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FLIGHT DYNAMICS OF *OSTRINIA NUBILALIS* HBN. (LEP., CRAMBIDAE) BASED ON THE LIGHT AND PHEROMONE TRAP CATCHES IN NIENADÓWKA (SOUTH-EASTERN POLAND) IN 2006–2008

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Abstract: The experiment was conducted in the 2006–2008 time period, in Nienadówka near Rzeszów, Poland (50°11′ N, 22°06′ E). The high suitability of light traps for the monitoring of *Ostrinia nubilalis* Hbn. moth flights on maize fields was shown. These light traps were compared to the pheromone types of traps; the "delta" model, and the "funnel" with a pheromone dispenser containing Z–11–tetradecenyl acetate (series ONC036A and ONC048A/107). In the light trap, the first moths were found in the second decade or third decade of June. The population peak was in the first decade or second decade of July, and the end of the flight in August. In September 2007 and 2008, single *O. nubilalis* moths collected in the light trap indicated the presence of a small second pest generation. The first male moths were captured in the pheromone traps in the third decade of June or the first decade of July, with a slightly marked population peak in the first or second decade of July. The moth flight ended in the last decade of July.
The first egg clusters of *O. nubilalis* were usually recorded 4–7 days after the first moths were found in the light trap. In the pheromone traps, the first male *O. nubilalis* individuals were usually found a few days following the oviposition of the first pest egg clusters, except in 2006, when the moths presence was observed in the field 2–3 days before the first eggs were found on maize plants.

Key words: *Ostrinia nubilalis* Hbn., light trap, pheromone trap, moths, dynamics, sex ratio

INTRODUCTION

The European corn borer (ECB) (*Ostrinia nubilalis* Hbn.) has been observed on maize (*Zea mays* L.) in Poland since the 1950s (Kania 1962a, b). By the end of 2008, this pest was present in 14 out of 16 Polish provinces and it continues to spread northwards (Bereś and Konefał 2010). Presently ECB is considered one of the most serious maize pests in Poland (Lisowicz 2001; Wałkowski and Bubniewicz 2004; Żołnierz and Hurej 2005; Bereś and Pruszyński 2008). In many regions with intense maize cultivation, especially southern Poland, ECB caterpillars damage from 50 to 80%, and sometimes up to 100% of plants, causing a 30–40% loss in maize grain yield (Lisowicz and Tekiela 2004).

Special agronomical and crop production methods are used for the control of the ECB. These methods include the cultivation of varieties less susceptible to damage, or the use of biological and chemical treatments (Bereś and Pruszyński 2008). In addition, since 2006 farmers in southern Poland have been growing transgenic maize, MON 810, synthesizing Cry1Ab protein, which is almost 100% resistant to damage caused by this pest (Haliniarz and Bojarczyk 2007; Bereś 2010).

The use of chemical treatments is another method form of maize protection against *O. nubilalis* (Lisowicz and Tekiela 2004). The introduction of biological preparations containing *Trichogramma* spp. is a considerably less popular method of controlling the population and harmfulness of ECB caterpillars in Poland.

In chemical and biological methods, particular importance is attributed to the timing of insecticide application and introduction of biopreparation on the field, as this determines the efficiency of control and the economic profitability of maize protection (Bereś 2007). For chemical control methods, plants should be sprayed at the time of mass caterpillar hatching. *Trichogramma* spp. parasitoids should be introduced when the first pest egg clusters occur (Bereś *et al*. 2007).

Information on the biology of the ECB, particularly concerning the dates of occurrence of individual developmental stages, is crucial for the optimal timing of biological treatment or chemical control. Several methods are used for monitoring pests in maize fields and identification of the optimal period of pest control. These include the observation of maize developmental stages, the use of pheromone traps and light traps for luring moths, and

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observation of plants with a focus on the first egg clusters (Bereś *et al*. 2007).

The objective of this study was to evaluate the suitability of the light trap and pheromone traps for the monitoring of ECB moth flights on maize fields, in order to know the optimal timing of pest control.

MATERIALS AND METHODS

The experiment was conducted on maize fields on a private farm located in Nienadówka, near Rzeszów, Poland (50°11′ N, 22°06′ E), in the 2006–2008 time period. The two experimental fields were about 1 km apart, had the same soil, and were under similar climate conditions. Maize was cultivated in a crop-rotation system. In 2006, the monitoring was carried out on the maize variety LG3226 (FAO 250), while in 2007–2008 on the Moncada variety (FAO 260).

A light trap was installed on the field with access to the power grid, while pheromone traps were installed on another field.

Light trap

The light trap used for the experiment had a 250 W mercury bulb and an inbuilt time programmer. The trap was located in the maize field at a 15-meter distance from the field's edge. A plastic container (with a bottom tank containing ethyl acetate or chloroform, covered with a fine net) was attached to the edge of the lamp to collect trapped insects. The light trap was switched on 2–3 times a week starting in mid-June between 21:00 in the evening and 02:00 at night. When no more moths were found for two consecutive weeks, the lamp was only turned on twice a week. The pest population was monitored until October. If the date of capturing coincided with heavy rainfall, observations were postponed until the next day. Captured moths were identified by sex.

