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INFLUENCE OF MACROSYNOPTIC WEATHER SITUATION ON THE AUTUMN MIGRATION OF BIRDS IN HUNGARY*

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ABSTRACT

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In the study we have examined the relation between the European macrosynoptic weather situation and the number of birds captured a day at four Hungarian ringing stations during the autumn migration. Along the research we examined the data of 32 809 individuals of 8 species using different migration strategies. Using the daily capture data at the four stations we constructed the migration diagrams for each year. We chose the migration peak days within ten-day periods and examined how these peak days or their preceding days are distributed over Péczely's macrosynoptic weather situations. Comparing the 8 bird species no significant difference in distribution of the peak days over the macrosynoptic weather situations was found (ANOVA: $F_{7,376} = 1.81$, $p = 0.084$). 85% of the migration peak days for all the species were connected with anticyclones, 10% with meridional cyclone / cold front situation and 5% with other cyclonic ones. The most frequent weather situation on the migration peak days was central anticyclone, which occurred in 61 cases.

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Key words: macrosynoptic weather situation, bird migration dynamics

INTRODUCTION

Earlier researchers, mainly American and Western-European authors proved that starting of the migration and its speed were in close connection with the change of weather phenomena (Alerstam 1978). The weather conditions which are favourable for migration help the orientation of birds, reduce the use of flying energy and increase the speed of migration (Emlen 1975, Bloch and Bruderer 1982, Gauthreaux 1982, Akesson 1993). The favourable weather conditions can occur in different macrosynoptic weather situations (Kerlinger and Moore 1989). The Sedge

Warbler (*Acrocephalus schoenobaenus*) migrating in the southern part of Hungary can be captured in the largest number during antycyclonic weather situations after cold weather fronts (Gyurácz *et al.* 1997). We usually know well the effect of weather phenomena on the bird migration activity (Richardson 1990) and flying activity of the insects (Novinszky *et al*. 1997), but we have little information about what kind of different adaptive behaviour patterns can occur among the species, which have different genetically determined migration strategies.

In the present study we had one goal: to study influence of macrosynoptic weather situation on the migration of some long- and short-distance migrants passing through Hungary.

MATERIAL AND METHODS

Along the research we examined the data of 32 809 individuals of 6 numerously caught species using different migration strategies: the Sedge Warbler with total number of birds ringed – N = 14 157, the Reed Warbler (*A. scirpaceus*) – N = 11 043, the Blackcap (*Sylvia atricapilla*) – N = 3228, the Robin (*Erithacus rubecula*) – N = 1808, the Chiffchaff (*Phylloscopus collybita*) – N = 732, the Blue Tit (*Parus caeruleus*) – N = 965, as well as two species caught in lower numbers: the Pied Flycatcher (*Ficedula hypoleuca*) – N = 118 and the Goldcrest (*Regulus regulus*) – N = 651.

Material was collected at the following ringing stations: (1) the BirdLife Hungary at Ócsa near Budapest (47°19'N, 19°13'E) in the periods: 15 July – 10 September 1988, 15 July – 16 September 1989, 15 July – 15 September 1990; (2) Fenékpuszta next to Lake Balaton (46°44'N, 17°14'E): 17 July – 17 September 1988, 15 July – 17 September 1989, 15 July – 23 September 1990; (3) Lake Sumony in southern Hungary (45°48'N, 17°56'E): 31 July – 4 September 1988, 30 July – 10 September 1989, 28 July – 9 September 1990 and from the middle of July to the middle of September in 1995-2000; and (4) Lake Tömörd in western Hungary (47°22'N, 16°41'E): 10 August – 19 September 1998, 22 August – 31 October 1999, 20 August – 19 November 2000 (Fig. 1).

To catch birds we used standard passerine mist-nets (12 × 2.5 m in size, four-shelf, with a mesh of 16 mm) – 66 in Ócsa, 10 in Fenékpuszta, 30 in Sumony and 29 in Tömörd. The nets were put at the same place every year.

Using the daily capture data at the four ringing stations we chose the migration peak days (*i.e.* days with the largest numbers of captured birds within ten-day periods) and examined how these peak days or their preceding days are distributed over Péczely's macrosynoptic weather situations (Péczely 1983, Károssy 1987). We controlled the distributions by χ^2-test. Macrosynoptic weather situations which characterised the migration peak days were compared using analysis of variance (one-way ANOVA). Thirteen Péczely's macrosynoptic weather situations based on typical current systems can be divided into 6 main types:

Fig. 1. Location of ringing sites (FE – Fenékpuszta, OC – Ócsa, SU – Sumony, TO – Tömörd)

I. Meridional northern direction situations:

Meridional cyclone / cold front (***mCc***) – Hungary belongs to the current system of back part of the cold front cyclone which occurs to the east, north-east of Hungary – over the Baltic region or Ukraine. This situation causes changeable, windy and rainy weather in the Carpathian basin. Summer weather can be without cold fronts. This situation favours local showers, thunder-storms. The average temperature is colder in summer. There are more clouds than the average and there is good visibility. Strong northern or north-western wind can blow. The temperature stratification of air is stable.

Anticyclone over the British Isles (***AB***) – Because of the Azores anticyclone, which is situated in the north, and because of the anticyclone which occurs to the south of the polar basins, high-pressure air-masses can develop over the British Isles or the North Sea. This is connected with passage of cold front in the Carpathian basin. It causes vivid northern or north-western current in our area. The cloudiness is average and in summer the amount of clouds is higher.

Cold front of the Mediterranean cyclone (***CMc***) – This meridional situation with northern current is the back current system of the cyclone. The situation develops that it gets into the back cold-front current system of the Mediterranean cyclone.

II. Meridional southern direction situations:

Meridional cyclone / warm front (***mCw***) – The area of Hungary is influenced by the warm front of the cyclone. In autumn it is cooler than the average temperature of given period. The cloudiness is stronger mainly in spring and in autumn. There is low visibility. Summers can be characterised by heavy air and the air-pollution is high.

Anticyclone to the east of the Carpathian basin (***Ae***) – The anticyclone which centre is situated to the east of the Carpathian basin causes sunny, dry, windless weather daytime in October. However, it is often foggy in the mornings, because the temperature cools down at night. The weather fronts are situated to the west of the Carpathian basin. The summers are dry, warm with clear sky. Most of the year is characterised by warmer weather than the average. The cloudiness is smaller, at this time the weather is often dry and there are droughts. The air shows inverse temperature stratification.

Mediterranean cyclone / warm front (***CMw***) – The frontal part of the cyclone occurs in Hungary. The weather is cooler in summer than the average. There is poor visibility and the cloudiness is high.

III. Zonal western direction situations:

Zonal cyclone (***zC***) – The European stage of the frontal zone is situated near the 50^{th} degree of latitude. The air flows from west to east. There is strong cloudiness. The amount of rainfall is higher at the beginning of autumn, and the weather is cooler in summer than the typical one for this season.

Anticyclone to the west of the Carpathian basin (***Aw***) – The anticyclone of Azores gets more northern (mainly in summer) and its extension appears in the area of Central-Europe. It causes intense north-western or western air current in the area of the Carpathian basin. The weather is cooler in summer than the typical one for this season. There is high visibility and the air pollution is low.

IV. Zonal eastern direction situations:

Anticyclone to the south of the Carpathian basin (***As***) – This zonal situation causes western air current. Most of the year the weather is warmer than the average and the cloudiness is smaller. It causes heavy air in summer, the air current is weak and the rainfall is small. The lowest air-stratum is colder than the higher one and inversion can occur.

