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EFFECTIVENESS OF COLOURED STICKY TRAPS IN MONITORING OF *Ctenosciara hyalipennis* (Meigen, 1804) (Diptera: *Sciaridae*) ON EXOTIC PLANT SPECIES IN GREENHOUSE

Edyta Górska-Drabik, Katarzyna Golan, Magdalena Ćwiklińska
University of Life Sciences in Lublin

Abstract. Coloured sticky traps are one of the most important tools for monitoring greenhouse pests. They allow to determine the need or appropriate time of treatment applications against phytophagous, evaluate effectiveness of previous control actions and reduce their number. The study was carried out in a greenhouse of the Maria Curie-Skłodowska University in Lublin Botanical Garden from March 30, 2005 to March 30, 2007 and was aimed at determining the population dynamics of *Ctenosciara hyalipennis* (Meigen) as well as the efficacy of two types of sticky traps in monitoring the number of the pest. During the study a total number of 12 263 specimens of *this species*, had been caught. These insects were the most numerous on yellow traps (7 915 specimens). During the entire study period some significant differences were demonstrated between the daily number of *C. hyalipennis* in relation to the color of traps. In season I, the mean number of this species specimens caught during a day on a trap was 2.75 for yellow traps and 2.59 for blue traps. During the study season I (30.03.2005–28.03.2006), the maximum of abundance was recorded from the third decade of May to the second decade of June, 2005 and in the third decade of March, 2006. In the study season II (28.03.2006–30.03.2007), the median of *this species* was 2.52 specimens. In this case the highest abundance of *C. hyalipennis* was observed from the beginning of the season to the first decade of May, 2006. An average number of this species caught on blue traps during a day was 1.88 specimens. The study proved that coloured sticky traps may be a useful tool in monitoring the presence and density of sciarid flies in greenhouse production. Yellow traps appeared to be more effective in monitoring and catching adult specimens of *C. hyalipennis* as compared to blue traps. However according to the literature, yellow sticky traps capture more natural enemies than other colours. Blue sticky traps can be also used to monitor the *C. hyalipennis* population in greenhouses production where biological control program is applied.

Key words: *Ctenosciara hyalipennis*, *Sciaridae,* pest, greenhouse*,* sticky traps, exotic plants, monitoring

Corresponding author – Adres do korespondencji: Edyta Górska-Drabik, Department of Entomology, University of Life Sciences in Lublin, Leszczyńskiego 7, 20-069 Lublin, Poland, e-mail: edyta.drabik@up.lublin.pl

INTRODUCTION

Sciarid flies are recognized common pests in greenhouse production worldwide [Lewandowski et al. 2004]. However, a few species may attack a lot of economic plants for example: potatoes, cultivated mushrooms and various ornamental plants [Mead and Fasulo 2001]. According to the literature, the insects can cause serious economic loss in mushroom production. Data on harmfulness of sciarid flies refer to Australia, USA, Russia, United Kingdom and other West European countries [Cantelo 1979, Binns 1973, White 1986, Geels and Rutjens 1992, Scheepmaker et al. 1995, White et al. 2000].

Sciarids are a problem in greenhouses where they colonize organic substrates, composts and mineral wool. Larvae of sciarid flies feed on decaying organic matter, fungi and algae inhabiting the substrate. They are responsible for direct damage by feeding on small roots, root hairs, and even lower, soft parts of plant stem in crops what may result in reducing a yield and sometimes plants' withering [Mead and Fasulo 2001]. First weeks when a rooting system is not yet fully developed is critical for plant production and it is very important to reduce the population of sciarid flies at this time. It is also the period when plants are particularly susceptible to damage [Gauge and Hague 1995, Taylor and Francis 2003]. However, the minute size of adult sciarid flies, their behavior – flying low above the ground and biology – short, overlapping life cycles, make the effective management of the pest problematic [Mead and Fasulo 2001]. In the protection of greenhouse cultivations against scarid flies, an early monitoring of that pest is very important. It makes possible to control effectively the Sciaridae before any damage occurs on the plants [Yano 1987, Gillespie and Quiring 1987, Shipp and Zariffa 1991, Górski 1999]. Early-control system is necessary to prevent sciarid flies from developing numerous population. One of the methods of early monitoring of this group of insect is the use of coloured sticky traps in plant production [Baranowski and Górski 1991, Górski 1999, 2001].

