

MIGRATORY SPECIES OF BUTTERFLIES IN THE SURROUNDINGS OF SIBIU (ROMANIA)

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Abstract

Butterfly migration is an entomological scientific community debated topic since the last century. Today we know more information about invasions of butterflies in different parts of the world some of them being attributed to climate change. The research started in 1999 and until now, the collections of Lepidoptera studied and also with collections around Sibiu enabled me to accomplish a list about the migratory butterfly species around Sibiu.

Key words: butterflies, climatic changes, migration, Romania, Sibiu

INTRODUCTION

One of the earliest reports of butterfly migration, is dating from 1100, reported as a flight of a swarm of butterflies in Saxony up to Bavaria. Cristofor Columbus reminds from his expeditions, about the appearance of an intense swarm of butterflies that darkened the sky. In 1745, a growing population of the cabbage butterfly created to the locals in Harra Germany, the impression of a snowstorm in the middle of winter. Today is known a lot of information about the butterflies invasions in most European countries.

Butterfly migration can be defined as a directed movement for a longer period of time, that is not dynamic, under normal conditions, which is obviously influenced by external factors. Most theories that try to explain the causes of butterflies migration start from the unfavorable environmental conditions. The lack of food or inadequate one [1,2,44], overpopulation, the approach of drought or cold periods, which triggers the migration in most cases.

From the effectuated research it seems that the admiral butterfly looks like *Vanessa atalanta* and the thistle one, they come to our country in search of a more cool and humid climate, their descendants returning to south in autumn, avoiding the cold winters in

Romania. But not to all species, triggering the migration flight can be correlated with the alternation of the environmental conditions[15].

Flying speed is characteristic to all species, being strongly influenced by environmental factors, especially by wind and precipitations. Diurnal butterflies can not fly but with the speed of 15-20 km / h, and in favorable wind conditions, the same species can travel even with 150 km / h. Top speed records the crepuscular butterflies of Sphingidae family from which *Acherobia atropos* (the skull butterfly) and *Daphis neri* (oleander moth), by its own force reaching 50 km/h, and by using the wind also 100 km/h.

Research on butterfly migration, revealed that major losses in agriculture and forestry may be due to the massive migration of harmful species, from a geographic area to another. Knowing the specifics of biology and flight, for potentially or actually harmful migratory species to agriculture or forestry would allow effective warning forecast, reducing annually damages. Studies on flight dynamics, speed, orientation could have considerable theoretical and practical implications[4].

It is important to understand the difference between dispersal and migration. The term dispersal is used to describe random and aimless movement away from the site where a butterfly emerges. Dispersing butterflies are

easily diverted from their course by minor changes in wind direction or obstacles in their path. They will for example fly around the edge of a block of forest rather than fly through it or over it. When they encounter hostile habitats such as arable farmland, lakes, rivers, roads or buildings they steer left or right to try to find a route around them[47].

Butterflies have strict requirements in terms of minimum/maximum temperature tolerance. The habitats they occupy are determined by where their larval food plants grow, and by the availability of adult food sources and roosting sites. They are unable to survive and breed unless these and numerous other vital conditions are precisely met. Suitable habitats are often highly localised so consequently many species have an extremely patchy distribution[5,8,11, 28]. Nothing in nature is constant. Habitats are continually changing [13,14,38,39]. Woodlands become overgrown and shade out herbaceous plants on which the caterpillars of many butterflies depend.

Butterflies commute altitudinally too, moving from peaks to valleys and back again, to areas where the temperature is most suitable. Sometimes these journeys take them to mountain passes. Over the millennia these become established routes by which species migrate seasonally from one valley to another[16,45].

MATERIALS AND METHODS

Due to the studies and the collection carried around Sibiu (Dumbrava Sibiu, Sibiel[25,31,43]), the analysis of museum collections with collections made since 1879 in different areas of the city but also personal collections started in 1999 and till 2015 of the Lepidoptera populations revealed that there are two types of migratory species of butterflies.

