P L A N T B R E E D I N G A N D S E E D S C I E N C E
Volume 61 2010

DOI: 10.2478/v10129-010-0010-x

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„FLAX SPECIALISTS" – WEED SPECIES EXTINCT IN POLAND ?

ABSTRACT

The results of a research on segetal weed communities in fibre flax in Poland are presented, with respect to different regions of cultivation, and changes in the level of infestation during the past forty years. Observations on composition and abundance of weed infestations were made in fields in six experimental farms at the Institute of Natural Fibres and Medicinal Plants. The observations conducted in the period 1967-2008 did not show the occurrence of weed species from the group of so-called "flax specialists": *Lolium remotum* Schrank, *Spergula arvensis* L. subsp. *maxima* (Weiche) O. Schwarz, *Camelina alyssum* (Mill.) Thell. and *Cuscuta epilinum* Weihe Ex Boenn. In Poland, weed populations in fibre flax consist of species typical for cereals and root crops: *Chenopodium album* L., *Polygonum convolvulus* L., *Viola arvensis* Murr., *Stellaria media* Vill., *Lamium amplexicaule* L., *Thlaspi arvense* L., *Elymus repens* (L.) Gould. and *Polygonum nodosum* Pers.

Key words: flax specialists, fibre flax, weed community,

INTRODUCTION

Crops are generally associated with unique sets of weed species. The knowledge about the level of weed interference in a crop is a key criterion for developing weed management programs. In fibrous flax, the problem is especially important as the main yield is straw which is a source of fibre. The status and degree of weed infestations in the crop influences the straw yield and fibre and fibre quality, namely divisibility, thinness, buttery handle, heaviness, strength, colour, uniformity, etc. The quality – fibre class (Tex) is evaluated according to organoleptical tests, which determined the fibre ability for spinning, namely the possibility of producing yarn of given quality. The higher the number of fibre, the better is its quality. The fibre contaminated by weed remains, is a low value raw material for the spinning industry.

Despite considerable progress in improvement of cultivation, harvesting and processing methods of flax, no method for mechanical weed removal from the straw has been developed so far.

Communicated by Denise Fu Dostatny

Observations of weed infestation of fibrous flax in Poland have been conducted at the Institute of Natural Fibres and Medicinal Plants for over 40 years. This paper presents the results of research on changes in weed communities over the last four decades, focusing on former typical flax weed taxa, described as "flax specialists". These taxa were common in the first half of 20th century, described as "flax specialists" which included species like *Lolium remotum* Schrank, *Spergula arvensis* L. subsp. *maxima* (Weiche) O. Schwarz, *Camelina alyssum* (Mill.) Thell. and *Cuscuta epilinum* Weihe ex Boenn.

Fig. 1. Research Stations of the Institute of Natural Fibres and Medicinal Plants

MATERIALS AND METHODS

Changes in weed infestations in the past 40 years in Poland were assessed using the results from 321 field experiments on chemical weed control (conducted in 1967-2008), from six Research Stations of the Institute of Natural Fibres and Medicinal Plants (RS INFMP) in Poznan (Fig.1) . The research was conduc-

ted in villages characterized by differentiated agronomy and climate conditions: Bialobrzezie (dolnoslaskie district), Bukówka (pomorskie district), Kolnica (podlaskie district), Petkowo (wielkopolskie district), Stary Sielec (wielkopolskie district), Wojciechow (opolskie district). Experiments on biological evaluation of herbicides in flax were set according to a randomized complete block design with four replicates. The experiments included evaluation of weed infestation in control plots – where no herbicides were used. Evaluation plants m^{-2} of weed infestation was conducted on day of flax harvest. Population density (plants × m^{-2}) and dry weight (g × m^{-2}) were assessed for each weed species. Data from the 321 field experiments conducted in 1967-2008 were collated in a relational database (MS ACCESS 2007).