Pheromone traps

Two types of pheromone trap were used for capturing male *O. nubilalis*: "delta" and "funnel" traps. The pheromone traps had attractant dispensers containing Z–11–tetradecenyl acetate from AgriSense BCS Ltd., identified with the following codes: ONC036A (2006–2007) and ONC048A/107 (2008).

Both trap models were placed in the maize field at the beginning of June, 10-meters from the edge of the field. The distance between traps was about 30 meters. In total, 2 pheromone traps of each type were placed in the field. Dispensers were replaced with new ones every 3–4 weeks. Captured moths were removed from the traps three times a week and counted. Monitoring ended in September.

Maize plants were observed for the presence of the first pest egg clusters. This was an ancillary method to verify the precision of the light trap and pheromone traps in the monitoring of the *O. nubilalis* moth's presence in the maize field. In order to verify the precision, observations and analysis were carried out. Starting from the first decade of June, 100 consecutive plants in each of the four places of cultivation (400 plants in total) were analysed three times a week, by searching for egg clusters. Observations ended when the first egg cluster was found.

RESULTS

General information on average daily air temperature, precipitation level, and the number of rainy and windy days (wind speed over 6 m/s) in individual ten-day periods having a potential effect on the flight dynamics of *O. nubilalis* moths is presented in table 1. Detailed changes in daily air temperature and precipitation on the light trap monitoring days are presented in figures 2, 4 and 6.

Between mid-June and mid-August, 2006, the temperature was relatively stable. The highest temperatures were in the last 10 dayss of July. In addition, the number of rainy days in July was relatively low in comparison to other study years, which in combination with high temperatures facilitated moth flights.

In 2007, major weather parameters varied significantly. Rainfall occurred from June to mid-September, and it was the most intense in the first decade of July (40.0 mm), the second decade of August (51.1 mm) and the first decade of September (115.6 mm). Also, temperature varied during the moth flights: between June and September the average air temperature varied from 12.0 to 21.8°C.

In 2008, in the Podkarpackie province, there was a high level of precipitation and moderate temperatures. The highest level of precipitation during moth flights was recorded in July (117.6 mm) and September (103.2 mm). Temperatures varied but they were lower than in the previous years, with July and August being the warmest months.

In the analysed three-year period, the most favourable weather conditions for ECB moth flights were recorded in 2006.

Flight dynamics of the European corn borer moths based on the light trap catches

Weather conditions in 2006 were favourable for ECB moth flights (Fig. 2). That year 2,375 moths were captured in the light trap, of which 39.5% (937) were male and 60.5% (1,438) female.

The first six moths, males were captured on 29 June, when maize was at BBCH 33–34 developmental stages (Adamczewski and Matysiak 2002) (Fig. 1). Males dominated in the moths collected before 6 July, while the female population was larger from 8 July to the end of pest occurrence on maize. The number of captured moths substantially increased after the first decade of July, with a peak on 10 July (337) when plants were at growth stage BBCH 51. Between 12 and 17 July the number of captured moths was comparable (273 to 285). In the second decade of July, a visible decrease in catches took place. The last two male and three female moths were captured on 14 August, when maize was at growth stage BBCH 75. In 2006, the peak in the population of *O. nubilalis* moths on maize was observed between 6 July, when plants were at stage 51, and 20 July – at plant stages BBCH 59–61 (Fig. 1).

In 2007, weather conditions were less favourable for moth flights demonstrated on a slight decrease in the

Table 1. Weather conditions in Nienadówka in 2006–2008

Month	Decade	Daily average air temperature [°C]			Precipitation [mm]			Number of days with precipitation			Number of windy days (average wind speed over 6 m/s)		
		2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
June	I	11.5	18.6	17.9	37.1	28.4	1.4	6	3	1	4	1	3
	II	18.0	20.4	16.2	6.7	13.7	40.0	1	4	3	1	3	2
	III	21.3	17.7	19.7	47.4	28.4	45.3	5	6	6	2	6	5
	monthly average/sum	16.9	18.9	17.9	91.2	70.5	86.7	12	13	10	7	10	10
July	I	18.8	17.5	17.8	2.7	40.0	35.9	1	7	5	2	6	6
	II	20.5	21.8	19.2	7.6	19.3	43.3	3	3	4	4	5	3
	III	23.2	20.4	19.0	5.6	14.3	38.4	3	4	5	2	8	4
	monthly average/sum	20.8	19.9	18.6	15.9	73.6	117.6	7	14	14	8	19	13
August	I	19.2	18.2	19.6	31.0	36.8	21.2	6	5	3	2	1	5
	II	19.7	19.3	19.9	29.8	51.1	18.2	8	5	3	4	2	5
	III	16.2	19.5	17.3	42.7	0.0	15.9	7	0	4	6	3	4
	monthly average/sum	18.3	19.0	18.9	103.5	87.9	55.3	21	10	10	12	6	14
September	I	16.0	12.8	19.3	22.1	115.6	5.0	4	8	2	7	7	6
	II	15.7	12.0	9.0	1.3	18.5	84.1	1	4	9	1	7	3
	III	13.3	12.7	10.7	1.2	7.6	14.1	1	2	4	1	3	2
	monthly average/sum	15.0	12.5	13.0	24.6	141.7	103.2	6	14	15	9	17	11
October	I	13.8	10.3	9.9	1.4	19.7	39.4	2	4	5	1	0	2
	II	8.7	6.6	11.0	2.9	8.4	10.7	1	4	4	4	4	4
	III	10.5	6.8	8.3	20.1	12.0	5.9	3	6	2	10	3	6
	monthly average/sum	11.0	7.9	9.7	24.4	40.1	56.0	6	14	11	15	7	12

