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RELATION BETWEEN COLORED SHADE NETS GREENHOUSE COVER TYPES AND INCIDENCE OF POWDERY MILDEW DISEASE ON CUCUMBER GROWN UNDER PROTECTED CONDITIONS.

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ABSTRACT

Powdery mildew development in the field is dependent to a large extent on the environmental conditions. This study aims to investigate effect of environmental factors (temperature and relative humidity). Using different covers (black and white nets and polyethylene sheet) on severity of powdery mildew disease of cucumber and there was positive relation between application of different cover and severity of powdery mildew disease, where application of cover lead to increase the disease severity compared uncovered. Application of different covers lead to increase environmental factors and disease severity compared with uncovered treatment. The disease was most severe with polyethylene sheet treatment compared with black or white nets treatment. There was positive relation between cucumber cultivar and type of covers. AlFared cultivar was more susceptible to the disease than Gainko and Safa 51 cultivars. Also, all tested cultivars were most susceptible to the disease with polyethylene sheet treatment compared with black or white nets treatments.

INTRODUCTION

Cucumber (Cucumis sativus L.) is considered one of the most important vegetable crops in Egypt grown under greenhouse conditions. In the recent years, growing vegetables is expanding under protected cultivation in Egypt. The common types of protected cultivation in Egypt are the plastic low tunnels and the single span

plastic house (El-Aidy et al., 2007). Powdery mildew caused by Podosphaera Fusca, limits the production of cucumbers through the world. Fungicide application and the use of resistant varieties are the major methods of disease control (Morishita et al., 2003).Powdery mildew of cucurbits is one of the most destructive foliar diseases in both temperate and subtropical climates (Sitterly, 1978). The destructive effect on cucumber is more common in greenhouse and plastic tunnels (Kristkova and Lebeda, 1999). The climate in the greenhouse is essentially warm, humid and wind-free (Baker and Linderman, 1979) and provides on ideal environmental for the development of many foliar diseases (Bewley, 1923). Relative humidity (RH) is frequently very close to 100% at night, under tunnels and greenhouse conditions (Raviv and Reuveni, 1995). Higher humidity will encourage disease development (Hochmuth, 1991).

In the past decade, much intensive framing in the Mediterranean and elsewhere has moved into screenhouses made of insect-proof nets. The popularity of these structures derived mainly from consumer demand for products grown with reduced pesticide application (Möller et al., 2004). Desmaris (1996) demonstrated that the screenhouses had the largest influence on temperature, ventilation and heat transfer properties of screenhouses. Black net provides better ventilation and water permeability because of its open lockstitch design which reduced wind speed and heat build up in structures and reduced soil moisture loss by helping lessen evaporation (Prasad and Kumar, 1999). The purpose of the present study aimed to study relationship between environmental factors and severity of powdery mildew of cucumber on cucumber plants grown using black or white nets and polyethylene sheet, under commercial greenhouses.

MATERIALS AND METHODS

The experiment was carried out in the Experimental Protected Cultivation site at El-Bosaily farm in the north coastal region of Egypt, during two successive seasons of 2008 and 2009, and carried out in twenty- seven single greenhouse, where each greenhouse has the dimensions of 40.0, 9.0 and 3.2 m length, width and highest, respectively. Each greenhouse included five rows, where each row planted in two sides.

Treatments:-

Black and white nets and polyethylene sheets were used through this study. The properties of nets were 40% shading, anti- Uv, 120 g /m^2 to weight, good for air and gas, over than 400 U to thickness and 2 year for mean life time. But, properties of sheets were anti-Uv and 50 µ m thick. Nethouses were covered by polyethylene sheet through winter (Reuveni and Raviv., 1997 and El-Aidy et al., 2007). Three cultivars of cucumber (El-Safa51, Gainko, and Alfared) were used through this study.

Meteorological data:-

These experiments were carried out in experimental protected site, for two successive seasons of 2008-2009 through the period from April to May. Averages of environmental factors were calculated to daily maximum and minimum temperature and relative humidity were obtained from Central Laboratory for Agriculture Climate, Ministry of agriculture, Giza, Egypt.