Anticyclone to the north of the Carpathian basin (***An***) – The anticyclone, which appears to the north of Hungary, over the Baltic region and Poland, creates high-pressure ridge from the British Isles to the east of Europe. In summer the weather is warmer than the typical one for the season. It is characterised by clean air and northern wind. Typical surrounding isobars can occur along the Carpathians and occlusive front is created because of the cold weather. The cloudiness is average. The air motion is north-eastern or north-western.

Anticyclone over the Scandinavian peninsula (***AF***) – The anticyclone, which appears in the Fenno-Scandinavian region, has north-eastern – south-western direction. It causes northern air current in Hungary. The rainfall is low.

V. Central anticyclone:

Anticyclone over Carpathian basin (***A***) – All the area of Central-Europe is dominated by a central anticyclone which is formed over the Carpathian basin. Its size can be smaller, only a few hundred kilometres, but it can be an inter-anticyclone, which separates cyclone systems and moves very fast. However, it stays mostly over the Carpathian basin. In winter the cold air-cushion which stagnates at the bottom of the basin (inversion) extends its staying. If it exists for a long time, it causes undisturbed solar weather. In summer the temperature rises very much, there are hot spells and thunder-storms. It is often characterised by air-motion which starts from the centre and moves into different directions. Most of the year the weather is sunny, it is warm daytime and summer, but it is cold at nights and in winter. The fluctuation of temperature is high. The cloudiness is small, in summer the sky is much clearer. The amount of precipitation is low, and it shows a very changeable territorial distribution. Homogeneous and typical direction of wind does not develop.

VI. Central cyclone:

Cyclone-centre over the Carpathian basin (***C***) – The centre of the cyclone is situated over the Carpathian basin. Usually it consists of Mediterranean cyclones. When it occurs in summer, the temperature is colder than in the previous days. There is poor visibility and the air pollution is low. The amount of precipitation is remarkably high. Lately, this central cyclone has occurred less frequently.

RESULTS

Seasonal migration dynamics of studied bird species

The data used were not evenly distributed over the migration season of studied species as periods of work of stations did not cover the whole autumn. This is differentiated for some species. In the case of the Sedge Warbler and the Reed Warbler, the data for the three stations (Ócsa, Fenékpuszta and Sumony) in 1988-1990 cover shorter, but central part of the time for data collected in Sumony in 1995-2000 (Fig. 2). Data for other species collected in Sumony in 1995-2000 are much shifted in time in relation to the data from Tömörd collected in 1999-2000 (Fig. 3) and the data from Tömörd 1998 came from a rather short period in the middle of the season. Details of the migration dynamics for Ócsa + Fenékpuszta + Sumony for years

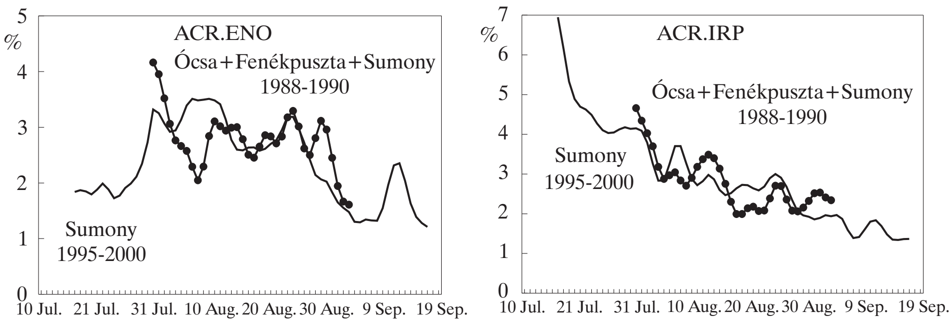

Fig. 2. Migration season of the Sedge Warbler (ACR.ENO) and the Reed Warbler (ACR.IRP) as studied at Ócsa, Fenékpuszta and Sumony; smoothed by 5-day moving average

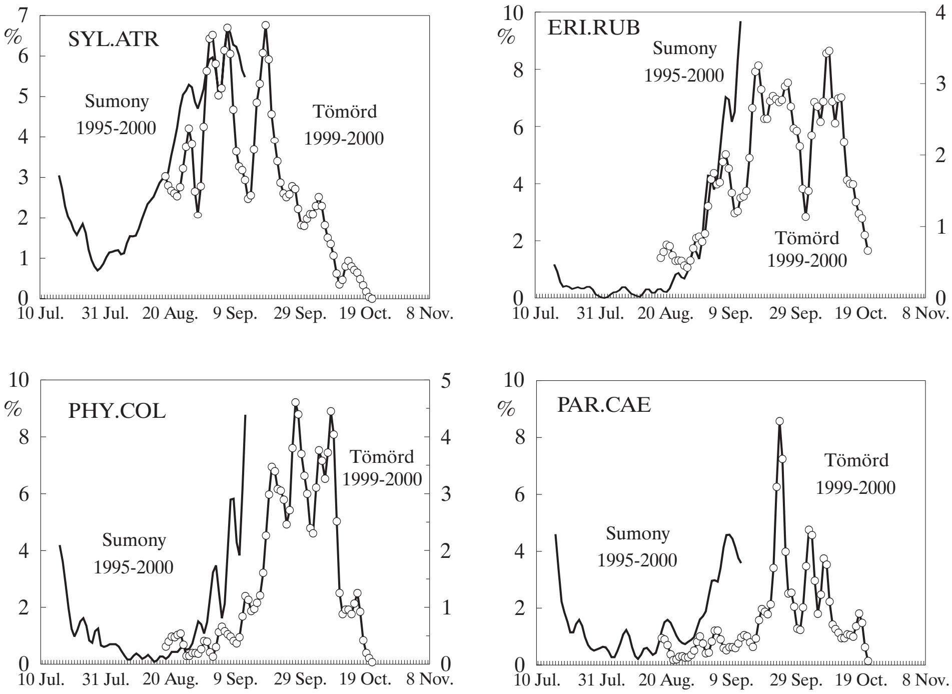

Fig. 3. Migration season of the Blackcap (SYL.ATR), the Robin (ERI.RUB), the Chiffchaff (PHY.COL) and the Blue Tit (PAR.CAE) as studied at Sumony and Tömörd; smoothed by 5-day moving average

1988-1990 are given in Figure 4, for Sumony 1995-2000 – in Figures 5-10 and for Tömörd 1998-2000 – in Figures 11-12.

Description of migration of birds based on macrosynoptic weather situations

Sedge Warbler

We separated 63 migration peaks (9 ones each year) studying the migration diagrams. About a quarter of migration peaks occurred in the *Aw* weather situation (Fig. 13). 4045 (on average 64.2) individuals were captured on the migration peak days. On the peak days that occurred in the *A* anticyclonic situations much more birds were captured than in the *Aw* weather situations (Table 1). Studying all the migration peaks, in 54 cases (85%) they were connected with anticyclones and cyclones occurred on peak days only in 15% of the cases. 33% of the cyclones were connected with cold fronts of northern direction ($\chi^2 = 57.57$, $df = 12$, $p < 0.01$). Migration peaks did not occur during warm front of Mediterranean cyclone (*CMw*). On the 24% days preceding migration peaks *Aw* anticyclone was typical ($\chi^2 = 44.4$, $df = 12$, $p < 0.01$).

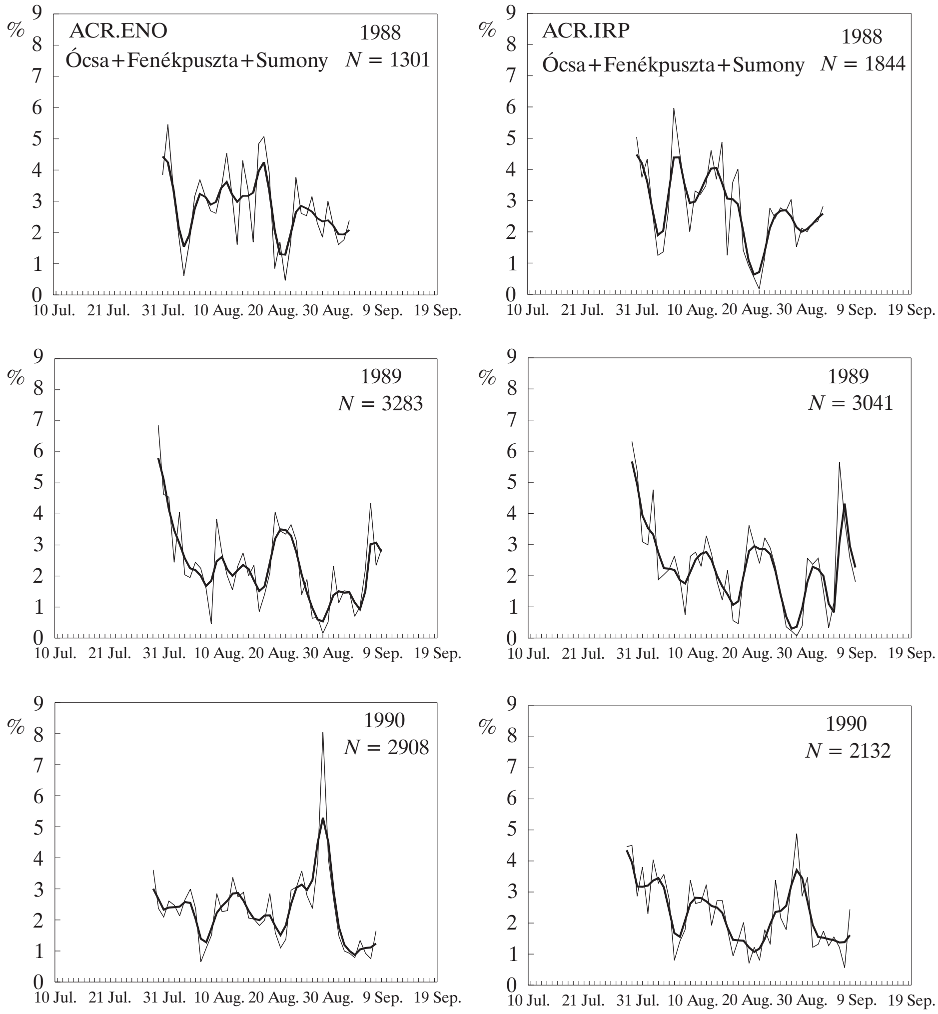

Fig. 4. Details of migration dynamics of the Sedge Warbler (ACR.ENO) and the Reed Warbler (ACR.IRP) at Ócsa, Fenékpuszta and Sumony 1988-1990; thin line – original data, thick line – smoothed by 5-day moving average

Reed Warbler

Based on the migration diagrams, we chose 62 migration peak days. On the peak days 3245 individuals were ringed, which constituted 29.4% of all individuals. The most frequent weather situation was *Aw* (Fig. 13), when there were ringed 690 individuals. This situation occurred 13 times on peak days, *i.e.* in 21% of all the migration peaks. The second most frequent weather situation was *A*, which occurred in 19% of all the cases ($\chi^2 = 50.91$, $df = 12$, $p < 0.01$). 880 individuals were ringed on these days. In the second most frequent anticyclone on average 73.3 individuals were captured daily, which is much more than the number of the most frequent anticyclone, when 53.1 individuals were captured daily (Table 1 – see page 33). The

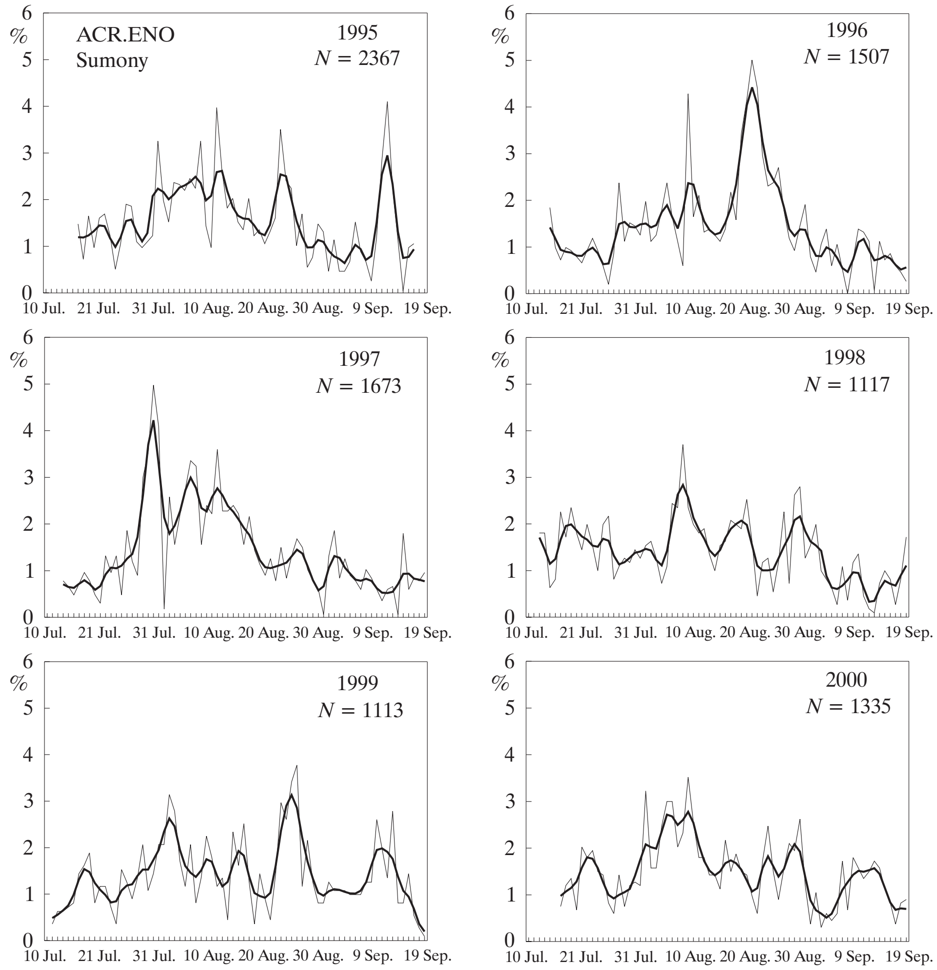

Fig. 5. Details of migration dynamics of the Sedge Warbler (ACR.ENO) at Sumony 1995-2000; explanation as in Figure 4

third most frequent weather situation, which occurred 9 times (15%), was also anticyclonic (*An*). All the 3 anticyclones were characterised by clear sky. On the 24% days preceding migration peaks *Aw* anticyclone was typical ($\chi^2 = 44.5$, $df = 12$, $p < 0.01$).

Blackcap

Studying the migration diagrams, we chose 60 migration peak days. 941 individuals, which constituted 29.2% of all individuals, were captured on the migration peak days. The most frequent weather situation was *Ae* anticyclone on the peak days (Fig. 13). It occurred in 13% of all the cases ($\chi^2 = 15.47$, $df = 12$, *ns*). The weather situation on the days preceding migration peaks usually was *mCc* cyclone. It occurred in 24% of all the cases. The second most frequent weather situation was *Ae* anticyclone ($\chi^2 = 39.1$, $df = 12$, $p < 0.01$).

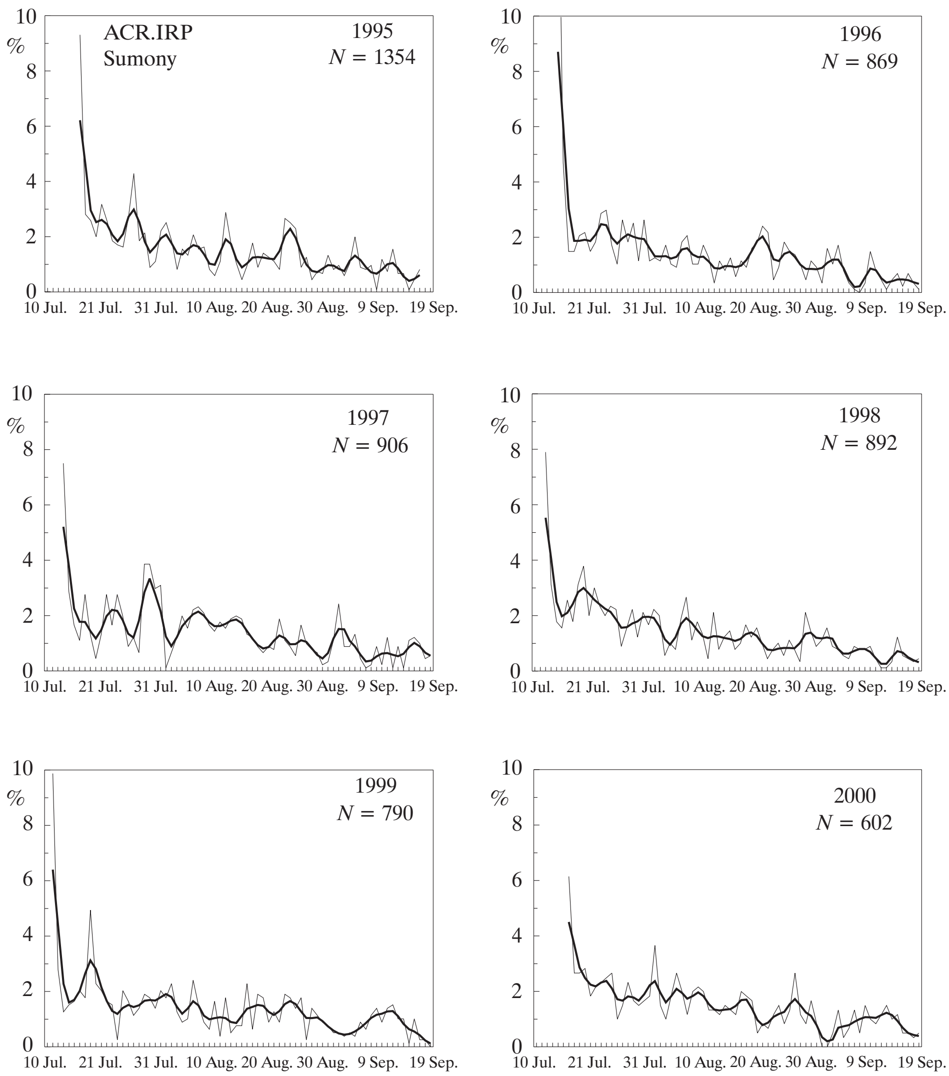

Fig. 6. Details of migration dynamics of the Reed Warbler (ACR.IRP) at Sumony 1995-2000; explanation as in Figure 4

Robin

There were 63 migration peaks in the migration diagrams. 628 individuals (34.7%) were caught on the migration peak days. The most frequent weather situation on the peak days was cold front of the northern cyclone (*mCc*) (Fig. 13). It occurred in 19% of all the cases and 110 individuals were caught those days. The second most frequent (17%) weather situation was *A* central anticyclone on the migration peak days ($\chi^2 = 45.1$, $df = 12$, $p < 0.01$). On the days preceding peaks the most frequent weather situation was *mCc*. It constituted 22% of all the cases. The second most frequent weather situation was *AB* anticyclone ($\chi^2 = 33.3$, $df = 12$, $p < 0.01$).

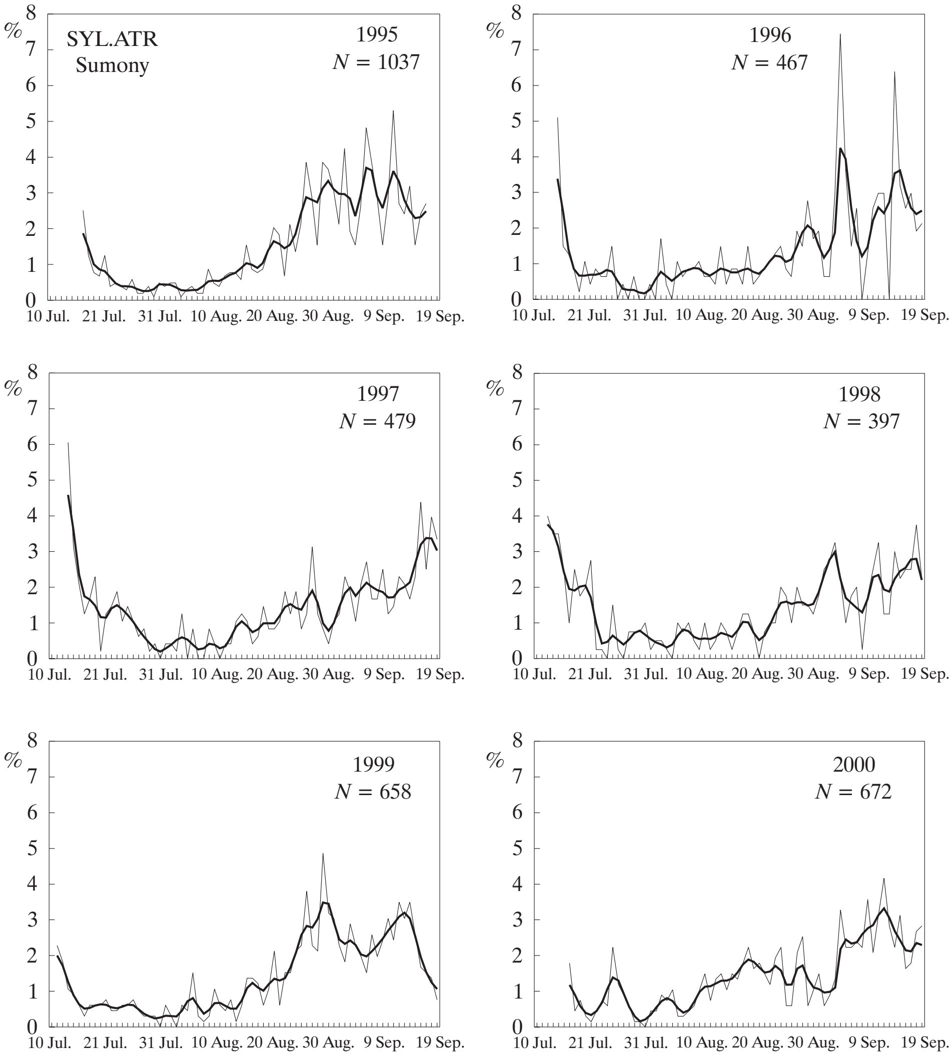

Fig. 7. Details of migration dynamics of the Blackcap (SYL.ATR) at Sumony 1995-2000; explanation as in Figure 4

Chiffchaff

Studying the migration peaks we separated 36 migration peak days with 270 (37%) individuals captured and ringed. The most frequent (18%, Fig. 13) weather situation was *Ae* anticyclone ($\chi^2 = 18.21$, $df = 12$, *ns*). On these days 73 individuals were caught. The second most frequent weather situations was *A* anticyclone. On the days preceding migration peaks the weather situation was *mCc* cyclone in 19% of the cases ($\chi^2 = 23.17$, $df = 12$, $p < 0.05$).

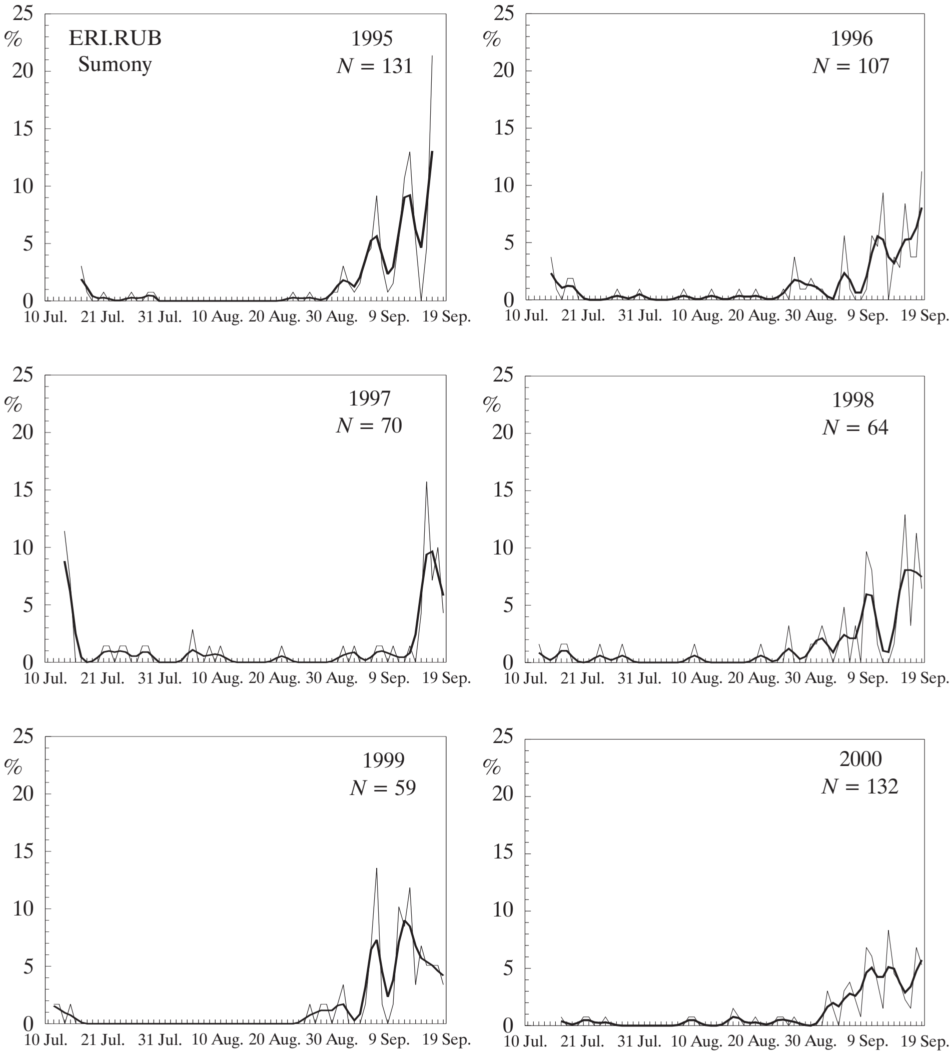

Fig. 8. Details of migration dynamics of the Robin (ERI.RUB) at Sumony 1995-2000; explanation as in Figure 4

Blue Tit

Studying the migration diagrams we separated 63 migration peaks. 378 individuals were caught on the migration peak days. It constituted 39.2% of all birds. The most frequent weather situation on the peak days was *AF* anticyclone (Fig. 13). It occurred in 17% of the cases. The second most frequent weather situation was *Aw* anticyclone – in 14% of the cases ($\chi^2 = 30.71$, $df = 12$, $p < 0.01$). On the days preceding migration peaks the weather situation usually was anticyclonic: *Ae*, *Aw* and *A* ($\chi^2 = 36.1$, $df = 12$, $p < 0.01$).

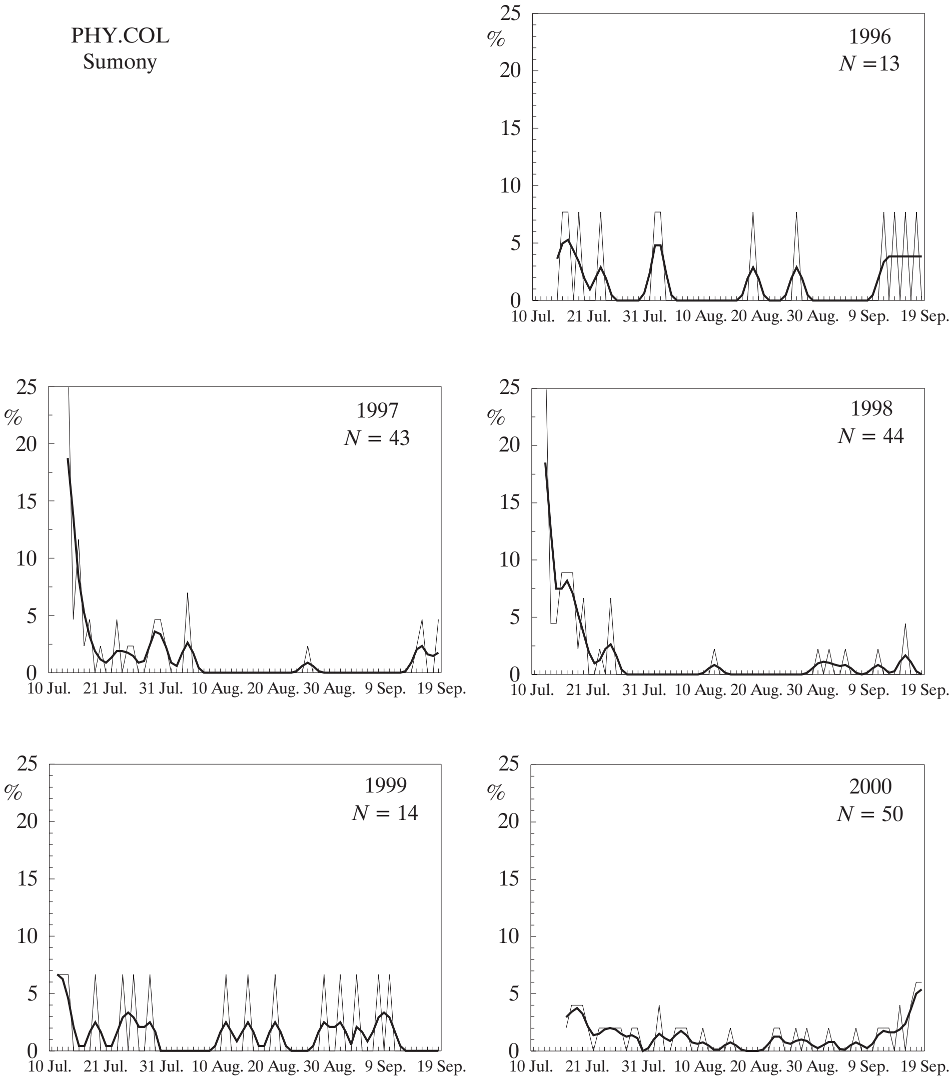

Fig. 9. Details of migration dynamics of the Chiffchaff (PHY.COL) at Sumony 1996-2000; explanation as in Figure 4

Pied Flycatcher

Between 1998 and 2000, 225 Pied Flycatchers were captured and 119 individuals of them passed on the migration peak days. This constituted 52.9% of all the individuals, so more than half of the birds migrated on peak days. The most frequent weather situations was *Ae* and *An* anticyclone on the migration peak days ($\chi^2 = 19.01$, $df = 12$, *ns*). *An* anticyclone was typical on the days preceding migration peaks. It occurred in 26% of the cases ($\chi^2 = 22.7$, $df = 12$, $p < 0.05$).

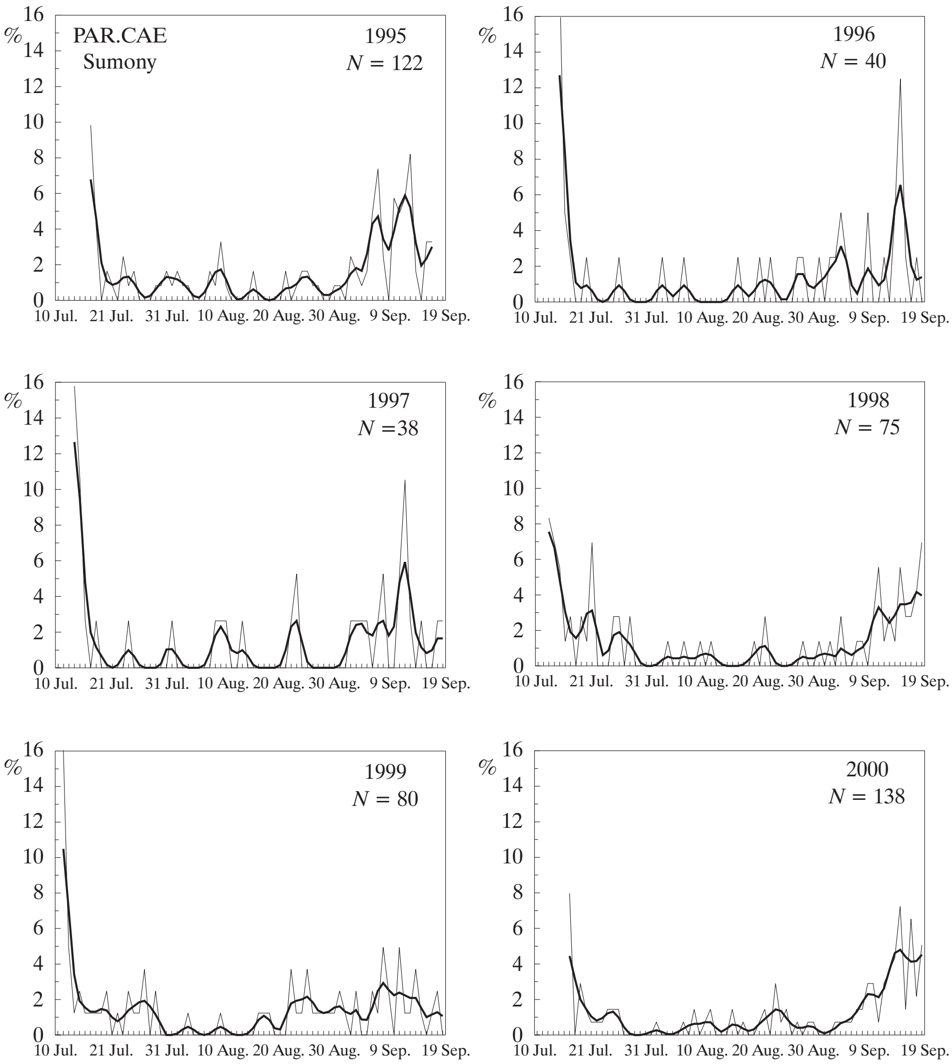

Fig. 10. Details of migration dynamics of the Blue Tit (PAR.CAE) at Sumony 1995-2000; explanation as in Figure 4

Goldcrest

Most of birds (520 of 651 individuals) were captured in Tömörd in 2000. Out of the total number of birds examined 294 individuals (45.2%) were captured on the migration peak days. Studying the migration diagrams we separated 17 migration peaks. On the 28% of the peak days *Ae* anticyclone was typical. The second most frequent weather situation was cold front of northern direction cyclone (*mCc*). It occurred in 18% of the cases (χ^2 = 17.7, *df* = 12, *ns*).

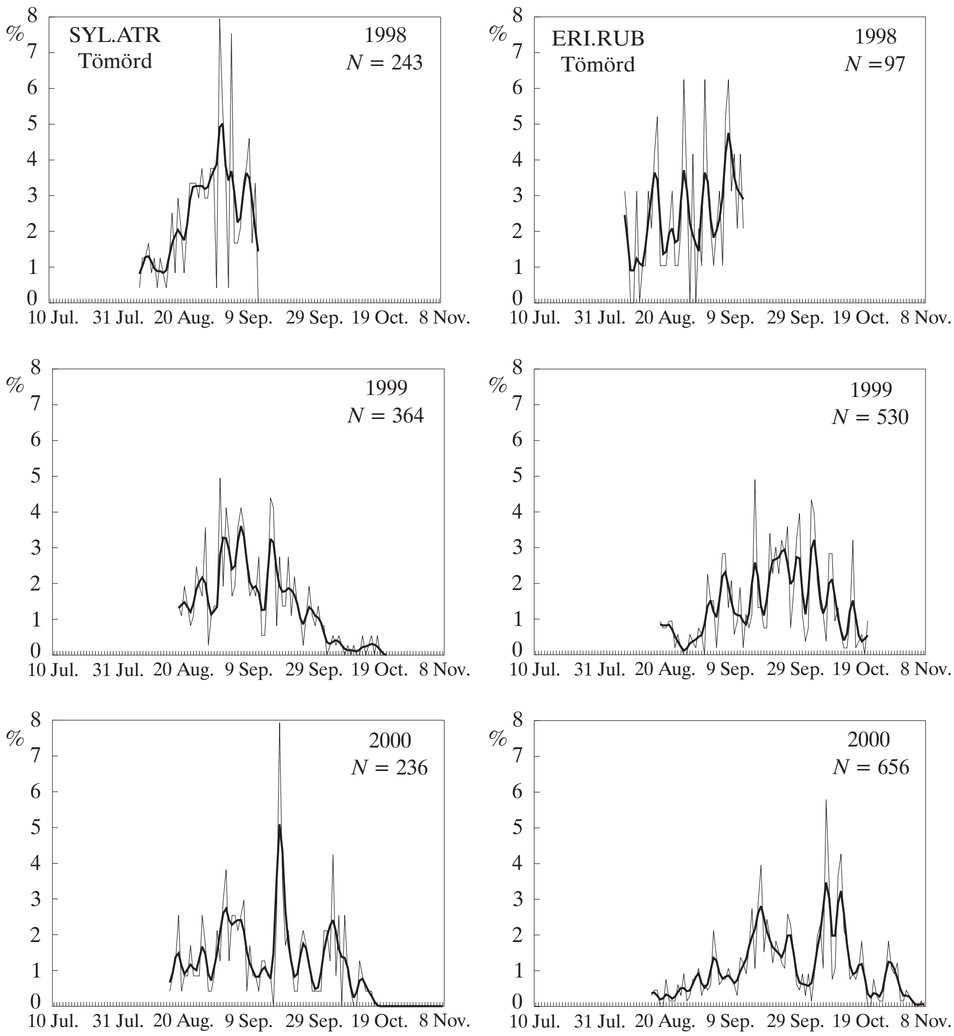

Fig. 11. Details of migration dynamics of the Blackcap (SYL.ATR) and the Robin (ERI.RUB) at Tömörd 1998-2000; explanation as in Figure 4

Comparison of species based on macrosynoptic weather situations

There is no significant difference if we study how the peak days are spread over the macrosynoptic weather situations comparing the 8 bird species (ANOVA: $F_{7,376} = 1.81$, $p = 0.084$). 85% of migration peak days for all the species were connected with anticyclones. 10% of them fell into meridional cyclone / cold front situation and 5% were the other cyclones. The migration peaks occurred least frequently when the weather situation was *CMc*, *CMw* and *Zc* cyclones. They occurred only in 1 or 2% of the cases. The most frequent weather situation on the migration