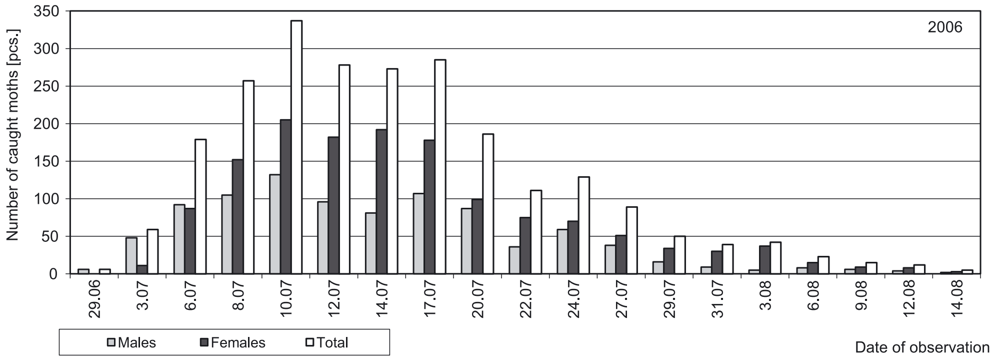

Fig. 1. Flight dynamics of *O. nubilalis* moths indicated by the light trap catches in 2006

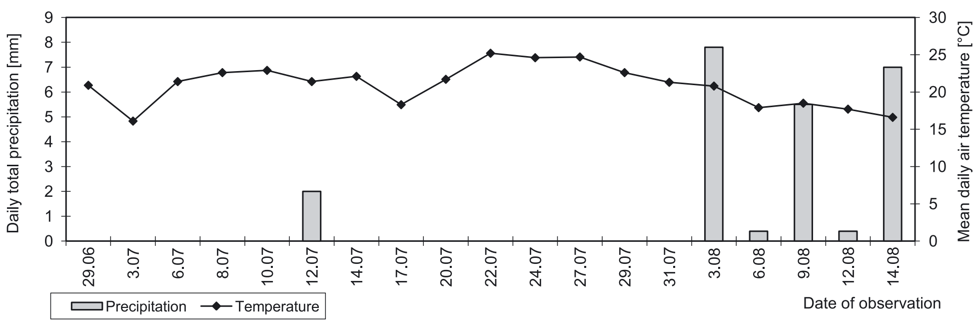

Fig. 2. Daily precipitation and average daily air temperature during the months which *O. nubilalis* moths were caught in 2006

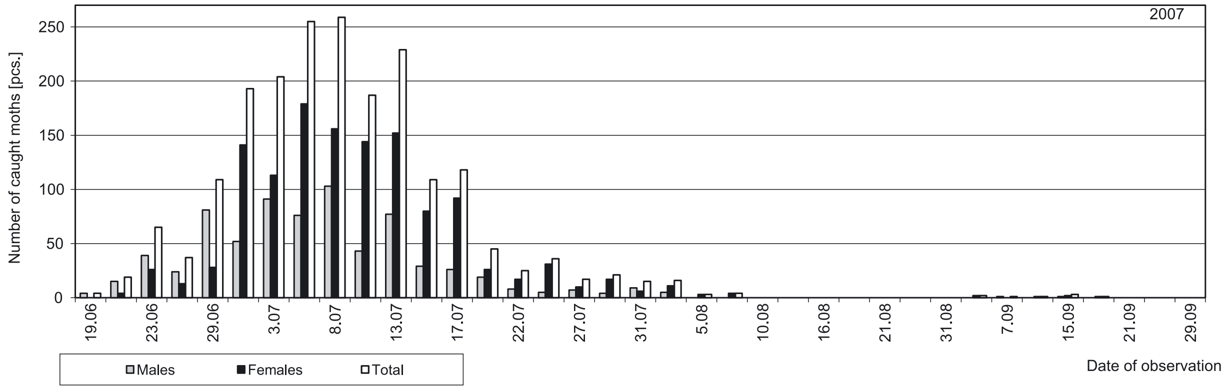

Fig. 3. Flight dynamics of *O. nubilalis* moths indicated by the light trap catches in 2007