The aim of the study was to determine the population dynamics of C. hyalipennis and evaluate the efficacy of two types of sticky traps in monitoring the number of the pest in greenhouse with exotic plants.

MATERIALS AND METHODS

The study was carried out in a greenhouse of the Maria Curie-Skłodowska University in Lublin Botanical Garden. The greenhouse, covering 270 m^2, houses tens of exotic plant species, representatives of tropical forests, the Mediterranean flora and many crops commonly cultivated in warmer regions of the world (coffee, banana, vanilla, fig, papaya, passion fruit, citrus crops, cotton, pomegranate, black pepper, palm tree, carob, loquat). The study was conducted from March 30, 2005 till March 30, 2007. The whole experimental period was divided into two seasons – season I (March 30, 2005 – March 28, 2006), season II (March 28, 2006 – March 30, 2007). Chemical plant protection in the greenhouse was performed twice a month, from April to November in 2005 and from March to October in 2006. Yellow and blue sticky traps were distributed on plants randomly, at the height of 30–50 cm above the ground level, in close vicinity of plants.

Five coloured sticky traps were used each time for one monitoring recording the presence of pests in the greenhouse. The collected material was then analyzed at the laboratory where the species composition as well as the number of the sciarid flies caught was determined with the use stereomicroscope. Seventy six single observations (records) were made, 38 per specific color per season. Observations were carried out with different intervals and involved different number of traps comparing between two colors. Therefore the comparison of the obtained results was done using the value expressed by average number of specimens per trap per day (24 consecutive hours) – a daily number of specimens.

Values computed in such a way were then subjected to statistical analysis (Statistica 9.1 (StatSoft, Tulsa, Poland), where the number of specimens caught after a day on yellow or blue trap was a dependent variable affected by the same factors as temperature, humidity, control treatments. Due to the distribution nature of the analyzed variables, nonparametric paired-sample Wilcoxon test was used to assess differences in the daily abundance of C. hyalipennis in different seasons. Therefore, the variables were characterized by the median.

RESULTS AND DISCUSSION

Yellow sticky traps are commonly used for monitoring and management of whiteflies (*Trialeurodes vaporariorum* Westw.) and certain other pests. They have also been used to monitor their natural enemy activity [Hoelmer et al. 1998]. The authors suggested, that yellow sticky traps are not highly selective for natural enemies especially parasitoids. Results of their studies demonstrate that yellow sticky traps were strongly attracted for observing parasitoid populations, they caught more individuals of *Eretmocerus eremicus* than other coloured sticky traps. Dowell and Cherry [1981] were studied attractiveness of sticky traps of eight colors for two species of parasitoids. In the results of their investigation yellow sticky traps captured significantly more parasitoids that other colors tested. During the own studies also blue sticky traps were caught individuals of *C. hyalipennis* although in lower amount than yellow traps. However this information is needed to protection of natural enemies populations using in greenhouses where biological control program is applied.

Coloured sticky traps are one of the most important tools for monitoring greenhouse pests. They allow to determine the need or appropriate time of treatment applications against phytophagous, evaluate effectiveness of previous control actions and reduce their number [Fiedler and Sosnowska 2002]. During the study a total number of 12 263 *C. hyalipennis* had been caught. According to Fiedler and Sosnowska [2002] representatives of Sciaridae are, comparing to other insects, caught most frequently on coloured sticky traps in greenhouse production of ornamental plants. The use of coloured sticky traps in monitoring greenhouse pests was investigated by Baranowski and Górski [1991, 1992] and Górski [1999]. Both yellow and blue sticky traps are commonly used for monitoring sciarid flies [Pniak 2003].

In the present study the insects were observed to be most abundant on yellow traps (7 915 specimens) – 3 517 specimens had been caught during season I, and 4 398 during

season II. Blue traps had caught a total number of 4 348 – 2 277 in season I and 2 071 in season II (tab. 1).