RESULTS

Flax cultivation is associated with weed species typical for root crops and cereals. Results from forty years of observations of segetal weed communities in fibre flax in Poland showed that the greatest threat to the development of this crop is posed by: *Chenopodium album* L., (98,6 % of area – on average 45,0 plants × m^2), *Fallopia convolvulus* (L.) A. Lőve (86.6 % – 11.2 plants × m^{-2}), *Viola arvensis* Murray (70.0 % – 25.2 plants × m^{-2}), *Stellaria media* (L.) Vill. (70.0 % – 13.0 plants × m^{-2}), *Lamium amplexicaule* L. (56.3 % – 12.1 plants × m^{-2}), *Thlaspi arvense* L. (53.0 % – 15.1 plants × m^{-2}) and *Agropyron repens* (L.) P. Beauv. (81.2 % – 7.5 plants × m^{-2}) and *Polygonum lapathifolium* L. subsp. *lapathifolium* (55.6 % – 6.0 plants × m^{-2}).

Based on the frequency of occurrence and plant density, the second group of weeds were: *Polygonum aviculare* L. (44.7 % – 4.5 plants × m^{-2}), *Sinapis arvensis* L. (37.9 % – 5.0 plants × m^{-2}), *Capsella bursa-pastoris* (L.) Medik. (35.4 % – 8.0 plants × m^{-2}), *Anthemis arvensis* L. (31.8 % – 6.71 plants × m^{-2}) *Galium aparine* L. (30.0 % – 5.3 plants × m^{-2}), *Echinochloa crus-galli* (L.) P.Beauv. (24.2 % – 14.8 plants × m^{-2}) and *Poa annua* L. (21.3 % – 19.6 plants × m^{-2}).

Quite important in flax fields in Poland were such weeds as: *Galeopsis tetrahit* L. (19.9 % – 9,0 plants × m^{-2}), *Polygonum persicaria* L. (19.9 % – 5.6 plants × m^{-2}), *Fumaria officinalis* L. subsp. *officinalis* (18.0 % – 5.1 plants × m-*2*), *Geranium pusillum* Burm. F. ex. L. (15.2 % – 9.5 plants × m^{-2}) *Galinsoga parviflora* Cav. (14.8 % – 8.5 plants × m^{-2}), *Spergula arvensis* L. subsp. *arvensis* (13.4 % – 13.6 plants × m^{-2}) and *Avena fatua* L. (12.6 % – 5.2 plants × m^{-2}).

The taxa that were found quite frequently but in low number were *Cirsium arvense* (L.) SCOP. (degree of stability 28.2 % – average density 3.0 plants × m^{-2}), *Equisetum arvense* L. (25.6 % – 1,3 plants × m^{-2}), *Sonchus arvensis* L. subsp. *arvensis* (16,9 % – 1,5 plants × m^{-2}) and *Vicia hirsuta* (L.) S.F. Gray, (16,2 % – 2.4 plants × m^{-2}). Among rarely found weeds, yet found in high density, were the following : *Lamium purpureum* L. (11.2 % of plantations – on average 24,6

plants × m^{-2}), *Glechoma hederacea* L. (7.6 % – 27.9 plants × m^{-2}), *Veronica hederifolia* L. (5,4 % – 39,5 plants × m^{-2}) and also *Matricaria recutita* (L.) Rauschert. (5.4 % – 15.4 plants × m^{-2}).

In total, 106 species of weeds were counted in 321 experiments. The average number of taxa was 10.2 species × m^{-2}. The number of species for a single phytosociological evaluation ranged from 5 to 27 taxa × m^{-2}.

Within the last four decades, a systematic reduction of weed population density (plants × m^{-2}) and biomass (g × m^{-2}) was observed. The number of taxa (species × m^{-2}) remained relatively stable (Fig. 2).