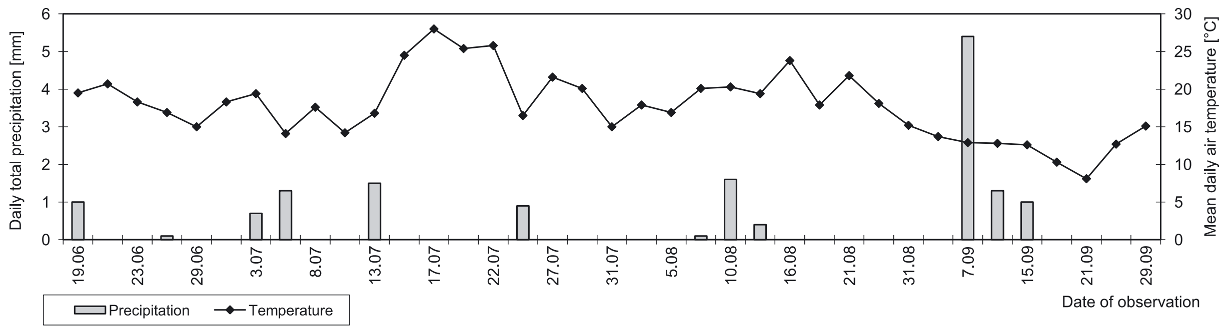

Fig. 4. Daily precipitation and average daily air temperature during months when *O. nubilalis* moths were caught in 2007

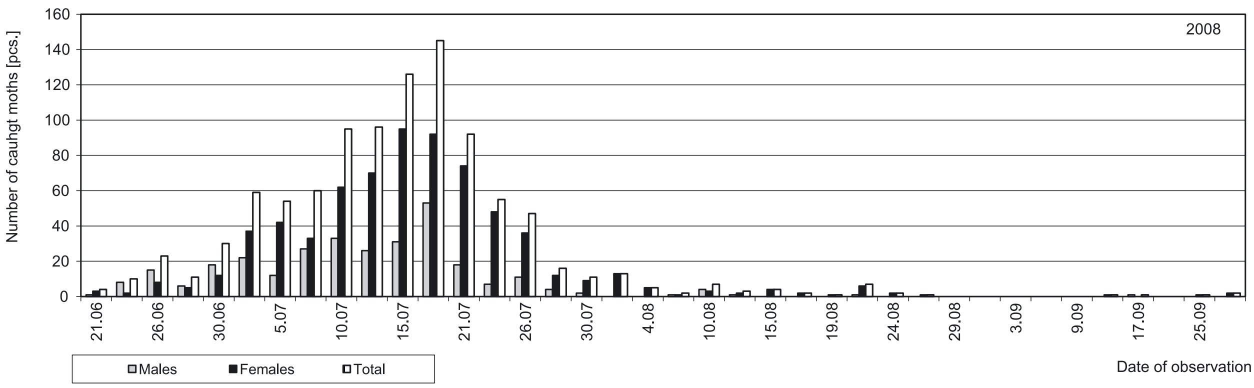

Fig. 5. Flight dynamics of *O. nubilalis* moths indicated by the light trap catches in 2008

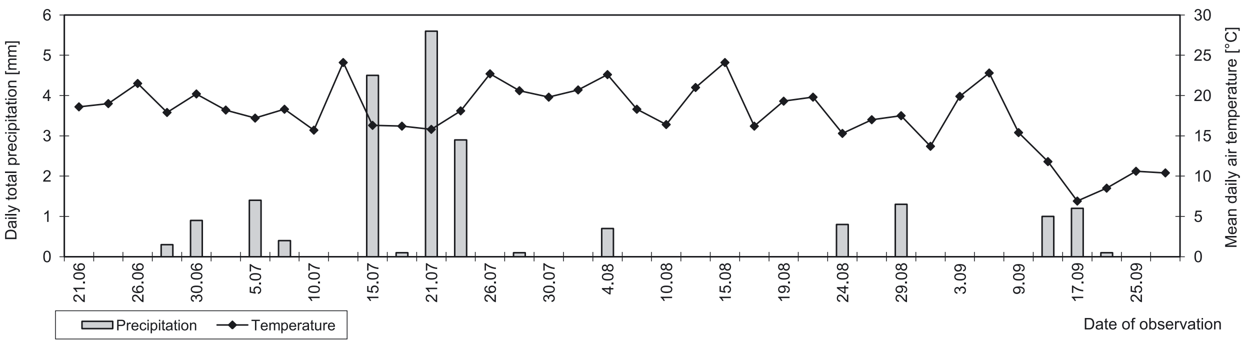

Fig. 6. Daily precipitation and average daily air temperature during the months when *O. nubilalis* moths were caught in 2008

moth population in comparison to 2006 (Fig. 4). In 2007, the light trap captured 1,978 moths, of which 36.3% (719) were male and 63.7% (1259) were female.