Table 1. Abundance of Ctenosciara hyalipennis (Meigen) on yellow and blue sticky traps in greenhouse of Botanical Garden in Lublin, Poland (2005–2007)
Tabela 1. Liczba odłowionych osobników Ctenosciara hyalipennis (Meigen) na barwnych tablicach lepowych w szklarni Ogrodu Botanicznego (Lublin, 2005–2007)

Year Rok	Number of insects individuals on two types of sticky traps Liczba osobników owadów odłowionych na dwóch rodzajach tablic lepowych		
	yellow – żółte	blue niebieskie	total – razem
I season – I sezon (2005/2006)	3 517	2 277	5 794
II season – II sezon (2006/2007)	4 398	2 071	6 469
Total – Ogółem	7 915	4 348	12 263

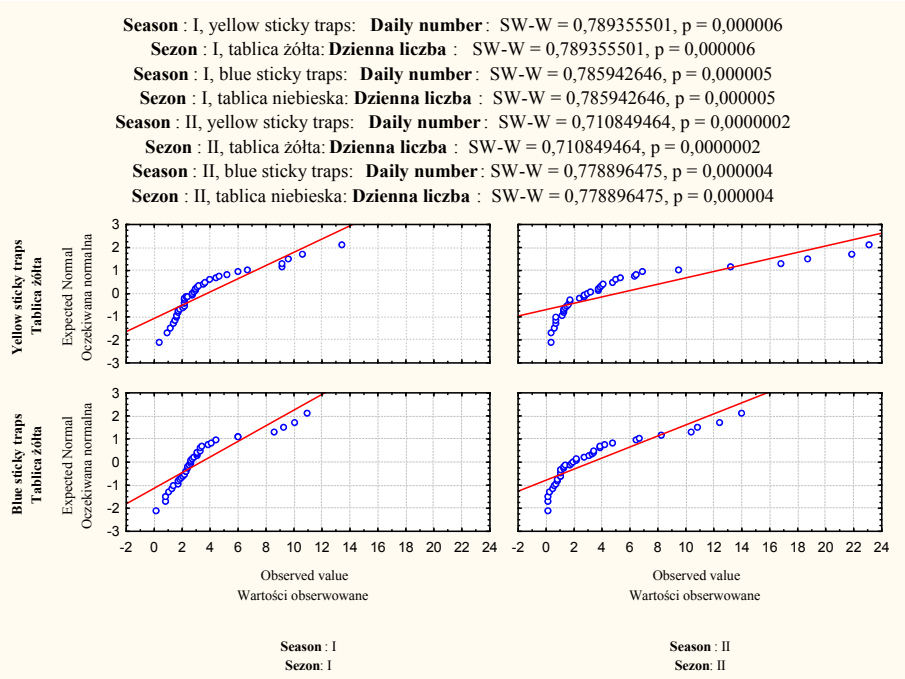

Fig. 1. Data for normality plots. Daily number of Ctenosciara hyalipennis (Meigen)
Ryc. 1. Wyniki testowania normalności rozkładu dziennej liczby odłowionych osobników *Ctenosaura hyalinipennis* (Meigen)

Based on normality plots and the results of Shapiro-Wilk test, the hypothesis of normality distribution of daily number of *C. hyalipennis* for each season and for trap of different color had been rejected (fig. 1). The hypothesis on normal distribution of daily numbers of the insects caught on yellow and blue sticky traps was rejected considering the analysis of entire experimental period performed with Wilcoxon test. Significant differences had been proved in daily number of sciarid specimens caught on traps of different color ($p = 0.006413$). The range of variation of the daily number of the caught *C. hyalipennis* specimens was higher for yellow traps and reached higher values. Quartiles 0.25 and 0.75 were 1.61 and 4.90 for yellow traps and 1.28 and 3.82 for blue traps respectively, indicating higher efficiency in the case of yellow traps (fig. 2). Mean daily number of the caught pest per trap recorded over the entire experiment was 2.78 specimens for yellow traps and 2.41 for blue traps, that is, the number of sciarid flies caught on yellow sticky traps during one week was higher by c.a. 3 specimens as compared to blue sticky traps (tab. 2). Similar studies conducted Górski [2005a, 2005b] in the experimental greenhouses of the University of Life Sciences in Poznań. The author investigated the use of essential oils as attractants added to yellow and blue sticky traps. In the control group, without fragrant additives, he found that yellow sticky traps were more efficient than blue ones.

