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DISTRIBUTION AND EFFECTS OF CHEMICAL CONTROL OF GOUT FLY (*CHLOROPS PUMILIONIS* BJERK.) ON SPRING WHEAT IN SOUTH-EASTERN POLAND

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Abstract: The research carried out in 2004 and 2006 focused on the effectiveness of chemical control of gout fly (*Chlorops pumilionis* Bjerk.), and the influence of selected insecticides used at various stages of spring wheat growth on economic results of treatments. Spring generation of gout fly caused damage from 11.4 to 60.2% of stems. The applied insecticides demonstrated effectiveness ranging from 45.5 to 100%. The wheat grain yield increased by 0.08 t/ha to 1.2 t/ha, at 9.3% on average. Slightly lower effects were achieved when insecticides were applied at the first date of pest control. Control measures applied at the second date differed more considerably with respect to their effectiveness and grain yield increase.

Key words: spring wheat, gout fly, chemical control, effectiveness

INTRODUCTION

Crop cultivars are damaged by many dangerous pests. The exposure of plants to the pest activity results in a considerable economic loss in grain yield and the decrease of its quality. Pest control is possible by correctly planned crop protection including chemical measures and crop production methods (Bubniewicz *et al.* 1993; Lipa 1999; Mrówczyński *et al.* 2004). Gout fly (*Chlorps pumilionis* Bjerk.) is one of the most harmful wheat pests, and is commonly distributed in northern and central Europe. It has been observed as one of the most important crop pests in Poland since the period between the world wars, particularly in sub-mountain regions (Simms 1937; Ruszkowski 1950; Węgorek 1972; Derron and Goy 1990; Lisowicz 2001). Poland is located in a geographical zone where good fly appearance on cultivars is more frequent

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than in other regions. In some parts of southern, south-eastern and south-western Poland this pest appears abundantly every year and is considered one of the most harmful crop pests.

The tack of measures focused on the control of good fly contributes to a substantial decrease in grain yield and flowers its quality.

The objective of this research was to evaluate the effectiveness of chemical control of spring generation of good fly using selected insecticides in spring wheat, and the influence of such control measures on grain yield.

MATERIALS AND METHODS

The research was carried out between 2004 and 2006 on the Koksa cultivar of spring wheat in Boguchwała. The experiment was performed using the random block method in four replications. Spring wheat was sown on brown, class III soil, where leguminous plants were cultivated as cover crop. Mineral fertilizers were used: N – 90 kg/ha, P_2O_5 – 75 kg/ha, K_2O – 112 kg/ha. Seeds were treated with Sarfun T 65 DS (karbendazim, tiuram) in the amount of 200 g per 100 kg of grain. Weed control in 2004 and 2006 was carried out using Chwastox Mix 292 EW (MPCA, fluroksypyr) in a dose of 2.0 l/ha, and in 2006 using the herbicide Mocarz 75 WG (dikamba, tritosulfuron) in a dose of 200 g/ha.

Good fly control was carried out sing insecticides listed in tables 1 and 2. Control measures were performed by a Solo 412 Master sprayer, using 300 litres of liquid per hectare. Pest control measures were applied twice during the vegetation season in 2004 and 2005, and in 2006 only once during the vegetation season. The first control spraying was performed after the detection of frit fly eggs (*Oscinella frit* L.), and the second spraying 10–14 days later.

The percentage of wheat ear bases damaged by good fly larvae was calculated by analyzing a series of 100 wheat stems on the experimental plot, when wheat was between 71 and 77 developmental phases (BBCH scale) (Adamczewski and Matysiak 2002). Ripe plants were harvested using a harvesting machine. Grain humidity was determined and the obtained grain yield was recalculated for 15% humidity. Significant differences between average results were estimated using the Duncan's test at 5% significance level.

RESULTS AND DISCUSSION

Weather conditions in 2004 and 2006 were unfavourable for the pest development. A cold and rainy spring of 2004 disturbed the appearance of dipterans and ovipositor. Therefore, the wheat stem damage caused by gout fly was insignificant (11.4% of damaged stems). However, in 2005 weather conditions in the spring were more favourable for the development of gout fly, and damage to wheat stems was relatively substantial (20.2% of damaged stems). Damage to wheat stems in 2006 on average amounted to 60.2% and was influenced by favourable weather conditions (Fig. 1)

Other pests also appeared on spring wheat, such as cereal leaf beetles (*Oulema* spp.), aphids (*Aphidae*), thrips (*Thysanoptera*), frit fly (*Oscinella frit* L.) and gall midges (*Cecidomyidae*). In the studied period the most abundant appearance concerned larvae of gout flies and cereal leaf beetle, followed by aphids, gall midges and thrips, while

Table 1. Biological effectiveness of applied insecticides in control of got fly on spring wheat

No.	Insecticides		Dose per ha	% damage of stem	% effectiveness	Yield		
	growth stage 30–33 BBCH	growth stage 33–35 BBCH				increase		
	first spraying	second spraying				[t/ha]	[t/ha]	[%]
2004								
1.	Control		–	11.4		6.79	–	–
2.	Karate Zeon 050 CS	–	0.1	0	100	7.48	0.69	10.1
3.	–	Karate Zeon 050 CS	0,1	2.2	80.8	7.37	0.58	8.5
4.	Karate Zeon 050 CS	Karate Zeon 050 CS	0.1 + 0.1	0	100	7.56	0.77	11.3
5.	Bi 58 Nowy	–	0.5	1	91.0	7.14	0.35	5.1
6.	–	Bi 58 Nowy	0.5	1	91.0	7.21	0.42	6.1
7.	Bi 58 Nowy	Bi 58 Nowy	0.5 + 0.5	0	100	7.50	0.71	10.4
8.	–	Alphaquard 100 EC	0.1	2.8	75.5	7.11	0.32	4.7
9.	–	Sumi-Alpha 050 EC	0.25	2,6	77.2	7.22	0.43	6.3
10.	–	Trebon 10 SC	0.5	0	100	7.28	0.49	6.3
	LSD (0.05)			0.51		0.91		
2005								
1.	Control		–	20.2	–	5.58	–	–
2.	Karate Zeon 050 CS	–	0.1	4.0	80.2	5.96	0.38	6.8
3.	–	Karate Zeon 050 CS	0.1	8.0	60.4	5.66	0.08	1.4
4.	Karate Zeon 050 CS	Karate Zeon 050 CS	0.1 + 0.1	3.0	85.2	5.98	0.40	7.1
5.	Bi 58 Nowy	–	0.5	8.0	60.4	5.79	0.21	3.7
6.	–	Bi 58 Nowy	0.5	11.0	45.5	5.88	0.30	5.3
7.	Bi 58 Nowy	Bi 58 Nowy	0.5 + 0.5	3.0	85.2	5.97	0.39	6.9
8.	–	Alphaquard 100 EC	0.1	6.0	70.3	5.81	0.23	4.1
9.	–	Sumi-Alpha 050 EC	0.25	4.2	79.3	6.43	0.85	15.2
10.	–	Trebon 10 SC	0.5	7.5	62.9	6.19	0.61	10.9
	LSD (0.05)			2.10		0.72		

2004 – first spraying: 26.05.2004, second spraying: 07.06.2004
2005 – first spraying: 30.05.2005, second spraying: 09.06.2005

Table 2. Biological effectiveness of applied insecticides in control of got fly on spring wheat in 2006

No.	Insecticides	Dose per ha	% damage of stem	% effectiveness	Yield		
	growth stage – 35–39 BBCH				[t/ha]	increase	
	first spraying: 14.06.06					[t/ha]	[%]
1.	Control	–	60.2	–	5.93	–	–
2.	Karate Zeon 050 CS	0.1	17.7	70.5	6.58	0.65	10.9
3.	Sumi-Alpha 050 EC	0.25	19.2	68.4	6.71	0.78	13.1
4.	Trebon 10 SC	0.5	17.0	71.7	6.79	0.86	14.5
5.	Fastac 100 EC	0.1	15.2	74.6	7.16	1.23	20.7
6.	Bi 58 Nowy	0.5	17.2	71.3	6.61	0.68	11.4
7.	Alphaquard 100 EC	0.1	17.0	71.7	6.59	0.66	11.1
LSD(0.05)			4.34		0.51		

other insects were represented in insignificant numbers. In some years spring wheat may be exposed, apart from the gout fly, to the harmful activity of cereal leaf beetle, aphids, frit fly and gall midges, as has been reported in other studies carried out in various regions of Poland (Wałkowski 1991; Kaniuczak and Matłosz 1999; Kąkol and Miętkiewski 2002; Mrówczyński *et al.* 2004).

The results of the chemical control of gout fly in spring wheat and its influence on wheat grain yield are presented in tables 1 and 2.

In 2004 the highest efficiency was demonstrated for Karate Zeon 050 CS (lambda-cyhalotrin) and Bi 58 Nowy (dimetoat) insecticides used for the first spraying and twice over the vegetation season. Their efficiency amounted to approx. 100%. Slightly lower effectiveness was achieved when insecticides were used for the second spraying. The effectiveness of these control measures amounted to/from 75.5% to 100.0%, while in the control spraying carried out twice over the season it amounted to 100.0%.

Chemical protection of spring wheat increased the grain yield by 4.7% to 11.3%. The highest increase in grain yield was achieved on the experimental field where Karate Zeon 050 CS and Bi 58 Nowy insecticides were used twice over the season, in doses of 0.77 t/ha and 0.71 dt/ha, respectively.

In 2005, when the pest appearance was significantly higher, wheat was sprayed at the first date, which reduced the percentage of damaged plants by half, i.e. by 60.4% and 85.2%, respectively. The effectiveness of applied insecticides at the second date ranged from 45.5% to 79.3%. Chemical control of gout fly contributed to the increased grain yield, which amounted to from 1.4% to 15.2% (6.8% on average).

In 2006 the highest effectiveness was demonstrated for Fastac 100 EC (alfa-cypermetrin) at a dose of 0.1 l/ha (74.6%), and the lowest – Sumi-Alpha 050 EC (esfenwalerat) at a dose of 0.25 l/ha (68.4%). Chemical control of gout fly contributed to the increased grain yield, which amounted to from 0.65 t/ha to 1.23 t/ha (13.6% on average). Importantly, wheat stem damage in the analysed year was very high and on average amounted to approx. 60%.

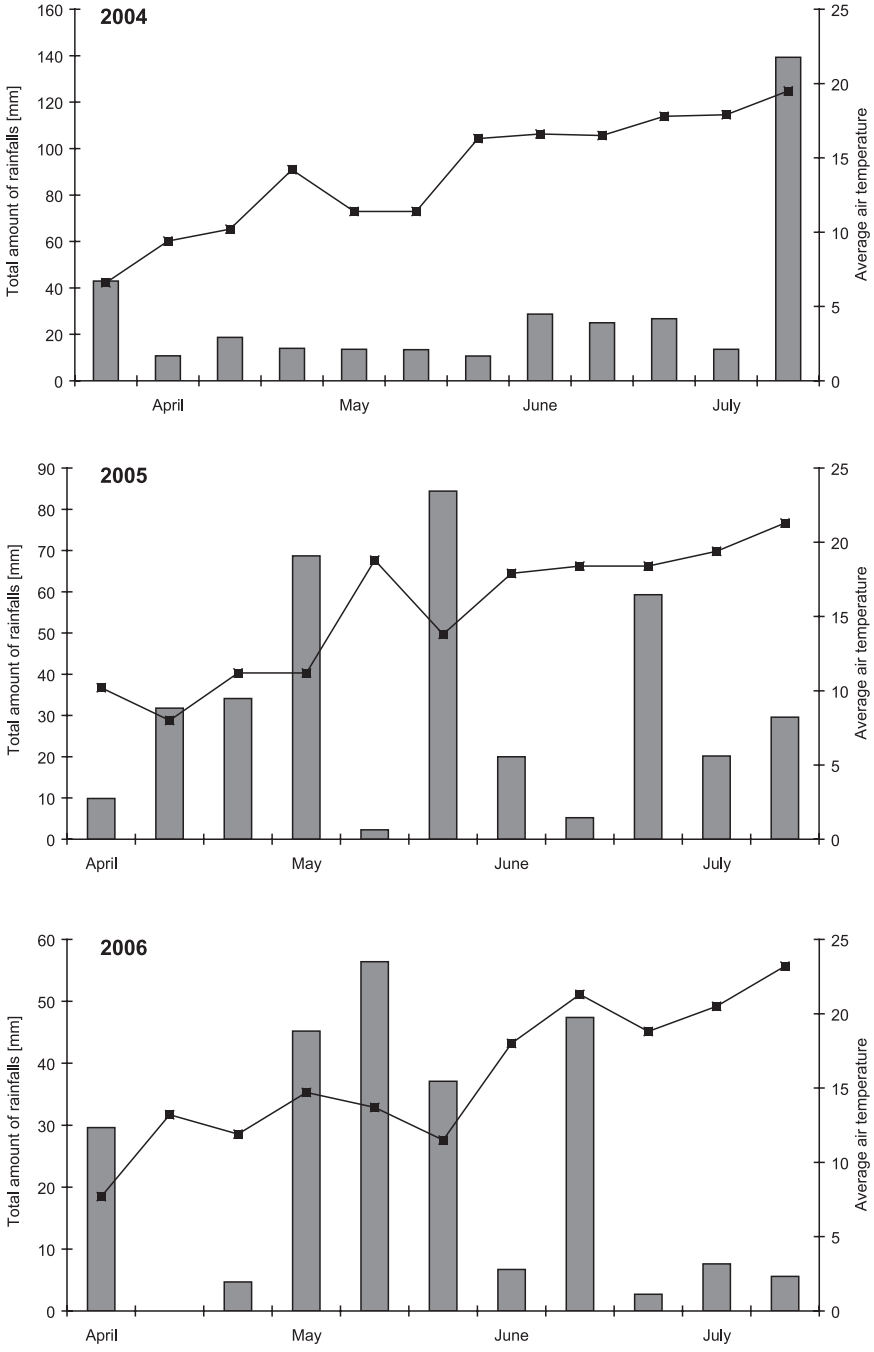

Fig. 1. Average decade air temperature and total amount of rainfall in the months: April – July 2004–2006

Gout fly is a widely-distributed pest in Poland, and its abundant appearance every few years results in a significant economic damage (Gołębiowska and Boczek 1959; Sekuła *et al.* 1965; Studziński 1971; Boczek and Żmijewska 1972; Lisowicz 2001). Gout fly most frequently affects spring wheat, winter wheat and spring barley, and very seldom rye. Other host plants of the gout fly include spear grass and timothy grass.

Other studies on the distribution of gout fly were carried in Podkarpacie region by Lisowicz (1998), who focused his observations on spring wheat and spring barley cultivars. The most frequent and most harmful damage caused in this region by gout fly spring-generation larvae concerns spring barley and spring wheat (Kaniuczak and Matłosz 2003). According to the authors of this paper these larvae damaged on average 33.8% of ear bases, which resulted in a 14.1% grain yield decrease.

Economically significant damage is caused by spring generation larvae. They feed on cereal ear bases, making an oblong furrow on the external side of the ear base. Significantly damaged wheat plants have shortened ear base and ear, as well as reduced size and number of grains (Sekuła *et al*. 1965; Studziński 1971). Additionally, gout fly larvae feeding on wheat lower the straw and grain quality and negatively change their chemical composition. Feeding larvae shorten plant height, and when damage is considerable, ears remain inside the sheath.

Many authors have investigated the harmful activity of gout fly, and have concluded that economically significant damage is caused exclusively by spring generation larvae. They feed on the cereal ear base, making an oblong furrow on its external side reaching the first internode. After hosting larvae plants are shortened, their damaged stems cease growing, and ears are often retained inside the sheath (Gołębiowska 1957; Gołębiowska and Boczek 1959; Sekuła *et al.* 1965; Studziński 1971).

Lisowicz and Kozioł (2002) carried out studies to evaluate susceptibility of spring barley to the spring generation of gout fly. According to their findings, individual varieties of spring barley demonstrated different susceptibility to damage caused by gout fly larvae. A calculated grain yield decrease also varied considerably. Similar studies on spring wheat were also carried by Kaniuczak and Matłosz (2003).

CONCLUSIONS

1. Many harmful pests appear in spring wheat cultivars of south-eastern Poland, causing a significant decrease in grain yield and its quality. In favorable conditions damage to wheat stems caused by good fly amounted to on average to from 12.2% to 60%.
2. Spraying wheat cultivars at two dates focused on gout fly control provided high effectiveness in the studied period, amounting on average to 92.6%, and a high increase in grain yield ranged from 6.9% to 11.3%, 8.9% on average. Slightly lower effectiveness was achieved when control measures were applied during the first date of gout fly control. Chemical treatment to control good fly at the second date demonstrated higher differences of effectiveness and provided an increased grain yield.
3. Higher protection of spring wheat cultivars against damage caused by gout fly requires the application of chemical control twice during the vegetation season in the regions of abundant pest appearance.

REFERENCES

Adamczewski K., Matysiak K. 2002. Zboża. p. 15–19. In: „Klucz do określania faz rozwojowych roślin jedno- i dwuliściennych w skali BBCH" [K. Adamczewski, K. Matysiak – tłumaczenie i adaptacja]. Wyd. I. Inst. Ochr. Roślin, Główny Inspektorat Inspekcji Ochrony Roślin i Nasiennictwa, 134 pp.

Bubniewicz P., Walczak F., Mrówczyński M., Widerski K., Kaniuczak Z. 1993. Ochrona roślin w intergowanym systemie produkcji rolniczej. Skrzypionki występujące na zbożach i ich zwalczanie. Inst. Ochr. Roślin, 19 pp.

Boczek J., Żmijewska I. 1972. Szkodliwość niezmiarki paskowanej (*Chlorops pumilionis* Bjerk.) (*Diptera: Chloropidae)* i odporność na nią pszenic uprawianych w Polsce. Rocz. Nauk Roln., Seria E – Ochrona Roślin 2 (1): 23–37.

Gołębiowska Z. 1957. Badania nad wpływem różnych terminów siewu zbóż na porażenie ich przez muchy zbożowe. Roczn. Nauk Roln. 73A (4): 523–558.

Gołębiowska Z., Boczek J. 1959. Szkodliwość niezmiarki paskowanej (*Chlorops pumilionis* Bjerk.). Prace Nauk. Inst. Ochr. Roślin 1 (1): 107–135.

Derron J.O., Goy G. 1990. La mouche jaune des chaumes (*Chlorops pumilionis* Bjerk.): biologie, musibiliti, moyens de lutte. Revuesuisse Agric. 22 (2): 101–105.

Kaniuczak Z., Matłosz I. 1999. Efekty produkcyjne i ekonomiczne chemicznego zwalczania szkodników w zbożach. Pam. Puł., z. 114: 159–165.

Kaniuczak Z., Matłosz I. 2003. Niezmiarka paskowana (*Chlorops pumilionis* Bjerk.) (*Diptera, Chloropidae*) – znaczne zagrożenie plonów pszenicy jarej różnych odmian w okolicach Rzeszowa. Prog. Plant Protection/Post. Ochr. Roślin 43 (2): 714–717.

Kąkol E., Miętkiewski R. 2002. Występowanie i szkodliwość wciornastków (*Thripidae*) na pszenicy jarej. Prog. Plant Protection/Post. Ochr. Roślin 42 (2): 647–650.

Lipa J.J. 1999. Nowoczesna ochrona zbóż. Pam. Puł. 114: 241–259.

Lisowicz F. 1998. Niezmiarka paskowana (*Chlorops pumilionis* Bjerk.) – zapomniany szkodnik zbóż. Prog. Plant Protection/Post. Ochr. Roślin 38 (1): 156–159.

Lisowicz F. 2001. Straty w plonach jęczmienia jarego powodowane przez niezmiarkę paskowaną (*Chlorops pumilionis* Bjerk.) w województwie podkarpackim. Zesz. Nauk. AR w Krakowie, z. 76: 233–236.

Lisowicz F., Kozioł M. 2002. Podatność odmian jęczmienia jarego na niezmiarkę paskowana (*Chlorops pumilionis* Bjerk.). Prog. Plant Protection/Post. Ochr. Roślin 42 (2): 619–621.

Mrówczyński M., Boroń M., Wachowiak H. 2004. Ochrona zbóż przed szkodnikami. Wieś Jutra 3 (68): 31–35.

Ruszkowski J. 1950. Fauna roślinożerna łanów zbożowych w Polsce w okresie dwudziestolecia 1919–1939. Ann. Univ. M.C. Skłodowska, Sec. E., Suppl 2, Lublin: 1–95.

Simm K. 1937. Przyczynek do znajomości niezmiarki (*Chlorops pumilionis* Bjerk.). Roczn. Ochr. Roślin 4 (4): 1–3.

Sekuła J., Kania Cz., Mikuś D., Dzięgielewski F. 1965. Badania nad szkodliwością niezmiarki paskowanej – *Chlorops pumilionis* Bjerk. (*Dipt., Chloropidae)* na pszenicy jarej. Pol. Pismo Entomol. s. B, z. 1–2 (37–38): 181–192.

Studziński A. 1971. Występowanie niezmiarki paskowanej (*Chlorops pumilionis* Bjerk.) na dokłosiach pszenic oraz powodowane straty w Polsce w latach 1961–1968. Prace Nauk. Inst. Ochr. Roślin 12 (2): 117–149.

Węgorek W. 1972. Nauka o Szkodnikach Roślin. PWRiL Warszawa, 512 pp.

Wałkowski W. 1991. Wzrost znaczenia szkodników zbóż. Ochrona Roślin nr 5–6: 17–20.

POLISH SUMMARY

WYSTĘPOWANIE ORAZ EFEKTY CHEMICZNEGO ZWALCZANIA NIEZMIARKI PASKOWANEJ (*CHLOROPS PUMILIONIS* BJERK.) (*DIPTERA, CHLOROPIDAE*) W PSZENICY JAREJ W POLSCE POŁUDNIOWO-WSCHODNIEJ

W latach 2004–2006 wykonano badania nad skutecznością chemicznego zwalczania niezmiarki paskowanej w pszenicy jarej, odmiana Koksa. Doświadczenie założono metodą losowanych bloków w czterech powtórzeniach. Odsetki uszkodzonych dokłosi przez larwy niezmiarki obliczano poddając analizie po 100 kolejnych źdźbeł na poletku, w fazie rozwojowej pszenicy 71–77 (skala BBCH).

W 2004 roku larwy niezmiarki uszkodziły średnio 11,4% dokłosi pszenicy. Zastosowane insektycydy wykazały wysoką skuteczność biologiczną w zwalczaniu tego szkodnika wynoszącą od 75,5% do 100 %. Uzyskana zwyżka plonu ziarna wahała się od 4,7% do 11,3%.

Uszkodzenie dokłosi na roślinach pszenicy w 2005r. wynosiło 20,2%. Użyte insektycydy wykazały również dobrą skuteczność, która wahała się od 60,4% do 85,2%. Zwyżka plonu ziarna wynosiła średnio 6,9%.

W roku 2006 larwy niezmiarki uszkodziły średnio 60,2% dokłosi pszenicy. Zastosowane insektycydy wykazały wysoką skuteczność biologiczną w zwalczaniu tego szkodnika wynoszącą od 68,4 do 74,6%. Uzyskana zwyżka plonu ziarna wahała się od 10,9 do 20,7%.