In 2007 the first four moths were captured at the earliest date in the analysed three-year period, *i.e.* on 19 June at maize stage BBCH 31 (Fig. 3). As in the year before, males occurred first and their population was significantly larger than that of females until 29 June. After that date, a high number of flying females dominated the population of the captured insects until the end of the observation. Initially, the moth flight was not very dynamic and this was affected by weather conditions. A clear increase in the pest population occurred as late as at the end of June. The peak of the captured moth population (259) was recorded on 8 July, when plants were at stage 55. The highest number of moths in the light trap was observed between 1 and 13 July, which was followed by a clear decrease in the population. The last four females were captured on 8 August, when maize was at stage 71–73.

On 2 September, when maize was at BBCH 83, two females moths of European corn borer were found again inside the light trap. During the next few days 6 more moths were captured (2 male and 4 female). Finally, *O. nubilalis* moth flight to the light trap ended on 19 September, at maize stage BBCH 85.

In 2008, there was a significant decrease in the population of ECB moths on the maize field, which was associated with prolonged rainfall and relatively low temperatures during the flight (Fig. 6). That year, only 986 moths were captured, of which 30.6% (302) were male and 69.4% (684) female.

In 2008, the first four ECB moths were captured in the light trap on 21 June (at plant stage BBCH 31–32) (Fig. 5). Males and females occurred at the same time. On that day 1 male and 3 females were captured. The population of male moths was larger than that of females for a very short time; between 24 and 30 June. The moth flight on the maize plants was at a low level but regular, which was potentially affected by unfavourable weather conditions. After 2 July 2008, a clear increase in the number of flying moths was observed. The peak in the number of moths caught in the light trap, observed on 18 July, at maize BBCH 55–61, as in the previous years, included predominating females. After that period, a gradual decrease in the number of captured moths was observed. The population of collected moths was largest between 10 and 21 July 2008. Due to unsuitable weather conditions in 2008, the moth flight was prolonged. The last individual (female) was found in the trap on 25 August, when maize was at stage BBCH 75.

Starting from 12 September 2008, maize plants were at the ripening dough stage (BBCH 85), *O. nubilalis* moths were once again found in the light trap, and their flight ended on 28 September. During that period, five individuals (4 female and 1 male) were captured.

Flight dynamics of European corn borer males based on pheromone trap catches

In 2006, the first male *O. nubilalis* was found in the "delta" trap on 3 July, only a few days later than in the light trap. In the "funnel" trap the first ECB moth was found later – on 8 July (Fig. 7). In 2006, in the "delta" trap, two peaks of the male population were observed on 8 and 12 July (6 individuals each time), while the last male was captured on 24 July. In the "funnel" trap, the peak in the male population (4 moths) was on 12 July, and the last male was caught on 22 July.

In total, in both pheromone traps, one male population peak was observed on 12 July, when plants were at stage BBCH 51. The flight of male moths observed in the pheromone traps was short, and the number of captured moths was significantly lower than observed in the light trap. In total, in 2006, the "delta" traps lured 24 *O. nubilalis* individuals and only 13 male ECB were captured in the "funnel" traps.

In 2007, the first *O. nubilalis* male was caught in the "delta" trap on 27 June, i.e. 8 days later than in the light trap (Fig. 8). During the next few days, no insects were found in this type of trap until 3 July, when 2 moths were captured in the "delta" trap. The maximum number of captured males took place on 8 July, which coincided with the maximum number of moths in the light trap. During that period, only 3 ECB individuals were captured. The flight of male *O. nubilalis* to the "delta" trap ended on 25 July. A total of 12 moths were captured in this type of trap in 2007.

In 2007, the first moth was found in the "funnel" trap on 29 June. The maximum number of males was caught on 3 July when plants were at growth stages BBCH 53–55. On that day, 5 individuals were captured. The flight of *O. nubilalis* male moths to the "funnel" trap ended on 20 July. In total, 16 ECB males were captured in the "funnel" traps in 2007.

Based on the catches in both types of pheromone traps, the population peak for male *O. nubilalis* on the maize field was on 3 July; this was 5 days earlier than the date for the light trap.

In 2008, as in previous years, the first *O. nubilalis* male moth was captured in the "delta" trap in the third decade of June (Fig. 9). The signalled date of pest occurrence in the field was almost 7 days later than the date indicated by the light trap. Due to weather conditions the moth flight to the "delta" trap was irregular. The highest number of male ECB in the "delta" trap (3 moths) was observed on 2 July, and the last male was captured on 24 July.

In the "funnel" trap the first male ECB was found on 30 June. The highest number of individuals (2) was observed on 5 July and the last moth was captured on 18 July.