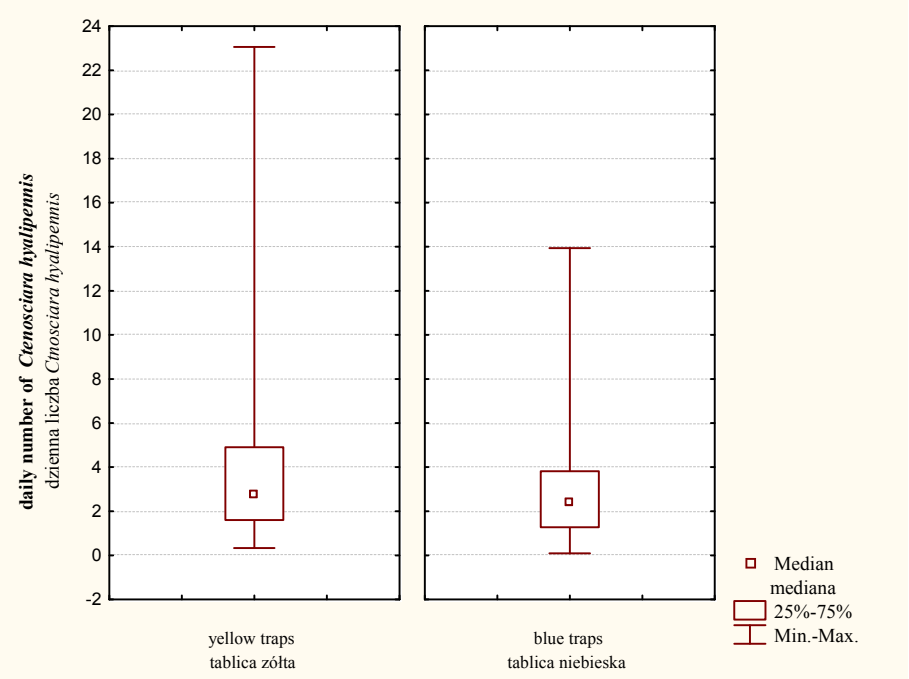

Fig. 2. Distribution of average daily number of Ctenosciara hyalipennis (Meigen) caught on yellow and blue sticky traps during the study period (Lublin 2005–2007)

Ryc. 2. Rozkład dziennej liczby osobników Ctenosciara hyalipennis (Meigen) odłowionych na tablicach żółtych i niebieskich w obu sezonach badań (Lublin 2005–2007)

The analysis of data recorded for season I revealed that a daily number of the caught *C. hyalipennis* had identical distribution irrespectively the trap color. No significant differences in the number of specimens caught in relation to the color of a trap had been found. There was little fluctuation in the number of the caught this species recorded during observations (tab. 2).

Table 2. Median of daily number of Ctenosciara hyalipennis (Meigen) on colored sticky traps in greenhouse of Botanical Garden in Lublin (2005–2007)
Tabela 2. Mediana dziennej liczby osobników Ctenosciara hyalipennis (Meigen) odłowionych na barwne tablice lepowe w szklarni Ogrodu Botanicznego (Lublin, 2005–2007)

Colored sticky traps Barwne tablice lepowe	Median of daily number – Mediana dziennej liczby		
	I season – I sezon (2005/2006)	II season – II sezon (2006/2007)	total – ogółem (I, II)
Yellow – Żółte	2.75	2.88	2.78
Blue – Niebieskie	2.59	1.88	2.41
Total – Ogółem	2.62	2.52	2.62

