Acta Sci. Pol.
Silv. Colendar. Rat. Ind. Lignar. 8(1) 2009, 19-26

EVALUATION OF EFFECTIVENESS OF SELECTED TYPES OF TRAPS USED IN CAPTURING OF LARGE PINE WEEVIL – *HYLOBIUS ABIETIS* (L.)

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Abstract. The purpose of the research was the comparison of capturing effectiveness of large pine weevils with different types of traps. The research was conducted in the forest of Oborniki forest division (RDLP Poznań). It has been shown that most large pine weevils are captured by the IBL-4 type trap. The least effective trap turned out to be the trap log.

Key words: *Hylobius abietis*, large pine weevil, traps, forest protection, forest insects

INTRODUCTION

Protection of young pine forests against large pine weevil is an annually recurring problem in Poland. One of the solutions to this situation is initial protection of seedlings (prior to planting) through dipping their overground parts in an insecticide solution. However, current trends in environmental protection are to limit the use of pesticides in the practice of forest protection. Gradual decrease of their use is also recommended by the FSC (an organization providing certification for Polish State Forests), which classifies the majority of registered chemicals as "highly dangerous", including 25 insecticides (out of 30) on the list of pesticides non-recommended by FSC [Środki... 2008]. In connection with the aforesaid, the importance of alternative methods of coniferous tree protection is increasing. Such methods include the long-present in Polish forests various kinds of traps for capturing of large pine weevils. From the point of view of forest protection practice, the factor of crucial importance is the trapping efficiency. Hence, it is purposeful to compare the efficiency of several selected types of traditional traps with the IBL-4 trap type, which is the aim of this elaboration.

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METHODOLOGY

The research took place in the territory of the Oborniki forest division, Kiszewo circle, Kiszewko district in sections: 568g (pine forest) and 568i (mixed forest). The above mentioned sections of total area of 3.36 ha were forested with pine, and were logged in winter 2001 by Ib method of felling.

In spring 2002 one-year and two-years pines were planted the research plots (568g and 568i respectively). In May 2002 the traps for capturing the large pine weevils were placed in a random-block arrangement on both research plots. The control of traps was carried out in 3-day intervals in the period between 23 May and 13 July.

The following kinds of traps were placed on each of the research plots:

a) pine log – of ca. 10 cm in diameter and 100 cm long, cut out of a freshly-felled pine and placed with its barked side down,
b) log in a ditch – pine log (of size specified above – point a) placed at the bottom of a trap ditch of dimensions of 120 cm × 30 cm × 30 cm (length × depth × width),
c) log + turpentine in a ditch – log in a ditch (of size specified above – point b) with additional bag filled with sawdust soaked with turpentine placed under the log,
d) ditch – a ditch sized 30 × 30 × 30 cm,
e) wooden disc – a disc (ca. 5 cm thick) cut out of a freshly-felled pine placed on the bottom of a ditch (as above),
f) wooden disc + turpentine – as point e with additional bag filled with sawdust soaked with turpentine placed under the disc,
g) wooden disc + Hylodor in a ditch – as point e with additional dispenser containing the Hylodor chemical,
h) IBL-4 type trap with the Hylodor chemical placed inside.

Research plot no. 568g and 568i contained six and eight traps of each kind, respectively. All traps were placed on the plots at the same time and were controlled simultaneously thereafter.

Statistical analysis of the research results was carried out with application of Statistica software.

RESULTS AND DISCUSSION

Throughout the research period, the traps were controlled every third day. The dynamics of insect trapping on both research plots is illustrated on Figure 1.

A total of 7895 large pine weevils were captured on the research plot no. 1 (no. 568g). Almost half of said number was caught within first nine days (first three controls of the traps). The situation on the research plot no. 2 (no. 568i) was similar, where half of the total beetle count was trapped within first 12 days (four subsequent controls). The maximum capture number was obtained on 26 May on both plots. After this, the numbers were gradually decreasing, whereby certain deviation (increase) was observed between 10 and 19 June. It seems unlikely that this was caused by the replacement of discs and logs during the control of traps, since the increase in capture rate was observed also in other types of traps – empty ditches and IBL-4, which were obviously unaffected by the mentioned elements.

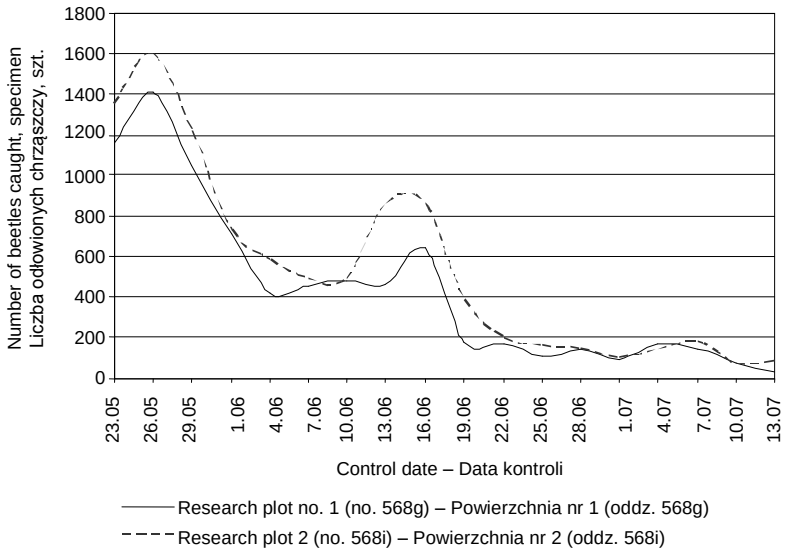

Fig. 1. Large pine weevil trapping dynamics throughout the whole research period
Rys. 1. Dynamika odłowu szeliniaków w czasie całego okresu badań

Most large pine weevils were caught on the research plot no. 1 (no. 568g) by the IBL-4 type trap (containing the Hylodor attractant; Table 1). In the experiment, an average of 319 beetles were captured by one trap. The capture rate of other traps was smaller, e.g. the pinewood disc placed in a ditch with sawdust soaked in turpentine attracted 251 imagoes on average. The smallest capture rate was obtained in case of a log placed directly on the ground (27 beetles on average).

It was shown in the conducted statistical tests (variance analysis and Duncan's test) that the capture ratio of the IBL-4 trap with Hylodor attractant was statistically significantly different from the majority of other types of traps. No statistically significant differences were obtained between the IBL-4 trap and the ditch with a pinewood disc with turpentine-soaked sawdust were shown.

Similarly, on the research plot no. 2 (no. 568i), the IBL-4 trap with Hylodor attractant turned out to be the most effective (Table 2) type of trap. Within the whole research period, one such trap captured 461 insects on the average. A log in a ditch trapped 256 whereas disc and turpentine-soaked sawdust – 200 beetles on average. Also on the second plot, the least effective was the log placed on the ground which caught only 19 insects on average. It follows from the statistical analysis that the capture rate of the IBL-4 trap significantly differs from all other trap types (Table 2).

Capture effectiveness of traps on both plots is shown on Figure 2. The highest capture rate was observed in IBL-4 traps with Hylodor attractant, whereas the lowest in wooden logs placed on the ground.

After the averaging of the figures from both research plots (Table 3, Fig. 3) and calculation of the relative capture rate, it may be easily noticed that the trap of lowest effectiveness in capturing imagoes of large pine weevil, was a log placed on the ground, which captured only 6% of the insects trapped by the IBL-4 with Hylodor. Other types of traps captured: ditch – 30%, disc in a ditch – 34%, disc + Hylodor in a ditch – 38%,

Table 1. Average capture rate of a single trap of a given type throughout the whole research period and evaluation of significance of differences. Research plot no. 1 (section no. 568g)
Tabela 1. Średnia łowność pojedynczej pułapki poszczególnego typu w trakcie całego okresu badań oraz ocena istotności różnic. Powierzchnia nr 1 (oddz. 568g)