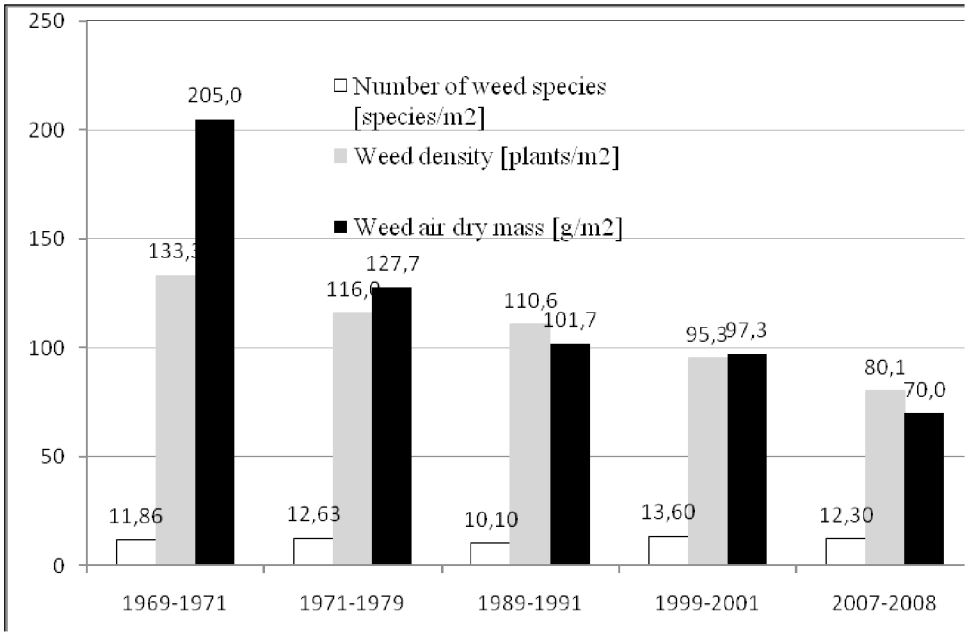

Fig. 2. The changes in the level of weed infestation of flax plantation in Poland (1967-2008)

No significant presence of weeds described as "flax specialists" was observed. Examples of such species are *Cuscuta epilinum* Weihe ex Boenn., *Camelina alyssum* (Mill.) Thell., *Lolium remotum* Schrank. and *Spergula arvensis* L. subsp. *maxima* (Weiche) O. Schwarz.

DISCUSSION

Research carried out by the author in 1967-2008 showed no occurrence of weed species known as "flax specialists" in Poland: *Lolium remotum* Schrank, *Spergula arvensis* L. subsp. *maxima* (Weiche) O. Schwarz, *Camelina alyssum* (Mill) Thell. and *Cuscuta epilinum* Weihe ex Boenn. According to Tymrakiewicz (1952) and Kornaś (1959), earlier flax plantations were associated with synanthropic weed communities characteristic for this crop – the so-called "flax specialists" which included flax dodder. Similarly, Szafer *et al*. (1986) and Turner

(1987) documented the occurrence of this species in flax.

A multi-year study conducted at the Institute of Natural Fibres (2543 observations carried out in commercial plantations in 1978-1984 and evaluation of weed infestations on experimental flax plots in 1967-2008) concluded that flax plantations in Poland in the last forty year were free of weed species from the "flax specialists" group (Heller 1992 and 1998).

According to Siciński (1974, 1976), the reason for disappearing "flax specialist" species was sowing of certified seeds and improvements in agronomic practices. The disappearance of these weed species is also described by Warcholińska 1986 and 1998 and Kornaś 1961.

"Flax specialists" are the taxa that are most frequently observed in regions where flax used to be grown and agronomic practices were not adequate. According to Kotle and Fitt (1997), these species were found in countries of the former Soviet Union everywhere where fibrous flax was grown. Over 1 million ha of fibrous flax was cultivated in 1980s in the former Soviet Union. *Cuscuta epilinum* Weihe ex Boenn was a big problem for the flax industry of that region (Safra and Konik 1957, Rogasz *et al*. 1967, Rudenko 1961, Emeljanowa 1971). In Russian literature (Emeljanowa 1971, Fisjunow 1977), despite often contrary and very general information about the threat posed to flax by "flax specialists", the predominant opinion is that this problem was being gradually solved. This was possible due to improvement in agronomic practices and most of all – using certified quality seeds for sowing that were weed free.

According to Kotle and Fitt (1997), in India, for instance, the flax dodder is noted in oil flax plantations in Charttisgarh, Madhya and in some parts of Orissa. In Poland, after World War II, *Cuscuta epilinum* Weihe ex Boenn was a common parasite of fibrous flax (Szafer et al. 1986, Schilling and Műller 1951, Domańska 1970, Tymrakiewicz 1976). As a result of improvement in agronomy, especially use of weed-free seed, plantations of flax in Poland have been free of flax dodder for over forty years (Heller 1992 and 1998).