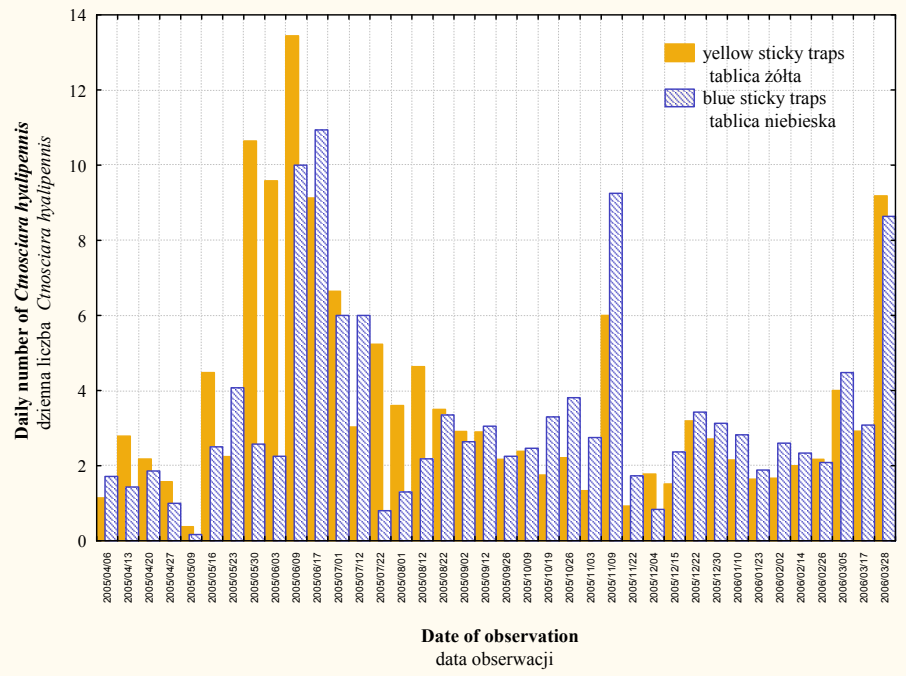

Fig. 3. Daily number of Ctenosciara hyalipennis (Meigen) caught on one trap in the season I (Lublin. 2005–2006)
Ryc. 3. Dzienna liczba odłowionych osobników Ctenosciara hyalipennis (Meigen) na jednej barwnej tablicy lepowej w sezonie I (Lublin. 2005–2006)

Median for the number of *C. hyalipennis* caught on yellow sticky traps during season I was 2.75 specimens (tab. 2, fig. 5). The insects were the least numerous in the first decade of May (0.38 specimens/1 trap) and in the third decade of November, 2005 (0.92 specimens/1 trap). The maximum number of this species was observed from the third decade of May to the second decade of June, 2005 and in the third decade of March, 2006. A daily number of specimens per one trap during this time reached 9.13 to 13.4 (fig. 3).

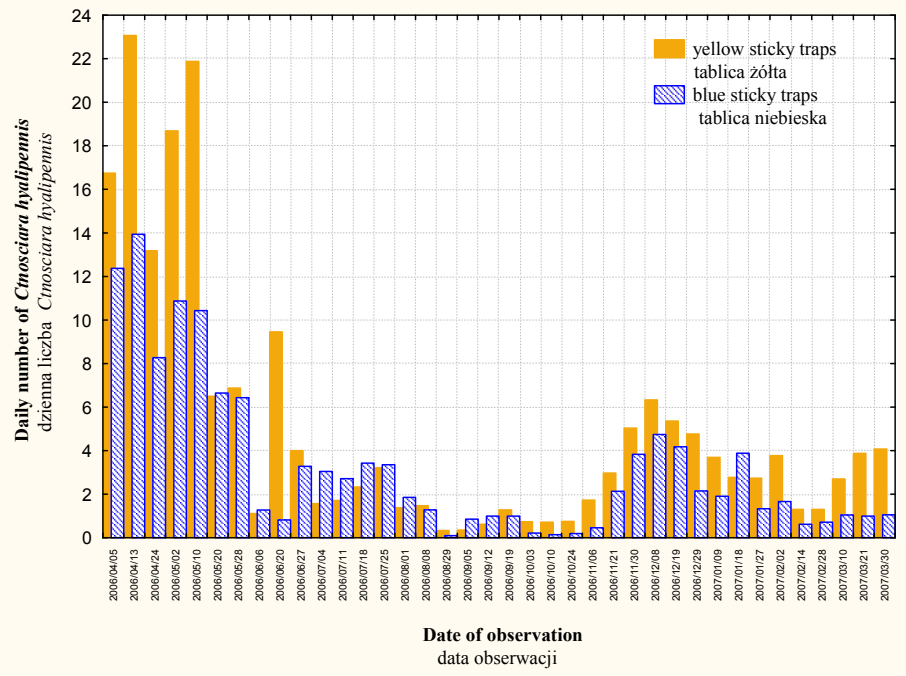

Fig. 4. Daily number of Ctenosciara hyalipennis (Meigen) caught on one trap in the season II (Lublin, 2006–2007)

Ryc. 4. Dzienna liczba odłowionych osobników Ctenosciara hyalipennis (Meigen) na jednej barwnej tablicy lepowej w sezonie I (Lublin, 2006–2007)

A mean number of *C. hyalipennis* caught during one day on blue sticky traps was 2.59 specimens per one trap (tab. 2). The smallest populations of this insects species were observed in the first decade of May (0.17 specimens/1 trap), third decade of July (0.8 specimens/1 trap) and first decade of December (0.83 specimens/1 trap), 2005. The pest was most abundant in the first and second decade of June, 2005 when daily readings from traps were 10.00 and 10.94 specimens/trap respectively as well as in the first decade of November, 2005 (9.25 specimens/trap) and in the third decade of March, 2006 (fig. 3). According to the observations carried out by Fiedler and Sosnowska [2002] in the Palm House in Poznań, pest population peaked only twice. Similar to the

present study the first of them fell in the period May – June, the second a bit earlier – in September. The authors did not record numerous pests during early spring, which, on the contrary, was observed in March in a greenhouse in Lublin.

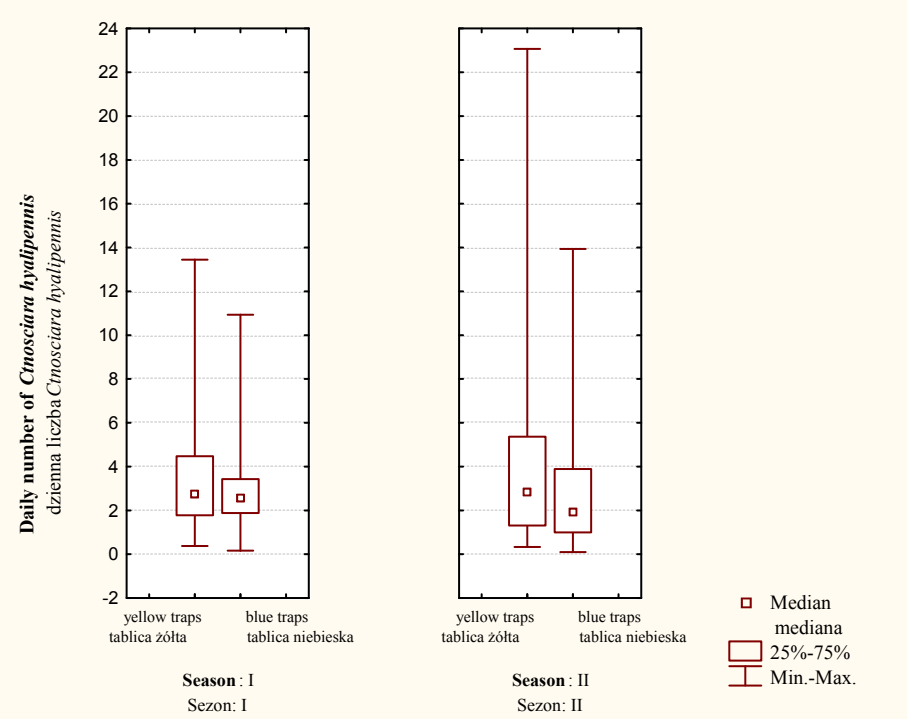

Fig. 5. Distribution of average daily number of Ctenosciara hyalipennis (Meigen) caught on colored sticky traps during the season I and season II (Lublin, 2005–2007)

Ryc. 5. Rozkład dziennej liczby osobników Ctenosciara hyalipennis (Meigen) odłowionych na barwnych tablicach w I i II sezonie (Lublin, 2005–2007)

The analysis of data recorded for season II with the use of Wilcoxon test resulted in the rejection of the hypothesis that assumed a normal distribution of daily number of the insects caught on yellow and blue traps. Significant differences in daily number of this species caught for one trap were found both for the yellow and blue trap ($p = 0.000199$). The range of variation of the daily number of the captured *C. hyalipennis* was higher for yellow traps and reached higher values. Quartiles 0.25 and 0.75 were 1.31 and 5.36 for yellow traps and 1.00 and 3.89 for blue traps respectively, indicating higher efficiency in the case of yellow traps (fig. 5). According to the statistical analysis, the median of these insects recorded for season II was in the case of yellow traps higher by c.a. 1 specimen comparing to blue traps (tab. 2).

During season II, a mean number of 2.88 specimens per yellow sticky trap was caught (tab. 2). The insects caught on yellow traps were least abundant from the end of third decade of August to the end of third decade of October, 2006. A daily number of the caught insects ranged from 0.33 to 0.75 specimens per trap. The maximum number of *C. hyalipennis* was observed from the beginning of season II to the end of first decade of May, 2006. A daily number of specimens per one trap during this time was 23 specimens (fig. 4). A mean number of this species caught during one day on blue sticky traps was 1.88 specimens per one trap (tab. 2). The smallest populations of *C. hyalipennis* (less than 1 specimen per trap) were observed from the end of third decade of August to the first decade of November, 2006 and from the second decade to the end of third decade of February, 2007 (fig. 4).

