Ornis Hungarica 5:23-32. 1995

Study of autumn migration and wing shape of Sedge Warblers (Acrocephalus schoenobaenus) in Southern Hungary

J. Gyurácz and L. Bank

Gyurácz, J. and Bank L. 1995. Study of autumn migration and wing shape of Sedge Warblers (*Acrocephalus schoenobaenus*) in Southern Hungary. - Ornis Hung. 5:23-32.

Migration dynamics of Sedge Warblers (*Acrocephalus schoenobaenus*) were studied at the Sumony Bird Observatory 45°58' N, 17°56' E in the southern part of Hungary. The wing length and wing shape indices of juvenile birds captured during different stages of migration were analysed as well. The migration of adult birds was more concentrated than that of juvenile birds. The migration peak for adult birds was in late July and early August (median date 10 August). There were four migration periods in the case of juvenile birds. Migration was very intensive in late August and early September (median date 17 August). On the basis of wing length, it is obvious that birds with short wings were in majority in reedy parts of southern Hungary in late July. These birds probably belong to populations breeding in the Central Europe. In late August and early September, the rate of birds with longer wings increased. These birds might come from Southern Scandinavia and the Baltic region and they use Hungary as a stopover site.

J. Gyurácz, Department of Zoology, Berzsenyi College, Szombathely, P.O. Box 170. H-9701, Hungary. L. Bank, Local Group of County Baranya, Hungarian Ornithological and Nature Conservation Society, Pécs, Felsőmalom u. 22., H-7621, Hungary.

1. Introduction

The Sedge Warbler is a breeding species in Hungary and a widespread and abundant species in Europe. This species spends the winter in Africa, south of the Sahara (Moreau 1972). During autumn migration season, populations which breed in South Scandinavia and in the Baltic area migrate across Hungary in huge numbers (Csörgő & Ujhelyi 1991, Gyurácz & Csörgő 1991). Migration is as fast as in Western Europe (Bibby & Green 1981, 1983, Insley & Boswell 1978, Shennan 1986, Sitters 1972).

The wing of migratory birds is assumed to take a shape that allows birds to fly the longest distance possible using a certain amount of energy (Pennycuick 1975). Flying resistance is significantly decreased by long, pointed and narrow wings. It is possible to tell the potential origins and destinations of migratory birds by studying the relationship between weight and wing shape (Lövei 1982). Researches made on Chiffchaffs (*Phylloscopus collybita*) proved the fact that there are differences in the shapes and sizes of wings of populations of different geographical sites (Tiainen & Hanski 1985, Hanski & Tiainen 1991). On the

basis of these research results it is possible to make distinctions among populations during the migration season (Gaston 1974, Lövei 1983, Csörgő *et al.* 1991, Miklay & Csörgő 1991). In case of the Sedge Warbler no such research has been made.

There has been a quick decrease in the number of Sedge Warbler in Europe recently (Haland & Burkjeland 1982, Spina & Bezi 1990, Gyurácz & Bank 1994). It is important to understand the migration strategy of the species because of the decline in number and for the protection of the species. In this study we examine the dynamics of migration of those Sedge Warblers which migrate across Hungary in autumn and we also compare the average wing length and wing shape of juvenile birds captured during different migration periods.We evaluted the following hypotheses: (1) In the case of Sedge Warblers, it is possible to make distinctions among populations originating from different places during autumn migration on the basis of the length and/or shape of wings. (2) During later periods of the migration (late August, beginning of September) populations from the North with longer and sharper wings are relatively more abundant than before during the migration in reedy parts in the Southern Hungary.

2. Study area and methods

Our studies were carried out during autumn migration seasons, from 1988 to 1992 (1988: 31 July - 4 September; 1989: 30 July - 10 September; 1990: 28 July - 9 September; 1991: 27 July - 8 September; 1992: 26 July - 13 September) at the Sumony Bird Observatory (45°58'N, 17°56'E) in the southern part of Hungary.

Every year birds were captured in reed banks of fish ponds at Sumony, using a mistnet of 900 m² (408 m). We ringed all birds and measured the wing length and the distance between primaries and tip of wing. These measurements were taken by using a method which allows a deviation of 1 mm. (Svensson 1984).

To study migration dynamics, different age groups were considered separately. Migration charts were drawn on the basis of capture rate averages of past five years. The length of time spent by recaptured birds on the study area and the number of days between first capture and last recapture were indicated year by year. On the basis of these data, migration periods could be defined which were handled as research units.

In the case of biometrial measurements, only data of juvenile birds were taken into account. We calculated the wing pointedness and symmetry indices of birds captured during different migration periods (Holynski 1965, Tiainen & Hanski 1985):

1. Wing pointedness (E-index) = $\frac{100x/\sum p - \sum d/}{wing\ \ length}$

where Σp and Σd are the sums of distances of proximal and distal primary tips from the wing tip, respectively.

2. Wing symmetry = $\frac{\sum p}{\sum d}$,

where p and d are the sums of distances of proximal and distal primary tips from the wing tip, respectively. The statistical analyses (Mann-Whitney U-test, t-test, one-way ANOVA, linear regression) were made with the Statgraf software.

Fig. 1. Migration curve of Sedge Warblers based on the average daily captures and recaptures. The five years were pooled.

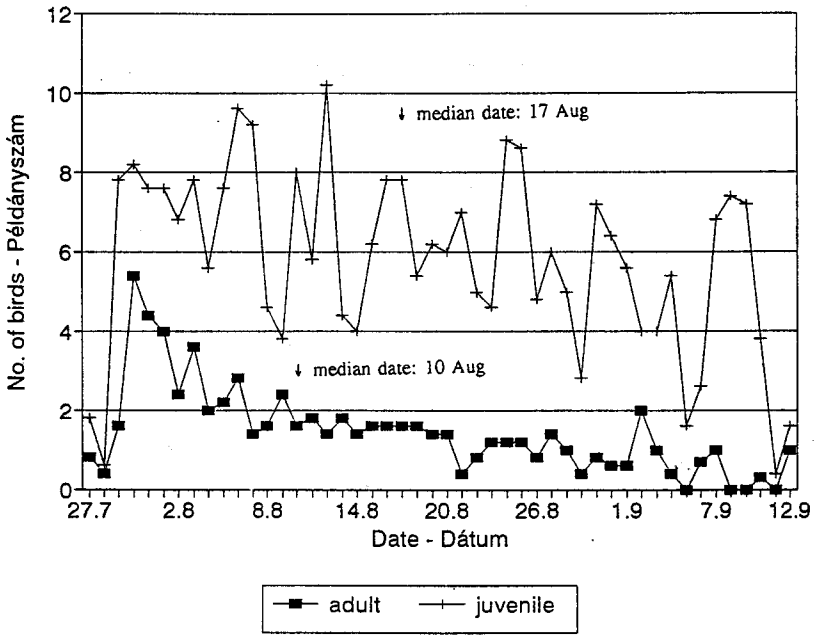
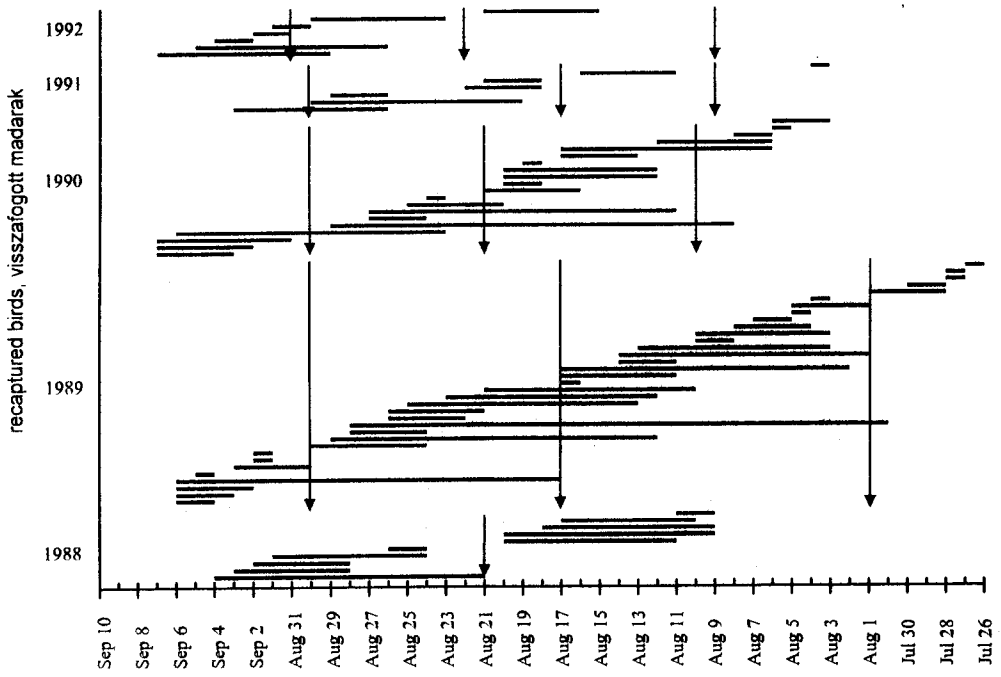


Fig. 2. Stopover time of recaptured birds on the basis of first capture and last recapture.



3. Results

3.1. Migration dynamics

We ringed 1693 Sedge Warblers during the five study years, 17.4% were adults and 82.6% were juveniles.

The migration peak of adult birds occurred at the end of July and at the beginning of August. The number of birds captured decreased gradually from that period until the end of migration season. The migration of juvenile birds was more uniform. On the basis of time spent in the area by recaptured birds and what the charts show, there were two migration periods in 1988 and four migration periods were separated in other years. Migration was intensive in late August and early September, as well (Figs 1,2).

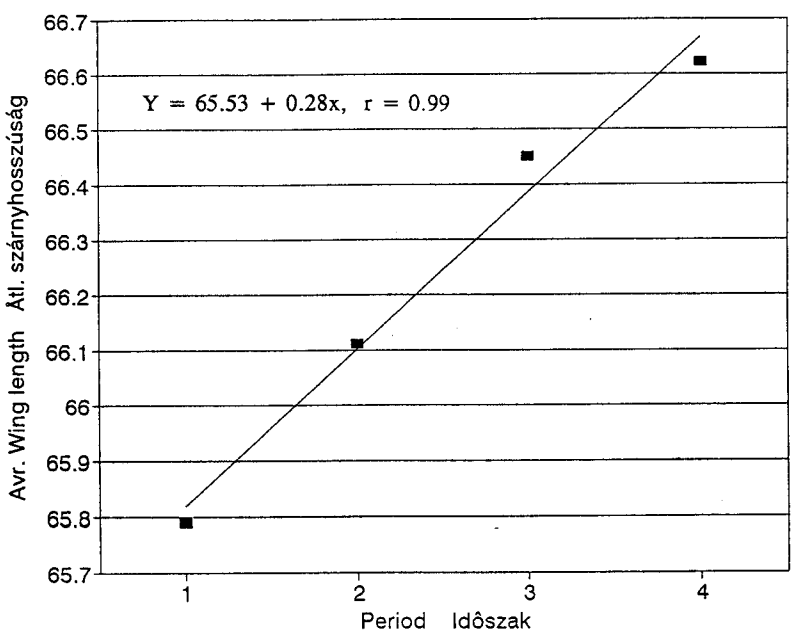
Migration of adult birds started and ended earlier than that of juvenile birds. The median date in case of adult bird migration was August 10, while this date was August 17 for juvenile birds, (Mann-Whitney U-test, $z=7.33$, $P<0.01$), (Fig. 1).

3.2. Biometrical data

3.2.1. Wing length

In 1988, wings of birds captured during the first half of migration period (until 15 Aug) were significantly longer (66.79 ± 1.49 mm) than that of birds captured during the second half migration period (65.88 ± 1.49 mm, $t=3.09$, $d.f.=134$, $P<0.05$). In 1989 there was no significant difference in wing length of birds captured during the four migration periods ($P>0.05$). In the other three years the wing

Fig. 3. Linear regression of wing length averaged for 1988-1992. ($F=107.79$, $P<0.01$)



length of birds captured during the third and fourth periods was significantly longer than that of birds captured during the first and second periods (one-way ANOVA, 1990: F=5.88, d.f.=333; 1991: F=10.14, d.f.=125; 1992: F=5.98, d.f.=313, P<0.01), (Tab. 1). The average wing length of the five years showed significant increase from the first period to the last one (one-way ANOVA, F=107.79, P<0.01), (Fig. 3).

3.2.2. Wing pointedness

In 1988, during the first half of migration period (until 15 Aug) the E-index of birds captured was significantly smaller (54.03±5.62) than that of those birds which were captured during the second half of migration period (59.76±7.8, t=4.73, d.f.=134, P<0.05). In 1989, E-index of birds captured during the third and fourth periods of migration was significantly higher than that of birds captured during the first and second migration periods. (one-way ANOVA, F=6.3, d.f.=359, P<0.01). In other years no significant differences were found (Tab. 1). The average E-index of the five years did not show significant increase during the autumn migartion period (F=2.51, P>0.05), (Fig. 4).

3.2.3. Wing symmetry

In 1988 there was no significant difference in symmetry between birds captured during the first half of migration period and second half of migration period, respectively (P>0.05).

Wing symmetry of birds captured between 20 Aug and 4 Sep, during the third migration period in 1989 were significantly higher (10.98±2.69) than those of birds captured during the other three migration periods (one-way ANOVA, F=3.12, d.f.=360, P<0.05). In the other years there was no significant difference in symmetry rates of birds captured during different migration periods (P>0.05) (Tab. 1). The average wing symmetry of the five years did not show significant increasing during autumn migration period (F=0.62, P>0.05), (Fig. 5).