Trap type Rodzaj pułapki	Average number of captured beetles Średnia liczba odłowionych chrząszczy	Capture percent Procent odłowu	Snedecor's F Wartość F Snedecora	Significance level p Poziom istotności p	Difference significance Istotność różnicy
IBL-4 + Hylodor	319	24			a*
Disc + turpentine in a ditch Krążek + terpentyna w dołku	251	19			a, b, c, d
Log in a ditch Wałek w rowku	169	13			b, c, d, e
Disc in a ditch Krążek w dołku	165	13	4.313332	0.000243	b, c, d, e
Ditch – Dołek	140	11			b, c, d, e
Disc + Hylodor in a ditch Krążek + Hylodor w dołku	135	10			b, c, d, e, f
Log + turpentine in a ditch Wałek + terpentyna w rowku	111	8			c, d, e, f
Log – Wałek	27	2			d, e, f

*Identical letters in individual lines mean that no statistically significant differences occur between the traps at the level of $\alpha = 0.05$.
*Jednakowe litery w poszczególnych wierszach oznaczają brak statystycznie istotnych różnic między pułapkami na poziomie $\alpha = 0,05$.

log and turpentine in a ditch – 45% of that caught in the IBL-4 trap. Rates over 50% were achieved only by the log in a ditch – 55% and disc + turpentine in a ditch – which caught 61% of the insects as compared to the IBL-4 type trap.

In general terms (Table 3), it may be stated that the unquestionably most efficient trap was the IBL-4 with the Hylodor attractant which captured the most beetles on both research plots. Apart from the raw effectiveness of the IBL-4 trap, it is a trap that does not pose any threats to other animals, whereas in case of ditches such threat may exist, since after the beetle capturing operation, they were not neutralized.

A wooden log placed on the ground was definitely the least effective trap. This was most probably caused by the fact that the beetles were able to leave the trap after they have fed on it, not being caught in a ditch. Hence, beetles present on free logs are only those feeding at the moment, which results in the necessity of checking the logs more often than on every third day. Ipso facto, the relatively high effectiveness of a log placed on ground obtained in previous research [Korczyński 1999] which captured numbers of beetles similar or higher than the IBL-4 trap with Hylodor, was not confirmed. In the course of the present research, it was definitely the least effective method, capturing significantly less beetles than the most effective traps.

Table 2. Average capture rate of a single trap of a given type throughout the whole research period and evaluation of significance of differences. Research plot no. 2 (section no. 568i)
Tabela 2. Średnia łowność pojedynczej pułapki poszczególnego typu w trakcie całego okresu badań oraz ocena istotności różnic. Powierzchnia nr 2 (oddz. 568i)

Trap type Rodzaj pułapki	Average number of captured beetles Średnia liczba odłowionych chrząszczy	Capture percentage Procent odłowu	Snedecor's F Wartość F Snedecora	Significance level p Poziom istotności p	Difference significance Istotność różnicy
IBL-4 + Hylodor	461	31			a*
Log in a ditch Wałek w rowku	260	17			b, c, d
Log + turpentine in a ditch Wałek + terpentyna w rowku	256	17			b, c, d
Disc + turpentine in a ditch Krążek + terpentyna w dołku	200	13	8.994498	0.0000001	b, c, d, e
Disc + Hylodor in a ditch Krążek + Hylodor w dołku	153	10			b, c, d, e, f
Disc in a ditch Krążek w dołku	71	5			c, d, e, f
Ditch – Dołek	72	5			c, d, e, f
Log – Wałek	19	1			d, e, f

*Identical letters in individual lines mean that no statistically significant differences occur between the traps at the level of $\alpha = 0.05$.
*Jednakowe litery w poszczególnych wierszach oznaczają brak statystycznie istotnych różnic między pułapkami na poziomie $\alpha = 0,05$.