Prospective migratory forms include species that recognize beforehand the unfavorable periods of life, and it is an internal factor that causes the migration. The migration takes place at the time when, the environment living conditions afford the maintaining of

the species. In this category we have migratory species as eumigrants which are seasonal migrators of the first rank, that leave every year at certain times their developmental areas in search of seasonal breeding areas. The descendants of these species of butterflies migrate in the opposite direction, returning to the areas where their parents migrated. Also in the collection area we met the paramigrants, that are seasonal migratory populations of rank 2. These Lepidoptera populations leave annually at some moments the area around Sibiu, seeking for areas where they can withstand the winter as adults after the latency period and changing life conditions. These species are returning in the study area for breeding.

Migratory consecutive forms, which include migratory species to whom the phenomenon of migration is triggered by improper survival factors (temperature, food, moisture, length of days or nights). In this type of forms we have species of immigrants that migrate targeted within the areal, these populations are not returning to the original territories, but remain in the new ones and here produce their descendants. Specimens exceeding the optimal area of the species, reaching atypical spaces disappear. Species that practice the dismigration are expansionist species or population with fluctuating density, which in cases of high densities, are expanding their areal. The character of migration is triggered irregular, random and the migration is not redirected.

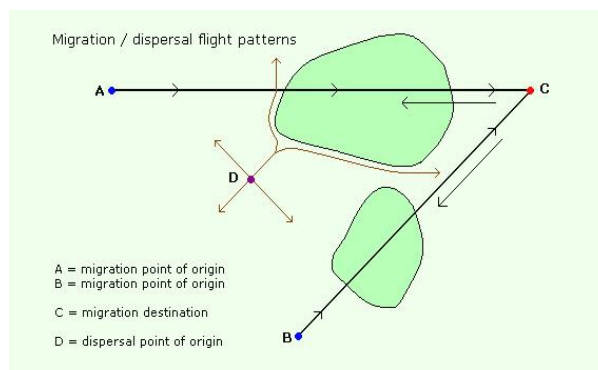


Fig.1. The diagram above illustrates the differences between dispersal and migrational flight patterns. The blocks of green represent 'hostile' habitats, e.g. a dispersing grassland butterfly would consider a forest to be hostile so would avoid flying into it or over it.

Source: <http://www.learnaboutbutterflies.com/Migration.htm>

Seasonal migration is an entirely different phenomenon from commuting or random dispersal. It tends to occur spontaneously and involves the mass movement of hundreds, thousands or even millions of butterflies (Fig.1.).

Other species such as Clouded Yellows, Whites and Swallowtails are nomadic, and migrate down to the lowlands in late summer to breed. In lowlands, but the habitat there becomes too hot and dry in summer, so they then return to the the early spring their progeny produce a further brood in the

mountainsides where there is cooler air and an abundance of flowers for nectaring[45,46].

RESULTS AND DISCUSSIONS

Of Macrolepidoptere migratory species that we have met over the years around Sibiu (Table 1) either from own collections [3,7,17-24,26,27,29,30,32-37,40-43], museum collections or from published data we have achieved a provisional classification [6,9,10,12,37], according to data from particular literature.

Table 1. The classification of the migratory butterflies species in the surroundings of Sibiu

GROUP	FAMILY	SPECIES
I Imigrants	NYMPHALIDAE	<i>Vanesa atalanta</i> Linnaeus, 1758 2♀♀, 11,17.VII.2001, 3♀♀, 11.VII.2003, 21.VIII.2003, 16.IX.2003, 24♂♂, 18.VII.2001; 22.VII.2004; 16.VIII.2009; 23.VIII.2011; 10♂♂, 26.VIII.2001; 17.IX.2003; 3ex. 22.IX.2004; 4ex. 23.IX.2009; 1.X.2010; 8.X.2011, 5♀♀,10.V.2011; 27.VI.2011, 2ex.15.VII; 15.VIII.1951 EW[10]; 1ex., 20.VIII.1920 DC; 1♂, 23.IX. 2011 CM[37]
		<i>Vanesa cardui</i> Linnaeus, 1758 3♀♀, 17,18,23.V.2001, 2♀♀, 13.15.VIII.2007, 5♂♂, 18.V; 9.VI.; 26.VIII; 2 ex. 8.X; 13.X. 2011; 2♀♀,9.IV; 18.V. 2011;16.VIII.1916 DC[9]; 30.VII.1907 VW; 1.IX.1952 EW[10]
	SPHINGIDAE	<i>Acherontia atropos</i> Linnaeus, 1758 2♂♂, 10.VIII.1938 EW [10]
	NOCTUIDAE	<i>Agrotis ipsilon</i> Hufnagel, 1766 2 specs., 18.VIII.1904 VW[12]
II Paramigrants	ARCTIIDAE	<i>Euplagia quadripunctaria</i> Poda, 1761 1 spec., 2.VIII.1888 DC [9] , 2specs.,11.VIII.1904 VW[11] , 15.VIII.1903 VW[12], 6 specs.,16.V.1939 EW, 10.VI.1945 EW; 13.VI.1938 EW, 27,28.VII.1953 EW; 17.VIII.1953 EW[10] [10]
		<i>Aporia crataegi</i> Linnaeus, 1758 3♀♀, 17,22,29.V.2001, ,9♂♂, 8 ex. 31.V; 9.VI. CM 2011; 12.VI.1904 VW; 13.VI.1907 VW [12,37]
III Emigrants	PIERIDAE	<i>Pieris brassicae</i> Linnaeus, 1758 1ex., 21.V.1904 VW; 68♀♀, 3ex. 2.VII; 4.VII; 2 ex.11.VII; 5ex. 18.VII; 1.VIII.1903 VW; 6ex. 2.VIII; 6.VIII; 5ex. 11.VIII; 3ex. 18.VIII; 3ex. 26.VIII; 17.IX; 11ex. 22.IX; 24ex. 23.IX; 1.X; 2 ex. 7.X. 2011 CM[10,37]
		<i>Pieris napi</i> Linnaeus, 1758 IV.1920 (non collections day) VW; 10.IV.1921 VW; 1♀, 25.VIII.2001, 2♂♂, 2.VII.2003; 26.VIII. 2011; 9♀♀, 3ex. 26.VIII.2001; 22.IX.2001; 2ex. 23.IX.2003; 7.X.2003; 21.VIII.2011, 8.X.2011; CM[12,37]
		<i>Pieris rapae</i> Linnaeus, 1758 1ex., IV.1920 (non collections day) VW; 4♀♀, 12.15,17,29.IV.2001, 2♀♀, 17.V.2003, 45♂♂, 3.IV.2003; 1.V.2003; 31.V.2003; 9.VI.2004.; 7 ex. 26.VI.2005; 2.VII.2005; 6.VII.2005; 4ex.11.VII.2006; 12.VII.2001; 15.VII.2006; 4ex. 2.VIII.2009; 2ex. 6.VIII.2009; 3ex. 11.VIII.2011; 3ex. 18.VIII.2011; ex. 26.VIII.2011; 3ex. 22.IX.2011; 6ex. 23.IX. 2011;CM; 1ex.11.V.1955 VW; 21.V.1904 VW; 41♀♀, 8.V.2001; 2ex. 9.VI.2001; 7ex. 26.VI.2003; 3ex. 2.VII.2001; 11.VII.2003; 3ex. 12.VII.2004; 2.VIII.2004; 5ex. 11.VIII.2011; 9ex. 18.VIII.2011; 2ex. 26.VIII; 5ex. 22.IX.2011; 7.X; 8.X. 2011 CM [37]
	NYMPHALIDAE	<i>Colias hyale</i> Linnaeus, 1758 1ex.; 12.V.1904 VW; 7♀♀, 8,11,22,27,29,30,31.VII.2001, 5♂♂, 11.VII.2001; 22.VII.2003; 18.VIII.2001; 23.VIII.2011; 9.X. 2011 CM; 1ex.,15.VIII.1903 VW; 4♀♀, 2 ex. 15.VII.2001; 23.IX.2011; 7.X. 2011 CM
		<i>Inachis io</i> Linnaeus, 1758 1ex.,23.VI.1953 EW[10]; 1ex., 12.VII.1918 DC; 1♂, 21.VI.2001, 2♂♂, 7.VII.2003; 1♂, 18.VII.2005, 1♀, 13.VII.2001, 1♀, 17.VII.2003, 1♀, 12.VIII.2008, 1♀, 22.VIII. 2011 CM EW [10]
		<i>Aglais urticae</i> Linnaeus, 1758 1spec.; 12.III.1922 VW[12] ; 1spec., 4.VI.1941 EW[10]
LYCAENIDAE	<i>Issoris lathoria</i> Linnaeus, 1758 1 spec., IV.1920 (non collections day) VW, 2 specs., 3.VIII.1903 VW, 15.VIII.1903 VW [12], 1 spec., 25.VIII.1938 EW [10,37]	
	<i>Lycaena phlaeas</i> Linnaeus, 1785 2specs.; 21.V.1904 VW; 14.VII.1903,1904 VW[11] ; 4♂♂, 24.VII.1952 EW; 2♂♂, 1♀,25.VII.1938 EW; 26.VII.1953EW [10,37]	
GEOMETRIDAE	<i>Cyclophora punctaria</i> Linnaeus, 1758 1 spec. 27.IV.1904 VW [12]	
PAPILIONIDAE	<i>Papilio machaon</i> Linnaeus,1758 2 ex.; 17.V.1902 VW; 1♂17.V.1939 EW; 9.VII.1904 VW; 1♂25.VII.1939 EW; 1♀,12.VII.2001, 1♂1.X.2007 CM [10,12,37]	
IV Dismigrants	NYMPHALIDAE	<i>Nymphalis xanthomelas</i> Esper, 1781 1spec.,9.VII.1904VW[12];1spec., 9.VI.1947 EW[10]
	SPHINGIDAE	<i>Hipparchia semele</i> Linnaeus, 1758 1 spec. 29.VII.1958 HH [37]
	NOCTUIDAE	<i>Hyloicus pinastri</i> Linnaeus, 1758 15.VIII.1938 EW [10]
		<i>Catocala sponsa</i> Linnaeus, 1767 3specs.; 23.VII.1907 VW; 26.VII.1904 VW;2specs.; 8,11.VIII.1904 VW [12,37]
		<i>Catocala elocata</i> Esper, 1787 1spec.; 16.VIII.1904 VW [12,37]