Monitoring carried out in 2008 using pheromone traps, indicated that *O. nubilalis* males were present in the maize field between 28 June and 24 July. There were two peaks in their population during the flight: the first on 2 July and the second on 18 July. The second peak in the number of moths coincided with the peak for the adult population observed with the use of the light trap.

In 2008, both types of pheromone traps demonstrated very low suitability for capturing European corn borer moths. In total, 9 males were captured in the "delta" traps and 7 in the "funnel" trap.

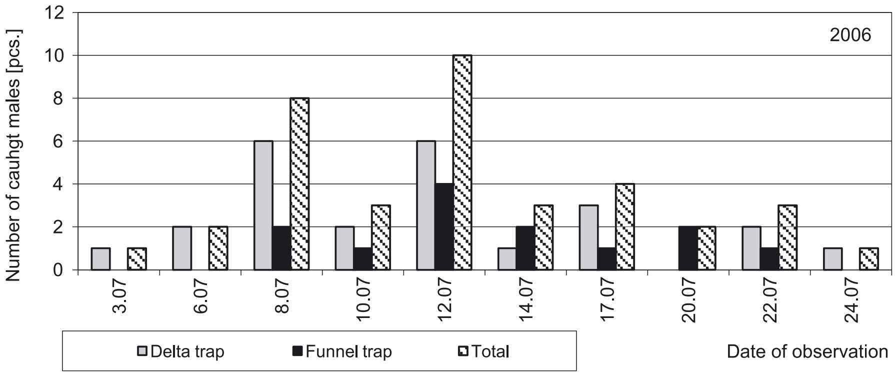

Fig. 7. Flight dynamics of *O. nubilalis* males shown by catches in the pheromone traps in 2006

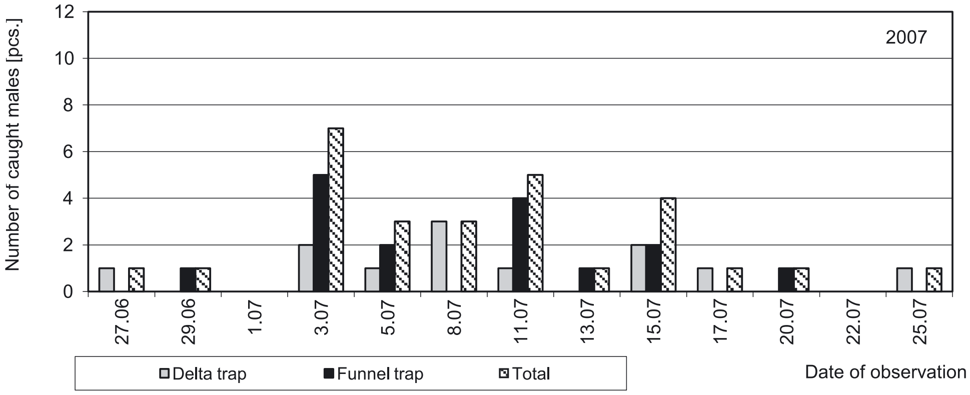

Fig. 8. Flight dynamics of *O. nubilalis* males based on the pheromone traps catches in 2007

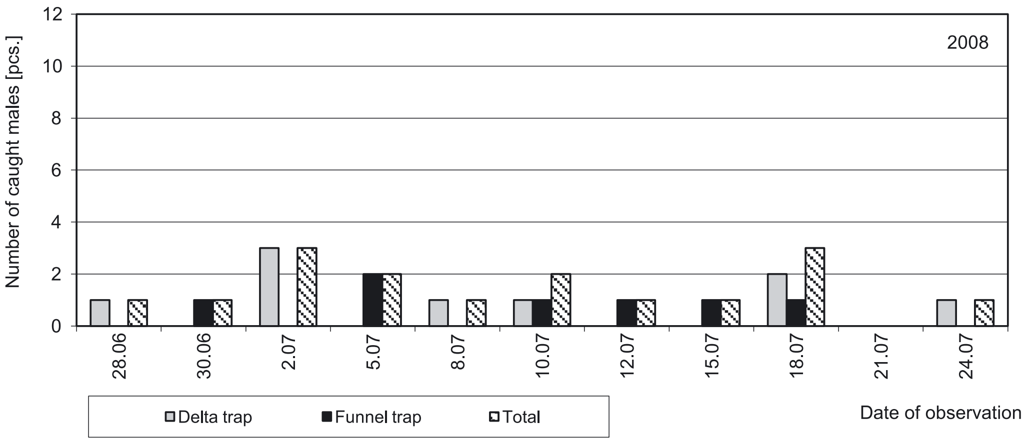

Fig. 9. Flight dynamics of *O. nubilalis* males based on the pheromone traps catches in 2008

The first egg clusters of *O. nubilalis* on maize plants

In 2006, the first two egg clusters from the 400 analysed plants were found on 5 July (maize stage BBCH 33–34) in the maize field monitored for the occurrence of ECB males using pheromone traps. The first pest egg clusters were found two days after the first male ECB were caught in the "delta" trap and three days after the first male was found in the "funnel" trap. The light trap indicated pest occurrence almost 7 days before the first egg cluster was found.