CONCLUSIONS

1. Due to the specificity of *C. hyalipennis* biology, coloured sticky traps are a useful tool for monitoring their occurrence and abundance in greenhouse production. The use of coloured sticky traps can significantly reduce the number of this species colonizing greenhouses.

2. *C. hyalipennis* pose a particular threat to the crops under cover in the spring, when their abundance is the highest. The use of coloured sticky traps at this time is an effective and easy to use method of early pest population control.

3. It was found that, despite common recommendations for monitoring sciarid flies with both yellow or blue sticky traps, yellow ones are more effective in capturing adult specimens.

4. Blue sticky traps can be also used to monitor the *C. hyalipennis* population in greenhouses production where biological control program is applied.

REFERENCES

Baranowski T., Górski R., 1991. Przydatność kolorowych tablic w ochronie roślin szklarniowych przed szkodnikami. In: Materiały 31 Sesji Naukowej IOR. 2, 39–43.

Baranowski T., Górski R., 1992. Kolorowe bioindykatory w ochronie roślin szklarniowych (ozdobnych) przed szkodnikami. Ochr. Rośl. 1, 10–11.

Binns E.S., 1973. Laboratory rearing, biology and chemical control of the mushroom sciarid *Lycoriella auripila* (Diptera: Sciaridae). Ann. Appl. Biol. 73, 119–126.

Cantelo W.W., 1979. *Lycoriella mali* control in mushroom compost by incorporation of insecticides into compost. J. Econ. Entomol. 72, 703–705.

Dowell, R.V., Cherry R.H.. 1981. Survey traps for parasitoids, and coccinellid predators of the citrus blackfly, *Aleurocanthus woglumi.* EntomoI. Exp. Appl. 29, 356–362.

Fiedler Ż., Sosnowska D., 2002. Barwne tablice chwytne w monitorowaniu liczebności szkodników roślin ozdobnych w Palmiarnii Poznańskiej. Progr. Plant Prot. 42 (2), 424–426.

Gauge D.H., Hague G.M., 1995. Glasshouse control of fungus gnats, *Bradysia paupera*, on fuchsias by *Steinernema feltiae*. Fundam. Appl. Nematol. 18, 77–80.

Geels F.P., Rutjens A.J., 1992. Bendiocarb and diflubenzuron as substitute insecticides for endosulfan in comercial mushroom growing. Ann. Appl. Biol. 120, 215–224.

Gillespie D.R., Quiring D.J.M., 1987. Yellow sticky traps for detecting and monitoring greenhouse whitefly (*Homoptera*: *Aleyrodidae*) adults on greenhouse tomato crops. J. Econ. Entomol. 80 (3), 675–679.

Górski R., 1999. Monitorowanie szkodników roślin szklarniowych. Progr. Plant Prot. 39 (1), 321–325.

Górski R., 2001. Barwne pułapki chwytne w monitorowaniu szkodników roślin szklarniowych. Rocz. AR Pozn. Rozpr. Nauk. 310, 3–108.

Górski R., 2005a. Effectiveness of natural essential oils added to blue sticky in the monitoring of the occurrence of Sciarid Flies (*Sciaridae*). Rocz. AR Pozn. 370, Ogrodn. 39, 27–32.

Górski R., 2005b. Effectiveness of atural oils in monitoring of the occurrence of pea leafminer (*Liriomyza Huidobrensis* Blanchard) in gerbera crop. J. Plant Protection Res. 45 (4), 287–291.

Hoelmer K.A., Roltsch W.J., Chu C.C., Henneberry T.J., 1998. Selectivity of whitefly traps in cotton for *Eretmocerus Eremicus* (Hymenoptera: Aphelinidae), a native parasitoid of *Bemisia Argentifolii* (Homoptera: Aleyrodidae). Environ. Entomol. 27 (4), 1039–1044.

Lewandowski M., Sznyk A., Bednarek A., 2004. Biology and morphometry of *Lycoriella ingenua* (Diptera: Sciaridae). Biol. Lett. 41 (1), 41–50.