CONCLUSIONS

After centralizing the data obtained during the years of study on the populations of Lepidoptera collected around Sibiu can conclude that there are these migratory species grouped into four classes: *Immigrants*, species of *Nymphalidae* families (2 species), *Sphingidae* (1 species) and *Noctuidae* (1 species), *Paramigrants*, a species of the family *Arctiidae*, *Emmigrants* who is the group best represented by 4 families: *Pieridae* (5 species) *Nymphalidae* (3 species), *Lycaenidae* (1 species) and *Geometridae* (1 species). In the *Dismigrants* group we have the following families: *Papilionidae* (1 species), *Nymphalidae* (2 species), *Sphingidae* (1 species) and *Noctuidae* (2 species).

From the undertaken research can be drawn that the species of lepidopteran family *Nymphalidae* leave annually at some point the study area of the enclosure of Sibiu, seeking actively areas where they can withstand as adults the winter time after the latent period and after changing life conditions. The distribution of a species within its range is also greatly affected by human intervention - urban expansion has the greatest impact, but governmental policy on farming, forestry and road planning also has a very profound effect on the distribution and abundance of butterflies. According to some authors, species such as *Apatura iris* which occur at low density in woodland habitats can't easily locate the opposite sex, so they have evolved 'hill-topping' - a strategy whereby both sexes fly to the highest point in the vicinity, typically a tall oak tree on a ridge, where courtship and copulation take place. After mating the females disperse to lay their eggs on sallow bushes which typically grow alongside ditches on lower ground. The males also disperse to low lying areas where they feed by imbibing mineralised moisture from the paths or patches of mud. Next morning they commute back to the 'master' oak tree to mate with other females [16].

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