Disease assessment:-

Approximimately 500 plants were randomly chosen per greenhouse (100 plant/ row, 50 plant for each side of row) to assess disease incidence and severity. The experiments were layed out in randomized complete block design with three greenhouse/ treatment. Disease severity was calculated as percentage of infection according to number of leaves per plant X 100 and as percentage of disease index (DI) according to scale rating from 0 to 4, where 0= no visual infection, 1 = less than 5% of the surface area of the leaf infected, 2= 6-25% of leaf, 3= 26-50% of leaf and 4= more than 5% of leaf (Morishita *et al.,* 2003). Percentage of disease index (DI) was calculated as following:

$$DI = \frac{\sum R.T}{4XN} X100$$

Where, T= number of plants with each category (R) disease severity scale (R =0, 1, 2, 3 and 4).

N = Total number of tested plants.

Data were statistically analyzed using the "F" test and value of LSD (P= 0.5) was calculated according to Snedicor and Cochran (1981).

RESULTS AND DISCUSSION

There was positive relation between environmental factors (Average temperature and relative humidity) and severity of powdery mildew of cucumber, ,during growing season 2008-2009 (April- May), where the disease severity was ranged from 13.0 to 23.5% when the temperature and relative humidity were ranged from 23.6 to 28.9 ^{o}C and from 33.0 to 42.3%, during growing season 2008, but the disease severity was ranged from 12.9 to 22.6% when the temperature and relative humidity were ranged from 23.9 to 29.1 and from 33.7 to 43.7%, during growing season 2009, respectively. The disease was increased with increasing environmental factors, where the disease severity was increased from 13.0 to 13.5 or from 12.9 to 12.6 % when the temperature or relative humidity were increased from 23.6 to 28.9 and from 23.9 to 29.1 or from 35.0 to 67.3 and from 33.7 to 43.7,during growing season 2008 and 2009, respectively (Fig.1).

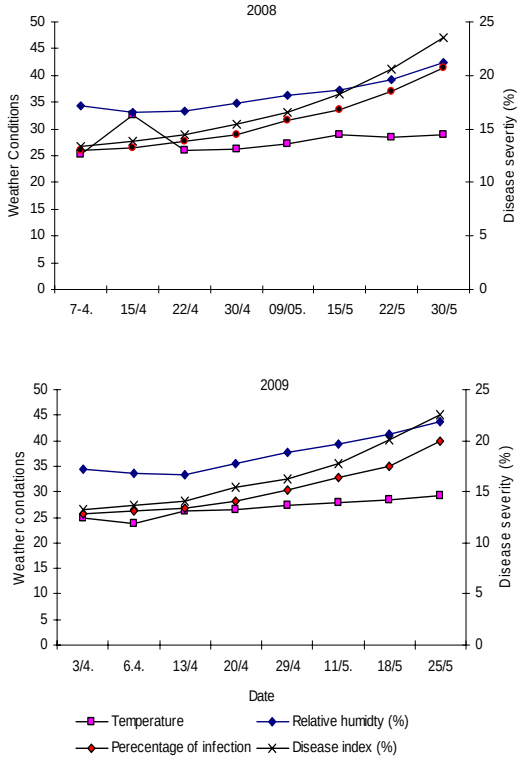

Fig.1. Effect of temperature and relative humidity on severity of powdery mildew of cucumber (infection (%) and disease index (%), during April-May 2008-2009 seasons, at El-Bosaly location.

Application of black or white nets and polyethylene sheet, as cover, effected on severity of powdery mildew of cucumber compared with uncovered , where disease severity was 22.2-37.6 % when the plants covered by net or sheet (Fig.2), but the disease severity was 12.9- 23.5% when the plant no covered by net or sheet. The disease was more severe with application of polyethylene sheet than application of black or white nets, where the disease was 23.8-37.6% with polyethylene and 22.5-31.8 or 22.2-31.2% with black or white nets. Application of polyethylene sheet lead to increase temperature and relative humidity compared with application of black or white nets, where temperature was 26.1-33.7, 26.0-31.5 and 25.5-30.2 oC and relative humidity was 56.9-67.1, 56.5-65.7 and 55.6-63.0%, respectively. Also, application of nets or sheets lead to increase temperature and relative humidity compared with no their application, where temperature was 25.5-33.5 and 23.6-29.1 ^{o}C and relative humidity was 55.6-67.1 and 53.0-63.7%, respectively (Fig. 2)

Data in table (1) show that interaction between cucumber cultivars and type of covers (net or sheet) affected severity of powdery mildew disease. the disease more sever on AlFared cultivar than Gainko and Safa 51 cultivar, where the disease was 28.6-39.7, 26.0-35.6 and 24.0-34.9%,respectively. All tested cultivars were more infection by powdery mildew under polyethylene sheet than black or white nets, where the disease was 30.-39.7, 25.2-32.7 and 24.0-31.2%, respectively.

Application of black net screen house was more effect on growth character and yield of sweet pepper due to that the shading effect that could be offering better microclimatic air temperature relative humidity and light intensity (Medany et al., 2008). The N, P and K uptake was influenced by both light intensity and temperature, leaf N, P, K and Ca contents were affected by shade due to the reduction in transpiration rate that might influence mineral uptake. The rate of nitrate was light dependent at low light intensities in both sun- adapted and shade- adapted. Calcium deficiency in the leaves was observed due to a reduction of transpiration (Bakker 1990 and Tadesse et al ., 1999). Air temperature is usually increased by 3.3 to 11.1 ^{o}C inside enclosed row covers at midday, depending on the type of tunnel and materials. Soil temperatures are increased by 2.4 to 4.8 ^{o}C in the day time to a depth of 3 inches (7.6 cm) according to Schrader at al ., (2002). The climate in the greenhouse is essentially warm, humid and

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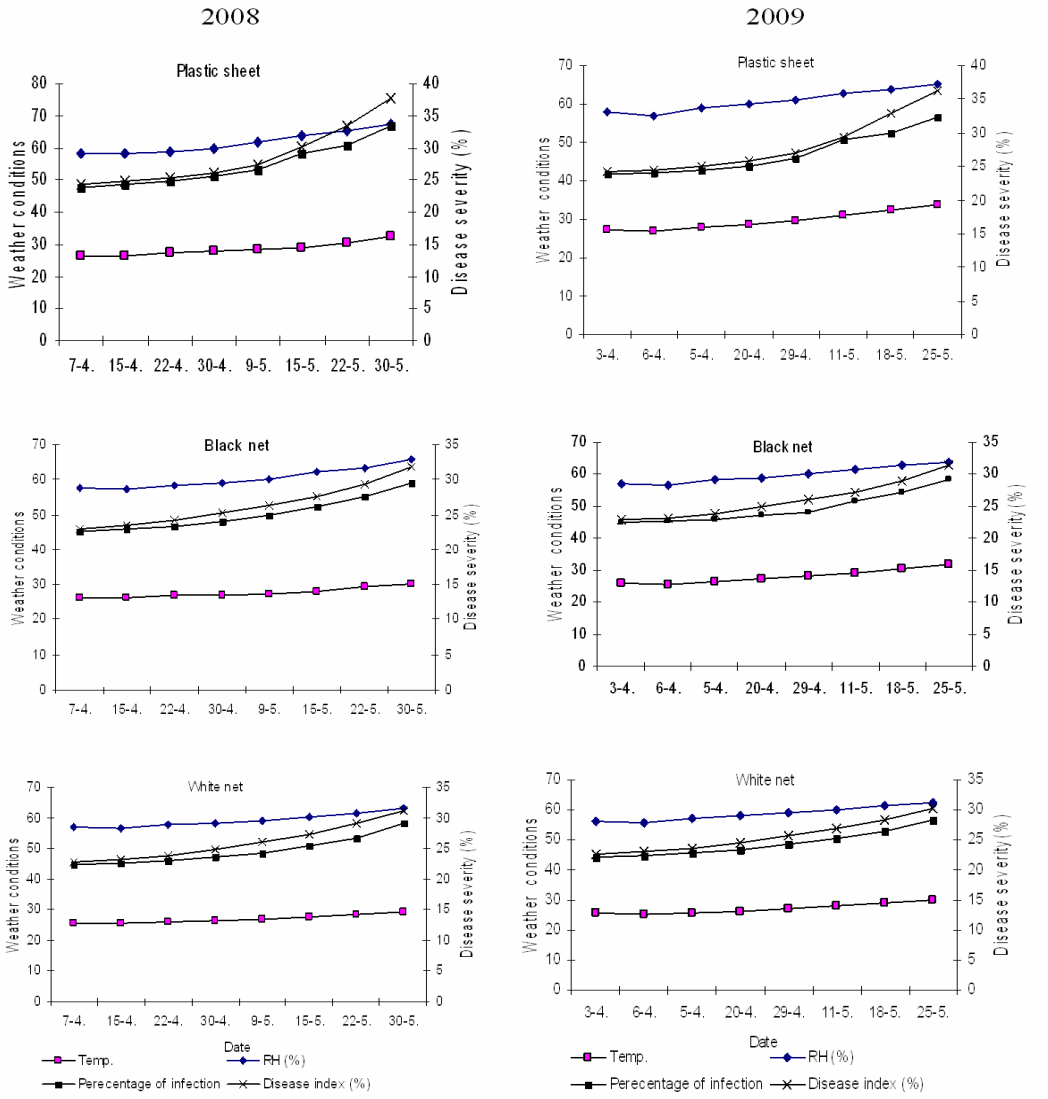

Fig. 2. Interaction between average temperature and relative humidity and different covered (plastic sheet and white nets and black nets) on severity of powdery mildew of cucumber (infection (%) and disease index), during growing season 2008-2009 (April- May), at commercial greenhouse.

Table (1) Interaction between cucumber cultivar and sheet type on severity of powdery mildew of cucumber, during growing season 2008-2009 (April- May) under commercial greenhouse.

Cultivar	Treatment	Disease severity (%)			
		A		B	
		2008	2009	2008	2009
Safa 51	**Plastic**	32.7	30	34.9	32.3
	White	24.2	24	25	24.9
	Black	25.7	25.2	26.6	26.1
Gainko	**Plastic**	33.8	31.5	35.6	33.7
	White	26.1	26	27.8	27.1
	Black	27.7	27	28.9	29.2
Alfared	**Plastic**	37.7	35	39.7	38.1
	White	29.7	28.6	31.2	30.4
	Black	30	29.5	32.7	31.6

A= Percentage of infection
B= Disease index (%) according to disease rating scale from 0 to 4 (Descalzo *et al*., 1990).

LSD at 5%	
Cultivar	1.4
Treatment	2.1
Season	1.0
Interaction	3.3

Possible control of several pathogens in the greenhouse by means of photoselective cladding materials that interface with the life cycle of the causal organisms has been reported by Reuveni and Raviv (1995) and Sasaki *et al.,* (1985). The light is the major controllable factor in the inhibition of the disease in the greenhouse (Reuveni and Raviv, 1997). Powdery mildew development in the filed is dependent to a large extent on the environmental conditions. Excessively high temperatures limit the development of the disease, whereas cool temperatures and shading enhance it (Morishita *et al*. 2003). Munger (1979) reported that a temperature regime of 15-21^{o}C was much more favorable for mildew development than a 21-27^{o}C regime and the effect of temperature was more pronounced on cucumber with intermediate levels of powdery mildew resistance than on susceptible ones. Powdery mildew was more destructive effect on cucumbers in greenhouse and plastic tunnels because of favorable climate including

high temperature (between 25 and 30^{o}C) and low relative humidity on the leaf surface (Roberts and Boothroyd, 1972).

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العلاقة بين الأغطية المختلفة للصوبة وانتشار مرض البياض الدقيقى فى الخيار تحت ظروف الزراعة المحمية

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تكشفت وزادت الإصابة بمرض البياض الدقيقى على محصول الخيار تحت ظروف الزراعة المصرية. أجريت هذه الدراسة بغرض دراسة العلاقة بين الظروف البيئية مستخدماً أنواع مختلفة من أغطية الصوب وشدة الإصابة بمرض البياض الدقيقى ودراسة العلاقة بين الأصناف وانواع الأغطية المختلفة. ومن أهم النتائج المتحصل عليها وجدت علاقة موجبة بين شدة الإصابة بمرض البياض الدقيقى فى الخيار واستخدام الأغطية المختلفة بالمقارنة مع الغير مغطاه (حرارة ورطوبة نسبية). أدي استخدام الاغطية المختلفة الى زيادة درجة الحرارة والرطوبة النسبية اسفلها وكذلك زيادة شدة الإصابة بالمرض. استخدام الإغطية البلاستكية زاد من شدة الإصابة بالمرض بالمقارنة مع اغطية الشباك السوداء والبيضاء. وجدت علاقة موجبة بين قابيلية الأصناف للإصابة بالمرض ونوع الغطاء المستخدم. ولقد وجد ان الصنف ألفريد كان أكثر الاصناف قابلية للإصابة بالمرض بالمقارنة مع الصنف جيانكو والصفا 51 وكذلك وجد ان تلك الأصناف تكون أكثر قابلية للإصابة بالمرض تحت ظروف الأغطية البلاستيكية بالمقارنة مع الأغطية الأخري.