Table 3. Average capture rate percentage as compared to the IBL-4 trap
Tabela 3. Średni procent łowności poszczególnych typów pułapek w stosunku do pułapki IBL-4

Trap type Rodzaj pułapki	Research plot no. 1 (no. 568g) Powierzchnia nr 1 (oddz. 568g)	Research plot 2 (no. 568i) Powierzchnia nr 2 (oddz. 568i)	Average Średnio
Log in a ditch Wałek w rowku	53	56	55
Log – Wałek	8	4	6
Disc in a ditch Krążek w dołku	52	15	34
Ditch – Dołek	44	16	30
Log + turpentine in a ditch Wałek + terpentyna w rowku	35	55	45
IBL-4 + Hylodor	100	100	100
Disc + turpentine in a ditch Krążek + terpentyna w dołku	79	43	61
Disc + Hylodor in a ditch Krążek + Hylodor w dołku	42	33	38

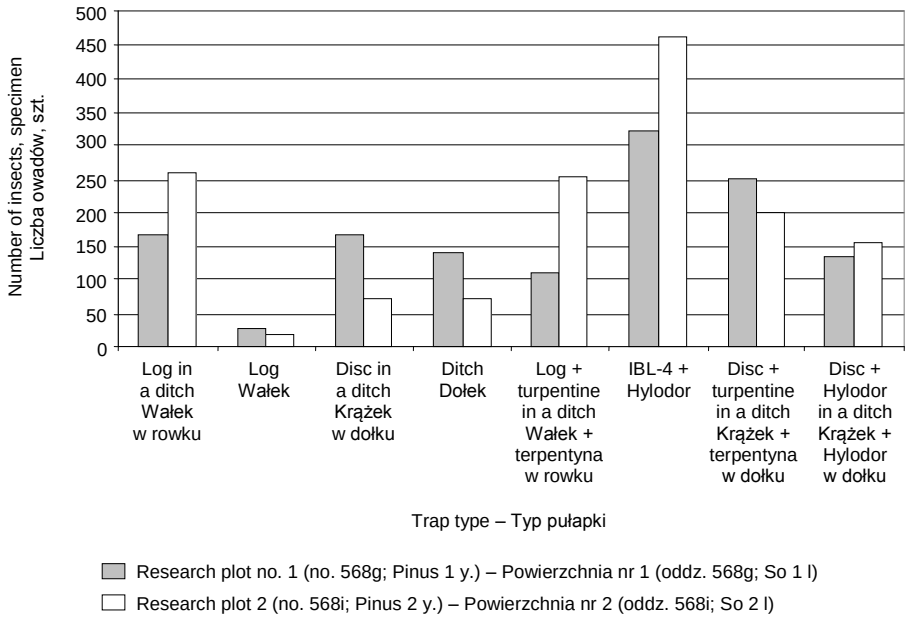

Fig. 2. Average numbers of large pine weevils captured in the experiment by one trap of a given kind

Rys. 2. Średnia liczba szeliniaków odłowionych w trakcie badań przez jedną pułapkę poszczególnego typu

