# Impact of Type of Greenhouse Cover Sheets on Certain Major Cucumber Pests under Protected Cultivation

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**Abstract:** Cucumber (*Cucumis sativus L.*) is considered one of the most important vegetable crops, under greenhouse conditions in Egypt. Application of black and white nets and polyethylene sheet affect on environmental factors under greenhouse conditions where as environmental factors (temperature and relative humidity) were higher with application of polyethylene sheet comparing with application of black and white nets. There was positive relationship between environmental (temperature and relative humidity) factors and population of aphids, spider mites, thrips and whitefly by using black and white nets and polyethylene sheet. Population of different pests were increased as well as increasing temperatures and decreasing relative humidity. Maximum population of aphid and whitefly were observed during May, but maximum population of spider mites and thrips were observed during June. Population of aphid was most frequent with using different shading nets, while population of spider mites and thrips were more frequent, While whitefly pests was less frequent. Populations of insects were more high when using polyethylene sheet than black and white nets.
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**Key Words:** Cucumber, Aphids, Spider mites, Thrips, Whitefly, Shade nets, Black net, White net, Polyethylene sheet, greenhouse.

## 1. Introduction:

Sucking pests cause severe damage of vegetable crops grown in greenhouses. Survey of insect and animal pests give the growers a picture of the risk of plant protection would be take attention to crop management. Annotated lists of insects associated with cucumber plants are recorded, which include both phytophagous and beneficial species. Additional notes are given on the most important pests **(Manley, 1983)** Greenhouses system is one of the protected cultivation types used to produce vegetables and flowers. Certain plastic covers protect plants from adverse weather condition and increase their resistance to pest attack **(Benoit and Ceustermans, 1992).** 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).**

The climate in the greenhouse is essentially warm, humid and wind-free **(Baker and Linderman, 1979)** Relative humidity (RH) is frequently very close to 100% at night, under tunnels and greenhouse conditions **(Raviv and Reuveni, 1995).** Higher humidity will encourage pest development **(Hochmuth, 1991)**. In Egypt **(Saad, 2002)** stated that vegetables under protected cultivation are attacked by numerous insects and mites caused serious damage and high yield loses.

The photoselective netting is an emerging approach, which introduces additional benefits, on top of the various protective functions of nettings. Some of the photoselective shade nets contain pigments known to attract whiteflies and thrips (i.e. yellow and blue).Therefore, crops grown under those nets could potentially be at a higher or lower risk for pest infestation. Covering greenhouses with films or screens containing UV absorbing additives is known to provide better protection against most pests, relative to standard cladding materials (**Antignus and Ben_Yakir 2004).**

The present work aims to study the effect of shade nets (black, white nets and polyethylene sheet) on some environmental factors (temperature and relative humidity) and population flactuation of Spider mites, *Tetranychus urticae*, Whitefly, *Bemisia tabaci* Thrips, *Frankliniella intonsa* and Aphids, *Aphis gossypii*.

## Material and Methods

### Experimental Greenhouse:-

The experiment was carried out in the Experimental Protected Cultivation site at El-Bosaily Farm in the North Coastal of Egypt, during two successive seasons of 2010 and 2011. Four greenhouses were chosen to carry out this study. Area of traditional greenhouse is 360 $m^2$ with 40m long, 9m wide and 3.25 high. Greenhouse unit

consists of five rows is 1m wide and 40m long and distance between two seedling in the row is 50 CM. Standard agricultural practices were applied at these greenhouse.

Black and white nets and polyethylene sheets were applied through this study. The properties of nets were 40% shading (white and black) (60 %) shading, anti-UV, 120 g /$m^2$ year for mean life time. Net houses were covered by polyethylene sheet (control) through winter.

**Meteorological Data:-**

Climatic data were recorded as maximum and minimum temperatures and relative humidity through the period from February to June for two successive seasons of 2010-2011. Averages of environmental factors were calculated to daily maximum and minimum temperatures and relative humidity under greenhouse conditions were obtained from Central Laboratory for Agriculture Climate, Ministry of agriculture, Giza, Egypt.

**The Samples:-**

Adult insects of whitefly (*Bemisia tabaci* (Genn.)), aphid (*Aphis gossypii*), spider mites (*Tetranychus urticae*) and thrips (*Frankliniella intonsa*) were estimated on leaves, weekly The study period started from February to June, during growing seasons 2010-2011. The numbers of pests were weekly counted on the terminal leaflet of one leaf of each plant. Ten plants per row were randomly selected from the middle row in each plot. Five leaves were examined per plant using a hand lens. In case of whitefly, leaves were carefully inverted and adults counted in the morning hours when adults are less easily disturbed **(Cszinszky, *et al*., 1999).** Data were statistically analyzed using the "F" test and LSD value (P=0.5) was calculated according to (**Snedicor and Cochran 1981).**

**Results and Discussion**

Temperature and relative humidity affected with application of black & white nets and polyethylene sheet as covering materials for greenhouse (Tables, 1-3). Environmental factors previous were its higher with application of polyethylene sheet compared with white and black nets, the average temperatures recorded 14.0-28.5, 13.7-27.7 and 11.7-26.7$^{o}$C. The average relative humidity recorded 63.5-69.7, 59.5-63.7 and 49.5-65.3%, respectively. Meantime, temperature was increased with increasing the period from February to June, where the temperature increased from (11.7 to 28.5 $^{o}$C) while, relative humidity decreased with increasing the period from February to June, where as the relative humidity decreased from (69.7 to 49.5 %). Similar results were reported by **(Saleh, M. I and K. Ozawa 2006) and (Hashem *et al.*, 2011).** They found a moderate decrease in temperatures associated with the use of nets at the spring season. 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 evaporation **(Prasad and Kumar, 1999).** Air temperature is usually increased from 3.3 up to 11.1$^{o}$C inside enclosed row covers at mid-day, depending on the type of tunnel and materials. Soil temperatures are increased from 2.4 up to 4.8 $^{o}$C in the day time to depth of 3 inches (7.6 cm) according to (**Schrader *et al*., 2002).** Application of black net screen house was more effective on growth and yield characters 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).** (**Iglesisas and Alegre 2006)** indicated that the greatest value of relative humidity was detected under polyethylene cover treatment followed by the black net cover and a 2-6% increase in humidity associated with the use of net.

**Table (1)**: Effect of black net on certain climatic factors (temperature and relative humidity) and population of some pests, at El-Bosaily region, Beheria Governorate, during 2010-2011 seasons

| Months | Average relative humidity (%) | | Average Temperature (°C) | | Mean number of adult pest / leaf | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2010 | 2011 | Spider mites | | Whitefly | | Thrips | | Aphids | |
| | | | | | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 |
| February | 58.3 | 59.3 | 11.7 | 12.4 | 3.3 | 5 | 0 | 0.7 | 0 | 0.7 | 0 | 2 |
| March | 55.2 | 56 | 15 | 16.5 | 13 | 15.4 | 7.4 | 7 | 9.6 | 12 | 16.6 | 17.8 |
| April | 52.5 | 51 | 20 | 21 | 15.5 | 18 | 23.5 | 25.3 | 29 | 31 | 33 | 33.3 |
| May | 51.4 | 50.6 | 23 | 24.9 | 19.4 | 21.8 | 36 | 40 | 43.8 | 45 | 164 | 167.4 |
| June | 49.5 | 50 | 25.5 | 26.7 | 14 | 16.5 | 48 | 50 | 54 | 55.5 | 29 | 32.5 |

LSD at 5% for
Date 9.0 Pest 7.2 Season 1.3 Interaction 13.7

**Table (2):** Effect of white net on certain climatic factors (temperature and relative humidity) and population of some pests, at El-Bosaily region, Beheria Governorate, during 2010- 2011 seasons

| Months | Average relative Humidity (%) | | Average Temperature (°C) | | Mean number of adult pest / leaf | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2010 | 2011 | Spider mites | | Whitefly | | Thrips | | Aphids | |
| | | | | | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 |
| February | 63.7 | 65.3 | 13.7 | 13.9 | 0 | 0 | 0 | 0.7 | 0 | 0 | 0 | 0 |
| March | 62.8 | 64.2 | 17.2 | 17.9 | 7.6 | 9.6 | 5 | 6.8 | 2.8 | 4.4 | 8 | 9.4 |
| April | 61.5 | 62.9 | 22.5 | 23.2 | 12.5 | 14 | 19.5 | 22 | 18.8 | 19.5 | 16 | 17.5 |
| May | 60.9 | 61.7 | 26 | 26.4 | 13 | 17.6 | 32.4 | 35 | 37.4 | 39.4 | 122 | 124.6 |
| Jun | 59.5 | 60.4 | 27 | 27.7 | 6.5 | 8.5 | 42.5 | 45 | 51.5 | 51.9 | 15 | 10.6 |

LSD at 5% for
Date 7.3 Pest5.4 Season 1.0 Interaction 11.5

**Table (3):-** Effect of polyethylene sheet on certain climatic factors (temperature and relative humidity) and population of some pests, at El-Bosaily region, Beheria Governorate, during 2010- 2011 season.

| Months | Average relative humidity (%) | | Average Temperature (°C) | | Mean number of adult pest / leaf | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2010 | 2011 | Spider mites | | Whitefly | | Thrips | | Aphids | |
| | | | | | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 |
| February | 69 | 69.7 | 14 | 14.7 | 13 | 1.7 | 0 | 2 | 0 | 0.7 | 2.3 | 69.7 |
| March | 67.2 | 68.6 | 17.4 | 17.6 | 14 | 9.8 | 8.4 | 13.6 | 12 | 15 | 20 | 68.6 |
| April | 66 | 67.5 | 23 | 23 | 18 | 21 | 26.3 | 29.3 | 31.8 | 33.3 | 35.3 | 67.5 |
| May | 65.8 | 66.2 | 26 | 26 | 21.4 | 30.4 | 38.4 | 44.8 | 45.8 | 48 | 171.4 | 66.2 |
| Jun | 63.5 | 64 | 28 | 28.5 | 16.5 | 28.5 | 51 | 57.5 | 57.5 | 60 | 36.5 | 64 |

LSD at 5% for
Date 8.2 Pest 6.1 Season 1.1 Interaction 12.7

Data shown in Tables (1, 2&3) revealed that there is positive relation between environmental factors (average temperature and relative humidity) and population of pests aphids, spider mites, thrips and whitefly, with using black, white nets and polyethylene sheet, during growing seasons 2010-2011, where by population of aphids, spider mites, thrips and whitefly pests were recorded 171.4, 60.0, 57.0 and 30.4 individuals / leaf, respectively. Population of different pests increased with increasing temperature and decreasing relative humidity, whereby, population of aphids, thrips, whitefly and spider mites ranged from (0.0 to 171.4), (0.0 to 60.0), (0.0 to 57.0) and (0.0 to 30.4) individuals/ leaf as well as increasing temperature from 11.7 to 28.5$^{o}$C and decreasing relative humidity from 69.7 to 49.5%, respectively (Fig.1) A, B, C&D. Meanwhile, maximum population of aphids and whitefly pests were appeared during may, where the population was 164.0-167.4, 122.0-124.6,171.4-66.2 individuals /leaf, respectively, but maximum populations of spider mites and thrips pests were observed during June where the population was 54.0-55.5, 51.5-51.9 and 57.5-60.0 individuals /leaf and was 48.0-50.5,42.5-45.0 and 51.0-57.5 insect/leaf, with using black and white nets and polyethylene, respectively. **(Cooper1991)** reported that infestation of 300 -700 thrips / leaf were found on aubergine and cucumber, resulting in crop loses of 50-90%. The major greenhouse pests were *Thrips tabaci, Tetranychus cinnabarnus, Aphis gossypii* and *Trialeurodes vaporariorum* in cucumbers **(Yasarakinci and Hincal, 1997).** Management of greenhouses should be geared towards optimal production condition via provision of appropriate environmental conditions and production imputes by avoiding condition that favor reproduction and development of plant pests **(Taher, 1992).** In the greenhouse micro distribution studies showed that on cucumber plants adults were mainly found on young leaves with larvae on older leaves. Economic injury thresholds were low: 4.04 adults per leaf for cucumber **(Kawai, 1990)**. Highly population of *Bemisia tabaci* was found during mid-September to the end of October. Number of this pest was moderate in November. Low infestation of whitefly was in December and January. Aphid population was high from October to mid-December and then become low before and after this period **(Aly, 1993).** A population dynamics study showed that *A. gossypii* populations might reach very high levels in June, causing economic damage to cucumber. The proliferation of *A. gossypii* on cucumber arises mainly from infestations by flying winged adults. Insect and mites are the main groups of pests which attack plants causing many types of

damage **(Van Lentern 1992)** reported that *Thrips tabaci* has severely damaged cucumber greenhouses.

