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Research note

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BUTTERFLIES (*LEPIDOPTERA*) OF YOUNG MIDFIELD SHELTERBELTS

ABSTRACT: The study was carried out in 1999–2000 in midfield shelterbelts located in mosaic agricultural landscape near village Turew (West Poland) with the aid of transect method (total length amounted to 4520 m). Five shelterbelts (transect length – 3070 m) have been planted in 1993 and one shelterbelt (transect length – 1450 m) in 1998. All the shelterbelts have been planted on arable land. Twenty seven species of butterflies (imagines) were recorded during the study period. *Pieris napi* and *P.rapae* dominated in all shelterbelts. Their dominance in 6–7 years old shelterbelts amounted to 30 and 24%, respectively, while in younger one (1–2 years old) – 34 and 32%. Total mean density of butterflies in older shelterbelts was equal to 91.9 ind. km^{-1} of transect (width 5 m) – and was about 40% higher than in the younger one. Lower dominance of *Aphantopus hyperantus* (8%) observed in 6–7 years shelterbelts (when compared to several tens years ones) was most likely caused by small share of grasses and perennial dicotyledons, which are important for this species. The butterflies recorded in shelterbelts may be assigned to four ecological groups: ubiquistic species (7 spp.), species typical for open area (10 spp.), species linked to afforestations (3 spp.) and woodland (7 spp.). In all studied shelterbelts most abundant were ubiquistic species and open areas species (*Pieris rapae* and *P. napi*) with no respect to age of shelterbelt. Also some rare species with higher environmental demands were recorded, i.e., *Polyommatus amandus* and *Carterocephalus palaeon*, which have not been previously observed in the study area.

KEY WORDS: shelterbelts, butterflies, secondary succession, *Aphantopus hyperantus*

Butterflies were frequently studied in farmland (Dover *et al.* 2000). However, relatively few authors focused to animal communities correlated with secondary succession of vegetation in this habitat (Brown and Southwood 1983, Greiler 1994, Novotny 1994). Development of vegetation contributes to creation of the higher number of ecological niches for these insects. Appearance of given plant species may constitute important source of food for adults and larvae (Dover 1994). As phytophages, butterflies are related to habitat with plant species – their host (Buszko and Nowacki 2000).

The study was carried out in 1999–2000 in midfield shelterbelts located in mosaic agricultural landscape near Turew locality (West Poland). The descrip-

tion of the study area is given in a paper of Ryszkowski *et al.* (2003).

Butterfly abundance was estimated in 1999–2000 using the transect method (Pollard 1977). Total length of transects amounted to 4520 m (1450 m in one 1–2 years old shelterbelt and 3070 m in five older, 6–7 years old shelterbelts). The width of each transect was fixed at 5 m irrespective of the width of shelterbelt. Butterflies (imagines) were counted from the end of April till end of August, 2–3 times a month. The butterflies were detected exclusively by watching. No died individuals were collected. Numbers of butterflies recorded have been summed up and then divided by length of transects. Thus, butterfly density was expressed as number of individuals per 1 km, as is commonly accepted in studies dealing with butterfly abundance. Results of studies on several ten years old shelterbelts conducted during 1998–1999 (Sobczyk 1998) were also presented in this paper for comparison (Table 1). These studies were made on the same transects as in case of the young shelterbelts. Butterfly species have been divided into four ecological groups according to Kretschmer *et al.* (1995).

Table 1. Mean (for two years) density (ind. km^{-1}) of transect (5 m wide) and percentage share (in total amount) of four ecological groups of butterfly species for the years 1999–2000 in young shelterbelts. Data for matured shelterbelts (for 1998–1999 in several ten years old, matured shelterbelts), according to Sobczyk (1998).