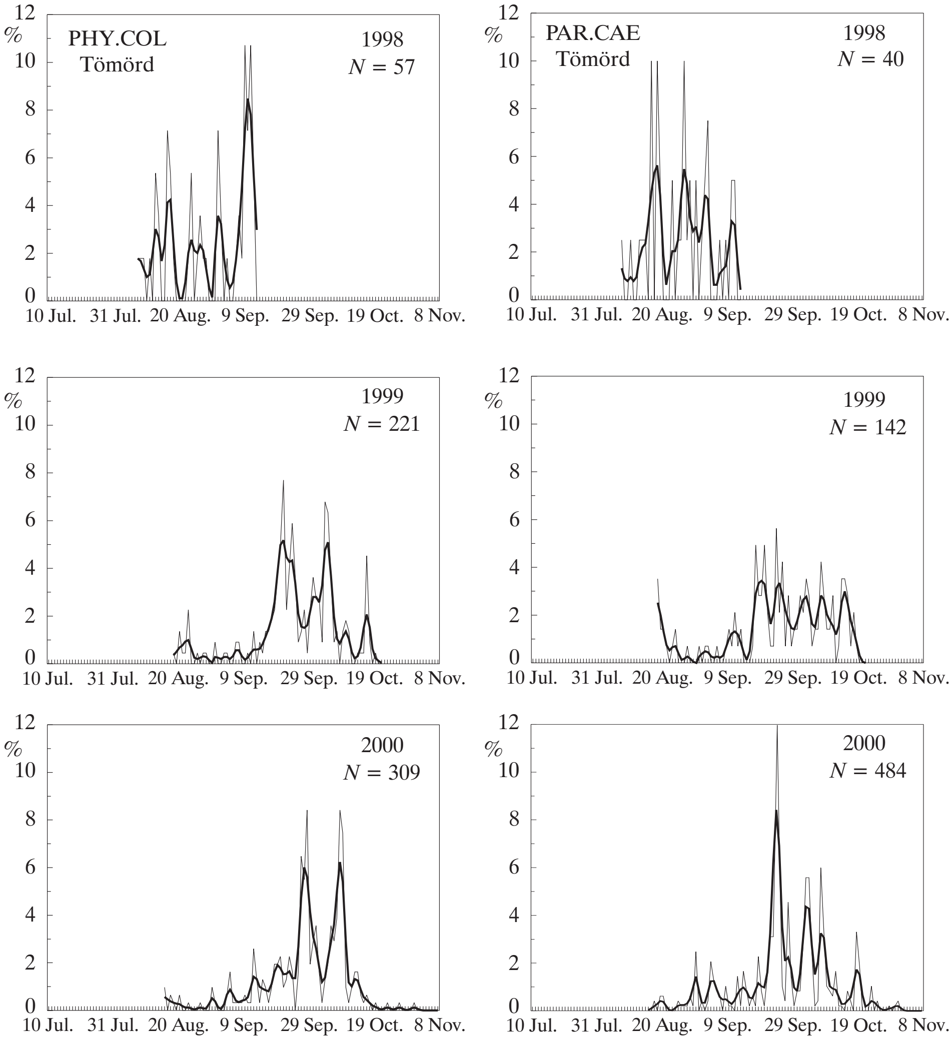

Fig. 12. Details of migration dynamics of the Chiffchaff (PHY.COL) and the Blue Tit (PAR.CAE) at Tömörd 1998-2000; explanation as in Figure 4

peak days was *A* central anticyclone, which occurred in 61 cases (what constituted 16% of all the cases). The second most frequent weather situation was *Aw* anticyclone, which occurred in 55 cases (14%). The anticyclone which occurred to the west of the Carpathian basin (*Aw*) was the most frequent on the migration peak days of Sedge and Reed Warblers (Fig. 13). However, the migration peaks of the Pied Flycatcher never appeared in *Aw* anticyclone.

On the days preceding migration peaks *Aw* anticyclone was found most frequently. It occurred in 64 cases (18%). It appeared most frequently in the two reed warbler species (24 and 24%), while it was not typical in the case of Blackcap and

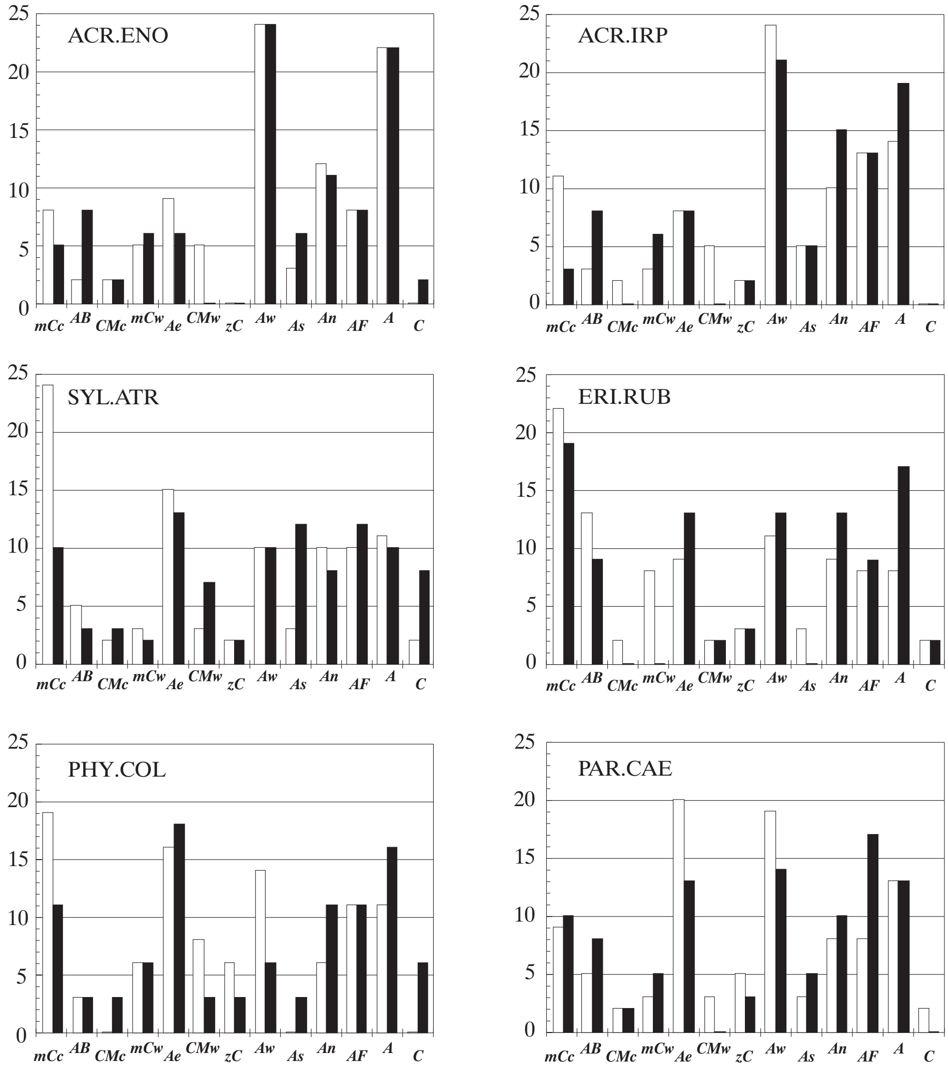

Fig. 13. Distribution of peak days (black bars) and days preceding peaks (white bars) over macrosynoptic situations; ACR.ENO – the Sedge Warbler, ACR.IRP – the Reed Warbler, SYL.ATR – the Blackcap, ERI.RUB – the Robin, PHY.COL – the Chiffchaff and PAR.CAE – the Blue Tit.