Seeds of *Cuscuta epilinum* Weihe ex Boenn can be imported to Poland with flax seeds brought from the zone where agro phage is noted – especially from East European Countries and Russia. Recently, 800-1000 ton of seeds are imported annually to Poland from Lithuania, Belarus, Ukraine and Russia for production of linseed oil. There is a threat that part of these seeds can be used for sowing in the following year for oil production purposes. If these seeds are contaminated with *Cuscuta epilinum* Weihe ex Boenn, they pose a potential threat to our fields.

Additionally, every year 300-400 tons of oil flax seeds from Canada are imported to Poland by oil and paint manufacturers.

CONCLUSIONS

Plantations of fibrous flax in Poland are associated with weed species typical for root crops and cereals.

Throughout the last four decades, a systematic reduction of weed density and biomass in flax grown in Poland has been observed. The number of occurring taxa (species richness) remained relatively stable.

Within last forty years, no weed species known as "flax specialists" have been observed in flax in Poland.

REFERENCES

Domańska H. 1970. Chwasty i ich zwalczanie. PWRiL. Warszawa: 274

Emeljanowa O.V. 1971. Oczistka seman l'na. Lon i konoplja (1): 30-31

Fisjunow A.W. 1977. Sornjaki parazity i borba s nimi. Wyd. Moskwa.

Heller K. 1998. Dynamika zbiorowisk chwastów segetalnych upraw lnu włóknistego w Polsce na przestrzeni lat 1967-1996. Wyd. Inst. Włók. Natur. Poznań

Heller K. 1992. Concentration of segetal weeds on flax plantations and the possibilities of combating them by chemical methods. Natural Fibres XXXIV-XXXV: 23-39 INF Poznań

Kolte S.J. & Fitt. B.D.R. 1997. Diseases of linseed and fibre flax. Ed. Shirpa. Delhi, India: 131-132

Kornaś J. 1959. Zespoły synatropijne. W: Szata roślinna Polski 1:427-449. PWN, Warszawa.

Kornaś J. 1961. The extinctionof the association Spergulo-loliotum remoti in flax cultivars in the Gorce (Polish Western Carpathian Mountains). Bull. Acad. Pol. Cl. 2, 9 (1): 38-40

Mirek Z., Piękoś-Mirek H., Zając A. Zajac M. 1995. Vascular Plants of Poland a Checklist. Ed. Polish Botanical Studies. Guidebook Series. No. 15, pp. 303

Rogasz A.R., Abramov N.H., Tolkovskij V.A., Lebedev J.A., Listvin K.S. 1967. L'novodstvo. Wyd. Kolhoz. Moskwa.

Rudenko A.A. 1961. Novoje v borbie s povilikami. Lon i Konoplja. (4): 46-47.

Safra R. & Konik B. 1957. Barba s povilikami v posevakh lubjanykh kultur. Lon i Konoplja (4): 26-28.

Schilling E., Můller W. 1951. Len. Państwowe Wydawnictwo Techniczne. Warszawa: 189

Siciński J.T. 1974. Zbiorowiska segetalne Kotliny Szczerowskiej (Widawskiej) Acta Uniw. Łodz.. Zesz. Nauk UŁ ser.II:31-61

Siciński J.T. 1976. Wpływ stosowania herbicydów na zmiany stanu i stopnia zachwaszczenia upraw zbóż w środkowej Polsce. W: Sbornik dokładov VII-go nauchnogo sympozjuma na temu Ekhologicheskije aspekty mnogoletnogo primenienija gerbicydov v selskom khozjasjte:269-284

Szafer Wł., Kulczyński St., Pawłowski B. 1986. Rośliny Polskie.: 488-489

Turner J. 1987. Linseed Law – A handbook for grower and advisers. Alderman Print. Book Co. Ipswich.

Tymrakiewicz W. 1952. Chwasty pól uprawnych Dolnego Śląska. PAN Pr. Rol.-Leś. 72: 1-127

Tymrakiewicz W. 1976. Atlas chwastów. PWRiL. Warszawa

Warcholinska A.U. 1986. Distribution of some recession segetal weeds in central Poland. Fragmenta Floristica et Geobotanica. 31-32, 1-2: 15-42

Warcholińska A.U. 1998. Właściwości zagrożonych segetalnych roślin naczyniowych Polski.Acta Univesatis Lodziensis, Folia botanica (13):7-14: