وجزيرة الذهب وبدرجة منخفضة فى منطقة الجيزة. ومن ناحية آخرى وجدت علاقة موجبة بين شدة المرض و المتوسط اليومى لدرجة الحرارة والرطوبة النسبية حيث ازدادت شدة المرض مع زيادة درجات الحرارة والرطوبة النسبية بالصوبة وكان المرض أكثر شدة فى منطقة الخطاطبة عن منطقة قها وذلك خلال موسم ٢٠٠٧-٢٠٠٨ مقارنة بموسم ٢٠٠٨-٢٠٠٩، وقد يعزى ذلك الى زيادة اختلاف العوامل البيئية فى هذه المنطقة و فى الموسم الأول للزراعة عن فى الموسم الثانى.

قام بتحكيم البحث

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