Goldcrest (Fig. 13). Cold front of the northern cyclone (*mCc*) occurred on 16% of the days preceding migration peaks (61 cases). It was the most frequent in the case of Goldcrest, Blackcap and Robin.

Studying relation between the migration peak days and the typical macrosynoptic weather situations, the Sedge Warbler and the Reed Warbler make one group – the most frequent weather situation was *Aw* on the migration peak days. The Chiffchaff, the Blackcap and the Pied Flycatcher belong to another group, because *Ae* anticyclone was the most frequent on the peak days of these species. *An* anticyclone was frequent only in case of Pied Flycatcher. The migration of the Goldcrest

Table 1
The average daily captures on the migration peak days of the two most frequent Péczely's macrosynoptic weather situations

	Weather situation	No. of cases	%	Average ± *SD* *t* prob., *df*, *p*
A. schoenobaenus	***Aw*** ***A***	15 14	24 22	47.60 ± 27.98 77.43 ± 51.76 t = 2.46, df = 13 , $\boldsymbol{p}$ **= 0.028**
A. scirpaceus	***Aw*** ***A***	13 12	21 19	53.07 ± 33.75 73.33 ± 58.76 t = 1.17, df = 11, p = 0.266
E. rubecula	***mCc*** ***A***	12 11	19 17	8.91 ± 6.47 8.27 ± 6.26 t = 0.48, df = 10, p = 0.697
S. atricapilla	***Ae*** ***AF***	8 7	13 12	10.38 ± 5.09 16.85 ± 6.89 t = 1.86 , df = 6, p = 0,111
Ph. collybita	***Ae*** ***A***	7 6	18 16	10.3 ± 10.19 7.66 ± 6.02 t = 0.48, df = 5, p = 0.65
P. caeruleus	***AF*** ***Aw***	11 9	17 14	2.36 ± 7.52 3.6 ± 5.85 t = 1.52, df = 8, p = 0.164
F. hypoleuca	***An*** ***Ae***	3 3	16 16	6.33 ± 5.51 3.30 ± 0.58 t = 1.03, df = 2, p = 0.407
R. regulus	***Ae*** ***mCc***	5 3	28 18	5.33 ± 3.51 15.33 ± 17.38 t = 1.00, df = 2, p = 0.422

and the Blue Tit in relation to the weather was very similar to each other, so they form the next group. The Robin was close to this two species.

DISCUSSION

According to Elkins (1989), the most ideal weather conditions for the autumn migration of birds occur in the northern Mediterranean zone, when northern or north-western or north-eastern winds blow. Nocturnal migrants (*e.g.* Reed Warbler or Robin) navigate using stars, although there is a lot of birds which are able to orient when the sky is cloudy (Emlen 1975). The factors that help the orientation are topographical formations such as the coastline (the most obvious) and also rivers, mountain chains and valleys. The moonlight also helps the orientation of birds migrating at night, because when there is moonlight birds can see the coastline very well (Gauthreaux 1991). The factors which postpone the migration are: thick clouds, low visibility, strong wind ahead or cross-wind, warm or occluded front.

Birds migrate in large numbers in the weather situations which are favourable for them. When the weather conditions are not favourable, they stay at resting places (Akesson 1993, Pyle *et al.* 1993).

Sedge Warblers and Reed Warblers migrate over Hungary in August and September. Studying the above mentioned bird species our results show that Sedge Warblers take advantage of the anticyclones which occur to the west of Carpathian basin (*Aw*) or over the Carpathian basin (*A*) most intensively. These anticyclones ensure good weather conditions to them, because there are few clouds and light northern wind, which facilitates the orientation and movement of birds. Their migration is the most intensive when there is a central anticyclone (*A*). Reed Warblers also migrate in the largest numbers during these two anticyclones, but there is no essential difference in the number of captured individuals between them. If we look at how the migration of the two reed warbler species spending winter in Africa depends on the weather, we can see a big difference, the reason of which is the following: the individuals come from different breeding areas, they have different migration strategies, and dynamics of their migration also differs when they migrate over Hungary. Most of Sedge Warblers come from the Baltic Sea area, while the populations of the Reed Warbler originated to the north of the Carpathians migrate over Hungary in small numbers, or they do not migrate here (Csörgõ and Ujhelyi 1991). The northern populations of the Sedge Warbler appear in large numbers in the Hungarian reedbeds at the end of August and at the beginning of September, while Reed Warblers migrate over Hungary in smaller numbers. Sedge Warblers fly at longer distances for one occasion because they have bigger fat reserves (Gyurácz and Csörgõ 1994). The migratory Sedge Warblers eat first of all reed aphids *(Hyalopteris pruni*), which live on the reeds standing mainly in water, and their quantity changes in time and space. Reed Warblers have smaller fat reserves, they fly shorter distances at one time on the way to their wintering area in Africa. During their migration Reed Warblers eat different kinds of arthropods, which are spread more evenly in space (Bibby and Green 1981, Schaub and Jenni 2001). Taking longer distances means bigger risk in bad weather conditions. Finding aphids is very important for migration, and storing larger reserves of fat fast is more difficult when the weather is rainy or windy. Thus, the natural selection established much more effective utilisation of the most favourable macrosynoptic weather situations (see Table 1) for the Sedge Warbler than for the Reed Warbler and for the short-distance migrating birds which eat more variable food including different kinds of arthropods and seeds.

Alerstam (1978, 1990) pointed out that northern wind which occurs after cold fronts is the most important factor which makes birds start to migrate. When the temperature decreases the birds start to feel cold and it makes them leave their hatching sites. We found this effect in the case of Reed Warblers, where 25% of the days preceding migration peaks were characterised by cold anticyclone (*Aw*), the temperature of which was colder than that of an average summer. The effect of cold weather is more typical for species which migrate in September and October.

In late autumn the *Ae* and *A* anticyclones cause a big fall in the temperature at night.

The cold front of the cyclone which appears in the Baltic region or over Ukraine (*mCc*) also takes a great effect on the autumn migration of species like Robin, Blackcap, Chiffchaff, Goldcrest and Blue Tit. On the following day of the cold front great numbers of individuals were caught in Hungary, most of which were ringed in Ukraine and the Baltic countries (Haraszthy 1998). The Mediterranean or southern air current cyclone (*CMw*) prevent the autumn migration of birds. During cold front the strong wind is favourable only when its direction is suitable for the migrating birds (back wind), because in that case flying does not need so much energy (Emlen 1975, Bloch and Bruderer 1982, Richardson 1990, Akkeson 1993). Moreover, birds can reach bigger migration speed and they can minimise the time of migration. Northern, north-western, north-eastern winds are typical for the *Aw* anticyclone and *mCc* cyclone of the days preceding migration peaks. These winds are favourable for both the long-distance and short-distance migrating species, which populations migrate south, south-west or south-east. Northern winds ”sweep in” the migrating populations into the Carpathian basin through the valleys of the Carpathians (”the wind channels”). In the case of Pied Flycatchers, on the peak days we experienced north-western or north-eastern winds with *An* anticyclone. The centre of this anticyclone is formed to the north of the Carpathians – in the Baltic Sea region. The northern populations use this weather conditions during their fast autumn migration, which ends from 6 to 21 September in 2 waves in Tömörd.

Usually, it is slight, changeable wind which is typical for the anticyclones (*Ae, A*) of the peak days. In this weather situations the risk of not to keep their original preferable way is smaller, and the feeding conditions are also good. These anticyclones have especially favourable influence on the migration and the feeding activity of birds after the cold fronts of the cyclones.

The long-distance and the short-distance partial migrants prefer anticyclonic weather situations during their autumn migration, but there are some smaller differences caused by the different behaviour of birds, because they follow different migration strategies to minimise the time and the energy of the migration.

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