Species	1–2 years old shelterbelts		6–7 years old shelterbelts		matured shelterbelts		Ecological group
	ind. km^{-1}	%	ind. km^{-1}	%	ind. km^{-1}	%	
Pieris rapae L.	18.9	32	22.4	24	3.2	3	Ubiquisitic species
Inachis io L.	1.7	3	2.4	3	1.2	1	
Pieris brassicae L.	2.7	5	2.2	2	4.7	5	
Aglais urticae L.	0.8	1	1	1	5.3	5	
Vanessa cardui L.	0.05	<1	1	1	1.8	2	
Vanessa atalanta L.			0.6	<1	1.3	1	
Pieris daplidice L.	0.2	<1	0.1	<1	1.2	1	
Pieris napi L.	19.6	33	27.4	30	18.4	18	Open habitat species
Lasiommata megera L	2.3	4	5.4	6	4.8	5	
Maniola jurtina L.	1.5	3	3.6	4	1.8	2	
Issoria lathonia L.	2.3	4	3.3	4	1.7	2	
Coenonympha pamphilus L.	2.9	5	3.3	4	2.0	2	
Polyommatus icarus Rott.	0.2	<1	0.8	<1	0.7	<1	
Lycaena phlaeas L.	0.4	<1	0.8	<1	0.9	<1	
Colias hyale L.	2.2	4	0.7	<1	0.4	<1	
Melanargia galathea L.			0.2	<1	3.2	3	
Papilio machaon L.			0.03	<1	1.3	1	
Aphantopus hyperantus L.			7.4	8	28.4	28	Shelterbelt species
Thymelicus lineola Ochs.	2	3	2.8	3	8.8	9	
Anthocharis cardamines L.	0.1	<1	1.2	1	2.5	2	
Lycaena tityrus Poda					0.9	<1	
Gonepteryx rhamni L.	0.5	<1	1.9	2	1.6	2	Woodland species
Araschnia levana L.			1.5	2	2.7	3	
Celastrina argiolus L.	0.1	<1	1.1	1	1.5	1	
Polygonia c- album L.			0.7	<1	0.9	<1	
Polyommatus amandus Schn.			0.05	<1			
Pararge aegeria L.					0.7	<1	
Quercusia quercus L.					0.4	<1	
Carterocephalus palaemon Pall.			0.04	<1	0.1	<1	
Apatura ilia Den & Schiff.			0.02	<1	0.2	<1	
Total	58.5		91.9		102.6		
	18 species		27 species		29 species		

Annual plant species, i.e., typical weeds (community with *Echinochloa crus-galli, Chenopodium album, Erigeron canadensis* and *Echinochloo-Setarietum*) dominated in younger shelterbelt. Vegetation cover in this shelterbelt was characterized by low density of perennials and grasses (mainly *Agropyron repens* and *Apera spica-venti*) as well as by their small (percent) cover. Among plant species which produce nectar suitable for adult butterflies, only *Cirsium arvense* occurred commonly. In vegetation cover of older shelterbelts perennials prevailed. The most important for adult butterflies (author's own observation) are species producing nectar such as *Cirsium arvense, Convolvulus arvensis* and less commonly occurring *Inula sp., Ballota nigra*. While the most significant for larvae were *Plantago lanceolata, Urtica dioica* and *Rumex acetosa*. Beside of perennials, also grasses (13 spp.) grown commonly. Among others, three species of *Poa genus* were recorded.

In 1–2 year old shelterbelt 18 species of butterflies imagines were recorded during two years of study. In 6–7 years old shelterbelts the number of species was higher (20–27 species) and approached those found in older shelterbelts (29 species) (Table 1).

Pieris napi (33%) and *Pieris rapae* (32%) dominated in the 1–2 years old shelterbelt. The shelterbelts 6–7 years old were dominated by the same species but their share was smaller – 30% and 24%, respectively, which made up 54% of total butterflies numbers. The density of butterflies in the 6–7 years old shelterbelts (91.9 ind. km^{-1}) was close to that found in old mature shelterbelts (Table 1).

Relatively high butterfly density and species richness in 6–7 years old shelterbelts were very similar to those observed in matured shelterbelts (Sobczyk 1998) (Table 1); it was most likely related to well developed herb layer. When the shelterbelts became older, the density of *Aphantopus hyperantus* will probably increase. In 1–2 years old shelterbelt it did not occur while in 6–7 years old shelterbelts its density amounted to 7.4 ind. km^{-1}. Likely it is related to more frequent occurrence of *Poa* spp., which is a source of food for larvae of this species as well as to improvement of physical conditions; the larvae need shadowed parts of herb-layer resulted from occurrence of trees (Roy *et al.* 2001). This species together with *Pieris napi* clearly dominates in the different types of linear afforestations in study