In 2007, the first egg cluster of *O. nubilalis* was recorded on plants on 23 June, at maize stages BBCH 31–32. The first egg clusters were noted 4 days before the insects were found in the "delta" trap and 6 days before the insects were found in the "funnel" trap, which indicated the presence of male ECB in the field. The light trap signalled pest occurrence in the field 4 days in advance.

In 2008, the first two egg clusters on 400 analysed plants were found on 24 June, at plant stages BBCH 31–32. Like the year before, the first egg clusters occurred 4 and 6 days earlier than the date of the pest flights indicated by the "delta" and "funnel" traps, respectively. The light trap signalled moth presence in the maize field 4 days before the first egg clusters were found.

DISCUSSION

The identification of the optimal timing for the control of the European corn borer is a prerequisite for its effectiveness. According to Jansens *et al*. (1997), ECB larvae are exposed to insecticides or natural enemies only for a short period before they start to gnaw into the plants. Also, in the biological control method, the introduction of preparations containing *Trichogramma* spp. must be closely synchronised with the presence of pest eggs newly deposited on plants (Bereś 2007). Wiąckowska (1995) reported that *Trichogramma* only attack newly deposited eggs in which advanced embryo development has not begun.

Because the optimal time for biological and chemical methods to control *O. nubilalis* is limited, the monitoring of pest occurrence in maize fields is of key importance for the identification of the optimal timing for treatment with insecticide or the introduction of biopreparations.

A popular method still used for identification of the treatment date to control the ECB, is based on the monitoring of maize growth stages. The treatment date should be carried out between the development of tassels but before pollination (Bereś *et al*. 2007). This method, however, is biased with a large error. Such factors as maize: sowing date, variety earliness, cultivation method (monoculture, crop rotation, non-ploughing tillage systems) or the effect of weather conditions on pest and crop growth are not taken into account. Therefore, other methods need to be used which are based on observations of the individual developmental stages of *O. nubilalis* on a maize field. For such purposes, light traps or pheromone traps for capturing moths are used, or plants are analysed for the presence of pest egg clusters (Bereś *et al*. 2007). Observation of moth flights on the maize fields using pheromone traps, and less frequently using light traps, are the most popular methods as they are the least labour-consuming.

In this study, we analysed the suitability of pheromone traps and light traps, widely available on the Polish market, for the monitoring of *O. nubilalis* moth flights on maize fields. The obtained results were compared to the dates when the pest's first egg clusters were oviposited on maize plants.

In the three-year studies on the use of the light trap, the first ECB moths were found in the trap at the end of the second decade and in the third decade of June. The date of their flight on maize fields was similar to that observed in south-western Poland by Żołnierz and Hurej (2007). These authors found the first *O. nubilalis* moths in light traps from the second decade of June. Conversely, Kania (1961), in a study carried out near Wrocław, observed the first ECB moths in the third decade of June and the first decade of July, while Pieprzyk and Romankow (1960) found the first flying ECB individuals in Oleśnica Mała in the first decade of July.

In our study, the maximum number of *O. nubilalis* moths in light traps was recorded in the first (2006–2007) and second (2008) decade of July. Also, Kania (1961) and Żołnierz and Hurej (2007) recorded the maximum number of ECB moths in light traps, in that same period. Only Pieprzyk and Romankow (1960) found the highest number of moths at the end of July and at the beginning of August.

The last moths in the light trap were captured in August which is consistent with observations by Kania (1961). In addition, in 2007–2008, the second ECB moth flight on the maize field was observed in September. This was also recorded in 2006 by Żołnierz and Hurej (2007), who suggested there was a presence of second-generation ECB moths.

Moreover, in our studies we observed that the duration of the *O. nubilalis* moth flight to the light trap was correlated with changes in weather conditions. In 2006 and 2007, when weather conditions were favourable for the flight, the pest was no longer present in the first decade of August or at the beginning of the second decade of August (except for the second flight in 2007). However, in the rainy year 2008, the major flight of *O. nubilalis* finished late, at the end of August.

A similar correlation was found by Kania (1961), who reported that in relatively cold periods with low precipitation, European corn borer flight was the longest. Flight was slightly shorter in warm and rainy periods, and shortest during hot and drought weather.

In our studies, the first moths found in the light trap were usually male. After a few days, females flew in. The number of females remained high until the end of pest occurrence on the maize field. Females dominated among the captured insects, which was also confirmed by other authors like Poos (1927), Kania (1961) and Żołnierz and Hurej (2007).

Pheromone traps are one of the most popular devices in Poland for the monitoring of *O. nubilalis* moths. In our study, pheromone traps ("delta" and "funnel" models) with a pheromone dispenser containing Z–11–tetradecenyl, demonstrated low suitability for capturing male ECB.