Mead F.W., Fasulo T.R., 2001. Darkwinged fungus gnats, *Bradysia* spp. (Insecta: Diptera: Sciaridae). http://edis.ifas.ufl.edu/in372

Pniak M., 2003. Monitoring szkodników roślin w szklarniach. http://www.ho.haslo.pl/article.php?id=1153

Scheepmaker J.W.A., Geels F.P., Van Griensven L.J.L.D., Smits P.H., 1995. Control of the mushroom sciarid (*Lycoriella auripila*) and the mushroom phorid (*Megaselia halterata*) by entomopathogenic nematodes. Mush. Sci. 14, 491–498.

Shipp J.L., Zariffa N., 1991. Spatial patterns of and sampling methods for western flower thrips (Thysanoptera: Thripidae) on greenhouse sweet pepper. Can. Entomol. 123, 989–1000.

Taylor D., Francis K., 2003. Control of sciarid flies with *Steinernema feltiae* in poinsettia cutting production. Intern. J. Pest Manag. 49, 95–103.

White P.F., 1986. Effects of bendiocarb and diflubenzuron on mushroom cropping. Ann. Appl. Biol. 108, 11–20.

White P.F, Smith J. E., Menzel F., 2000. Distribution of Sciaridae (Dipt.) species infesting commercial mushroom farms in Britain. *Entomologist's Mon. Mag.* 136, 207–209.

Yano E., 1987. Quantitative monitoring techniques for the greenhouse whitefly. Bull. Oilb-Srop. 10 (2), 198–202.

EFEKTYWNOŚĆ BARWNYCH TABLIC LEPOWYCH W MONITOROWANIU LICZEBNOŚCI *Ctenosciara hyalipennis* (Meigen, 1804) (Diptera: *Sciaridae*)

Streszczenie. Barwne tablice lepowe są jedną z ważniejszych metod monitorowania liczebności szkodników szklarniowych. Pozwalają określić odpowiedni czas rozpoczęcia zwalczania fitofagów, umożliwiają ocenę efektywności przeprowadzonych zabiegów oraz ograniczają ich liczebność. Badania prowadzono w szklarni Ogrodu Botanicznego Uniwersytetu Marii Curie-Skłodowskiej w Lublinie, gdzie na powierzchni 270 m^2 rośnie kilkadziesiąt gatunków roślin egzotycznych. Owady monitorowano w okresie od 30.03.2005 do 30.03.2007. W pracy określono dynamikę liczebności populacji *Ctenosciara hyalipennis* (Meigen) oraz skuteczność dwóch rodzajów tablic lepowych w monitorowaniu liczebności szkodnika. W wyniku badań odłowiono ogółem 12 263 osobniki ziemiórki szklar-

nianki. Owady te najliczniej obserwowano na tablicach żółtych (7915 osobników). W czasie całego okresu badawczego wykazano występowanie istotnych różnic pomiędzy dzienną liczbą osobników *C. hyalipennis* odłowionych na obu rodzajach tablic. W I sezonie badań (30.03.2005–28.03.2006) przeciętnie w ciągu jednego dnia na tablicy żółtej i niebieskiej odłowiono odpowiednio 2,75 i 2,59 osobników ziemiórek na jedną tablicę. W tym okresie maksimum liczebności odnotowano od trzeciej dekady maja do końca drugiej dekady czerwca 2005 r. oraz w trzeciej dekadzie marca 2006 r. W II sezonie badań (28.03.2006–30.03.2007) przeciętnie w ciągu jednego dnia odłowiono 2,52 osobniki *C. hyalipennis* na jedną tablicę. Maksimum liczebności tego gatunku obserwowano od początku drugiego sezonu badań do końca pierwszej dekady maja 2006 r. Na tablicach niebieskich przeciętna liczba odłowionych osobników ziemiórki szklarnianki notowana w ciągu dnia na jednej tablicy wyniosła 1,88 osobnika. W pracy udowodniono zastosowanie barwnych tablic lepowych, jako dobrego narzędzia do monitorowania występowania i liczebności ziemiórek w uprawach szklarniowych. Wykazano wyższą skuteczność tablic żółtych w monitorowaniu i odławianiu dorosłych osobników ziemiórki szklarnianki. Jednakże tablice niebieskie mogą mieć zastosowanie w szklarniach, gdzie stosowana jest walka biologiczna, ponieważ jak wskazuje piśmiennictwo w większym stopniu chronią organizmy pożyteczne.

Słowa kluczowe: *Ctenosciara hyalipennis*, ziemiórka szklarnianka, *sciaridae*, szklarnie, tablice lepowe, rośliny egzotyczne, monitorowanie

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