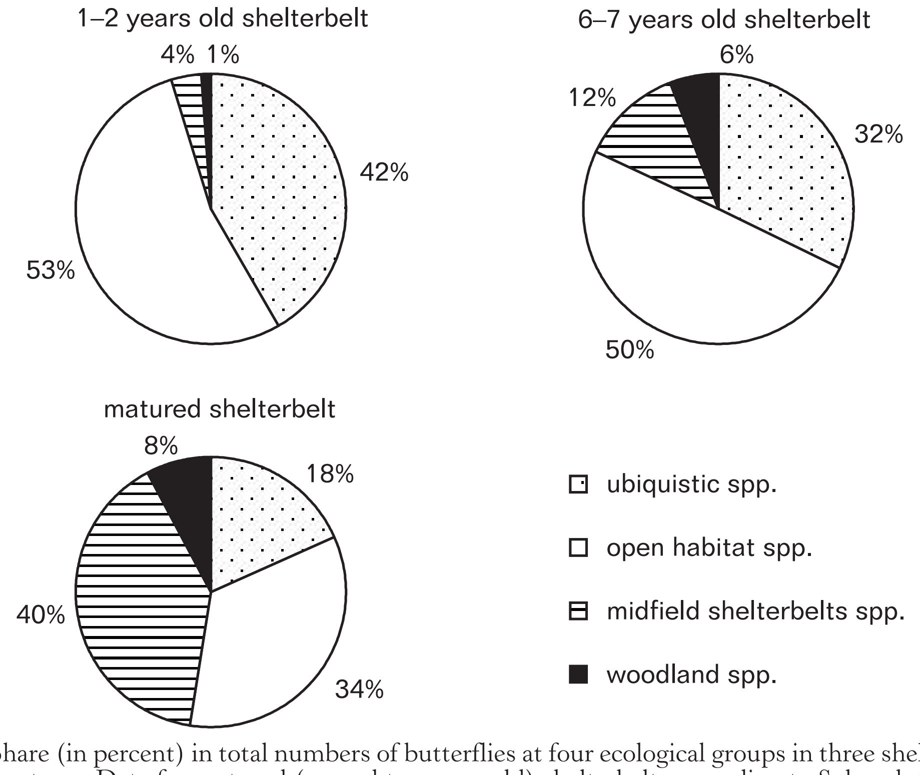

Fig. 1. Share (in percent) in total numbers of butterflies at four ecological groups in three shelterbelts of different age. Data for matured (several ten years old) shelterbelts according to Sobczyk (1998).

area (Sobczyk 1998). Dover (1994) underlined the importance of trees which play a role as a shelter from wind for *Satyridae*. The species of this family are characterized by high relation to a site of their occurrence and lack of that shelter from wind could cause their movement to a site with unfavorable conditions. Dense canopy-layer may inhibit fading of some species, e.g., *Cirsium arvense* which is important source of nectar for adult individuals of many butterfly species.

High dominance of *Pieris napi* and *P. rapae* in studied shelterbelts was partially related to immigration because these species are very mobile and could be attracted by occurrence of plant species producing nectar. They may also use the shelterbelts as corridors. Their reproduction there can not be also excluded. Larvae of theses species use different species of *Brassicaceae* which are common everywhere.

Appearance of *Carterocephalus palaemon* (two records in 6–7 years old shelterbelts in spring) may indicate proceeding development of different species of grasses, in this case – *Bromus* spp., which is a source of food for the larvae of this species. Occurrence of *Melanargia galatea* and higher percentage share of *Lasiommata megera* in relation to 1–2 year old shelterbelt may be caused by emerging stable grass cover which is important for butterflies.

Similarly to old matured shelterbelts (Sobczyk 1998) butterfly community of young shelterbelts was characterized by domination of ubiquistic species or species typical for open habitats (Table 1). However, in 6–7 years old shelterbelts the share of woodland species was markedly higher (7 spp.) and they were more similar to matured shelterbelts (Table 1). With development of the shelterbelt, share of butterflies species typical for forest and old shelterbelt increased (Fig.1). In the case of last group it was caused mainly by *Aphantopus hyperantus*.

According to the studies of Brown and Southwood (1983), Greiler (1994), Novotny (1994), the highest diversity and abundance were achieved as early as in second year of succession of vegetation. It was likely related to quick replacement of pioneer plant species by perennials. In respect to these earlier studies it is evident that well developed herb-layer positively affects occurring of some butterfly species.

It was evidenced also in a study carried out in English farmland dealing with the effects of introduced balks (Thomas *et al.* 1991, Feber *et al.* 1996) and enriched (by sowing) in plant species important for butterflies. Such kind of treatment significantly accelerated the rate of succession and allowed to skip the phases of succession which are unfavorable for butterflies. Young shelterbelts as early as in 1–2 year of their development contributed to enhancing abundance and species richness of butterflies. However, only in successive years of shelterbelt growth, when more stable plant communities start to emerge (which are independent from neighboring crop fields), communities of butterflies begin to be more stable and similar to communities occurring in matured shelterbelts. It is reflected by smaller dominance of *Pieris napi* and *P. rapae* and higher dominance of *Aphantopus hyperanthus* and other woodland species (Table 1). During first years of shelterbelt growth, plant communities are dominated mainly by weeds while grass communities are poorly developed. Then *Pieris napi* and *Pieris rapae* highly dominate because they prefer open habitats.

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