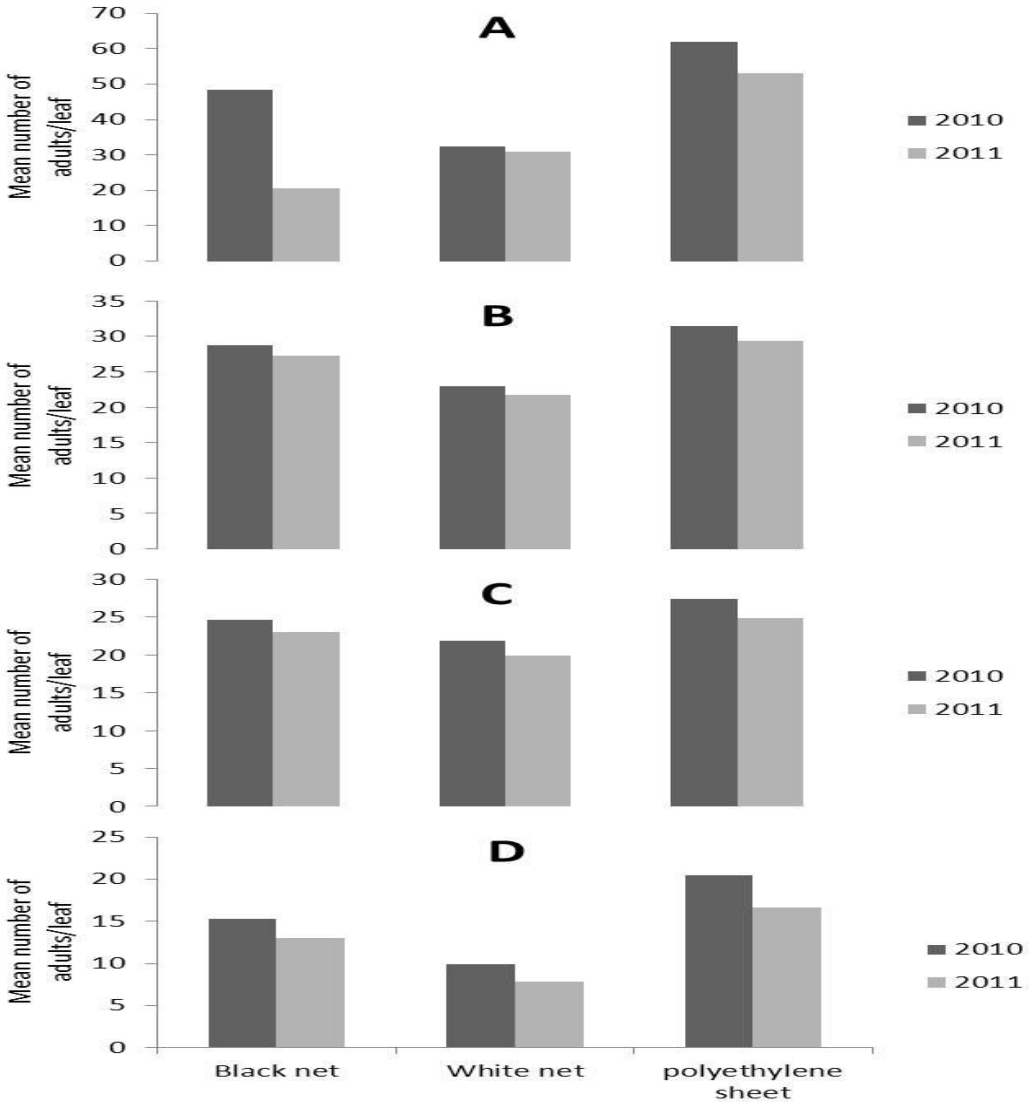


**Figure (1):-** Influence of sheet type on population of some pest (A: aphids, B: spider mites, C: white fly, D: thrips) at El-Bosaily region, Behira governorate, during season 2010-2011.

**Abou-taka and Zohdy (1990)** recorded that the spider mites in Egypt are one of the most serious pests on vegetable plants. However, the most dangerous of the mite was the two-spotted spider mites *T. urticae* who attack several greenhouse plants. Two pests were recorded on cucumber plants only, thrips and leaf miner **(El-Habi *et al*.1999)** draw attention to the fact that *Aphis gossypii* is one of the major pests of cucumber grown in greenhouses in the coastal areas of Morocco. Alternative cover provides better protection against arthropod pests may be explained by two alternative hypotheses: the light inside the screen-house contains less UV and therefore becomes "invisible" to the pest **(Antignus *et.al.*, 2004)** higher levels of reflected/scattered sunlight deter pest landing **(Matteson *et al.*, 1992).** The photoselective nets include "colored-ColorNets" (e.g. Red, Yellow, Green, Blue net products) as well as "neutral-ColorNets" (e.g. Pearl, White and Grey) absorbing spectral bands shorter, or longer than the visible range. The spectral manipulation is aimed at specifically promoting photomorphogenetic-physiological responses, while light scattering

improves light penetration into the inner canopy **(Rajapakse, N.C and Shahak ,Y., 2007)**. Radiation use efficiency increases when the diffuse component of the incident radiation is enhanced under shade **(Healey *et al.*, 1998).** In addition to its direct effect on the plants, the photoselective filtration of sunlight may also affect plant pests, beneficials and diseases.

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