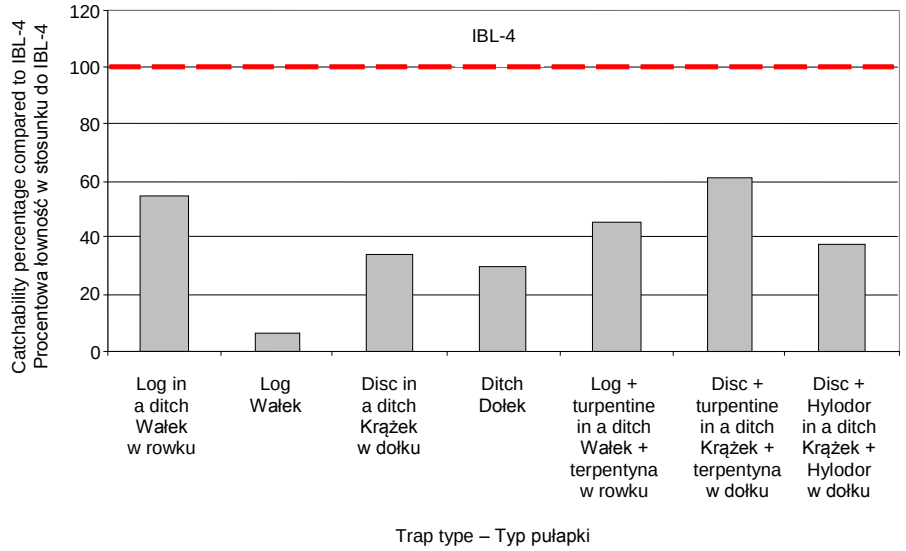

Fig. 3. Average effectiveness of individual trap types in comparison with the IBL-4 trap

Rys. 3. Średnia procentowa łowność poszczególnych typów pułapek względem IBL-4

A log in a ditch proved stable effectiveness, capturing on both plots approximately 50% of the beetles caught with the IBL-4 traps.

The capture rates obtained for other types of traps were not consistent between the research plots. Hence the statement that in different years (and in this situation – on different plots), the capture rates for different types of traps varies and is, most probably, dependent on reaction of specific populations of the large pine weevils [Korczyński 1999] may be extended as follows: the capture rate of individual types of traps depends on the environmental factors and on the reaction of specific populations of large pine weevils.

As aforesaid, the necessity of abandoning the use of chemical methods of young forests will result in the increasing use of various types of traps, not only for and information purposes, but also as a means of population control. Despite the fact, that the dependence of the size of damages in forests on the large pine weevil population density in young forests [Szmidt and Korczyński 1982] has not been found, the preventive capture of these insects may decrease the potential threat for it has been proved that in forests in which such preventive measures were taken, the damages occurred in a smaller scope and on a smaller number of trees [Korczyński and Kociubiński 2000]. Hence, it is advisable to use the most effective traps, out of the traps recommended by the Forest Protection Instructions [2004], for this purpose.

CONCLUSIONS

1. Definitely the most effective trap in capturing of large pine weevils is the IBL-4 trap with the Hylodor attractant.
2. The lowest effectiveness was observed for the trap log placed on ground.
3. Trap logs should be subject to more frequent controls as compared to other types of traps.
4. In order to obtain protection scale similar to that of IBL-4, one should:
   a) double the number of logs in ditches, logs with turpentine and discs with turpentine in ditches in relation to the number of IBL-4 traps,
   b) triple the number of ditches, discs in ditches and disc with Hylodor in ditches in relation to the number of IBL-4 traps.
5. Placing of turpentine-soaked sawdust or the Hylodor attractant with log in a ditch or with a disc in a ditch does not affect the capture rate of the traps in a statistically significant manner.

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OCENA EFEKTYWNOŚCI WYBRANYCH TYPÓW PUŁAPEK STOSOWANYCH DO ODŁOWU CHRZĄSZCZY SZELINIAKA SOSNOWCA – *HYLOBIUS ABIETIS* (L.)

Streszczenie. Celem badań było porównanie efektywności odłowu chrząszczy szeliniaka sosnowca przez pułapki różnego typu. Badania zostały wykonane na terenie Nadleśnictwa Oborniki (Regionalna Dyrekcja Lasów Państwowych w Poznaniu). Wykazano, iż zdecydowanie najwięcej szeliniaków odławiała pułapka typu IBL 4 z Hylodorem. Z kolei wałek pułapkowy wyróżniał się zdecydowanie najmniejszą łownością.

Słowa kluczowe: *Hylobius abietis*, szeliniak sosnowiec, pułapki, ochrona lasu, owady leśne

Accepted for print – Zaakceptowano do druku: 13.03.2009

For citation – Do cytowania: Kuźmiński R., Bilon A., 2009. Evaluation of effectiveness of selected types of traps used in capturing of large pine weevil – Hylobius abietis (L.). Acta Sci. Pol., Silv. Colendar. Rat. Ind. Lignar. 8(1), 19-26.