In 2006–2008, the earliest dates that first males were captured were on 27 and 28 June (2007–2008), and latest on 3 July (2006). The number of ECB moths captured in the pheromone traps was significantly lower than the number of moths captured by the light trap, which was also confirmed in studies by Żołnierz and Hurej (2007).

Sex pheromones for attracting *O. nubilalis* are a blend of geometric 11–tetradecenyl isomer in ratios determined by the geographic distribution of moths (Kalinowá *et al*. 1994). In North America and Europe, the ECB is found in a mixed population responding to two types of optical isomers of this compound: Z–11–tetradecenyl and E–11–tetradecenyl (Kalinowá *et al*. 1994; Gemeno *et al*. 2006; Bengtsson *et al*. 2006; Laurent and Frérot 2007). Depending on the population of *O. nubilalis* present in a given area, different blends of isomers in various Z:E ratios are used to lure the moths (Pélozuelo *et al*. 2004). According to Roelofs *et al*. (1987), the behavioural response of ECB males to pheromones in various Z:E ratios is determined by the genes located on the sex chromosomes. Welling (1989) demonstrated in a study carried out in southern Germany, that almost all captured ECB moths were attracted to the pheromone traps containing the Z isomer (where Z:E ratio was 97:3), while in the northern part of Germany pheromones with the E isomer (Z:E ratio 3:97) were more effective for attracting males.

In our study, the pheromone containing Z–11–tetradecenyl acetate showed low efficiency. This probably resulted from the fact that the undivided European corn borer in south-eastern Poland represents a population race which is responsive to a different blend of pheromone than that contained in the commercial pheromone trap available on the Polish market. However, no studies on the genetic structure of *O. nubilalis* populations in different regions of Poland have been carried out so far. Thus, we are unable to specify the ratios of Z:E 11–tetradecenyl isomers that would be most effective for the monitoring of male ECB flights on maize fields.

The low suitability of the used pheromone traps for signalling the date of *O. nubilalis* occurrence was confirmed by observations on presence of the first egg clusters on plants. Substantial differences between the signalled date for flight of the first male on the maize field and the presence of the first egg clusters were demonstrated in our studies. The first egg clusters occurred after males were caught in pheromone traps took place only in 2006. In the two other years, egg clusters were found earlier, and the pheromone traps signalled the beginning of *O. nubilalis* male flight on a maize field only a few days later. Our field data indicated the low precision of pheromone traps in monitoring of the ECB population under field conditions. The reason for the low precision was because of the low sensitivity of the traps making them unreliable as a source of data on pest population. Also, Furlan and Girolami (2001) reported that pheromone traps provided data on the dynamics of the *O. nubilalis* flight. The light traps and plant observations of deposited eggs together, offer more credible information of ECB population development. Żołnierz and Hurej (2007) indicated that light traps should be preferred when establishing the optimal timing for the control of the European corn borer.

In our studies, the light trap recorded the maximum number of ECB moths in the first (2006–2007) and in the second (2008) decade of July. In the pheromone traps the maximum number of male *O. nubilalis* was recorded in the first (2006–2008) and second (2008) decade of July.

Tancik and Cagan (1998) demonstrated that in Slovakia the optimal time for chemical treatment should be an indication of the maximum number of moths captured in the light traps, or 5–8 days after one or two egg clusters are found on 100 plants. Showers et al. (1989) recommend one spraying of plants with insecticide 4 days after the peak of the moth population is recorded.

CONCLUSIONS

1. *O. nubilalis* moths were captured in the light trap, in the second and third decade of June. Their maximum number was recorded in the first and second decade of July, and the flight ended in August.
2. In September 2007 and 2008, there was a second period flight of moth followed by a low number of ECB moths on the maize field. Presumably, these were the second generation.
3. The majority of moths captured by the light trap were female and their number was higher than males in all the study years. This indicates that females were the dominant sex, or that the source of light used in the study was more attractive to females than to males.
4. In the light trap which we used, males usually occurred first, followed by females a few days later.
5. "Delta" and "funnel" pheromone traps captured the first *O. nubilslis* males in the third decade of June and in the first decade of July. The maximum number of males was recorded in the first and second decade of July, while the last individuals were recorded in the third decade of July.
6. The used pheromone traps with dispensers no. ONC036A and ONC048A/107 (Z–11– tetradecenyl acetate) demonstrated their low suitability for the monitoring of *O. nubilalis* occurrence and for signalling the dates for control treatments.
7. The low suitability of pheromone traps was confirmed by the analysis focused on the presence of the first egg clusters deposited by the ECB. The first egg clusters occurred in 2007–2008, a few days before the pheromone traps indicated the presence of moths on the field.
8. Additional studies on the suitability of other pheromone dispensers and other trap models for the monitoring of ECB occurrence on maize are necessary.

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