4. Discussion

The difference between the dynamics of migration of adult and juvenile Sedge Warblers, which means that adult birds leave their breeding site and get to their winter site sooner, has been proven in the Carpathian Basin (Gyurácz & Csörgő 1991) and other parts of Europe (Insley & Boswell 1978, Spina & Bezi 1990). This difference has structural (Albu 1983), ethological (Alatalo *et al.* 1983), physiological (Ketterson & Nolan 1983, Koskimies & Saurola 1985) and selectional (Hussel 1991) reasons. Sedge Warblers prefer reedy parts during migration season (Ormerod 1990). According to Bibby *et al.* (1976) migration of southern populations begin earlier, beacuse reed grows sooner in southern areas. This definition refers to populations in the Carpathian Basin, because these populations migrate earlier than the northern ones (Zwicker 1982). An analysis of the recaptures showed that Sedge Warblers that migrate across Hungary, originated mostly from Southern Scandinavia and the Baltic region, and in smaller numbers from Central Europe. The

Fig. 4. Linear regression of wing pointedness (E-index) averaged for 1988-1992. (F=2.51, NS)

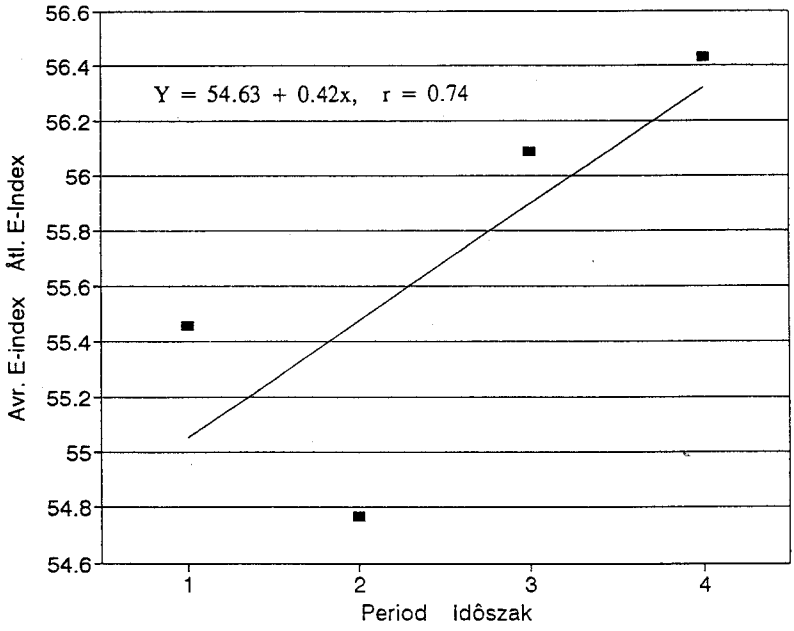
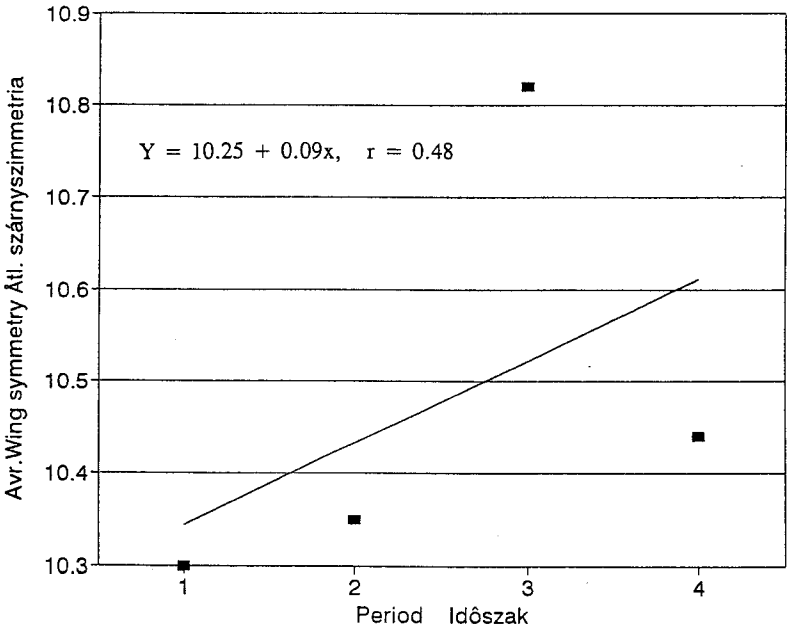


Fig. 5. Linear regression of wing symmetry averaged for 1988-1992. (F=0.62, NS)



Tab. 1.: Rates of wing length and wing shape index (mm) of juvenile Sedge Warblers according to autumn migration periods.

	Migration wave	Year				
		1988	1989	1990	1991	1992
Wing length	1.		66.70±1.58 81	65.40±1.94 75	65.33±1.77 36	65.71±2.32 115
	2.	66.79±1.93 80	66.37±2.13 97	66.15±1.59 67	64.97±1.96 33	66.03±2.00 61
	3.		66.52±1.87 84	66.16±2.28 122	66.59±1.53 22	66.53±1.91 91
	4.	65.88±1.49 56	66.45±1.99 103	66.80±2.06 74	66.89±1.52 38	67.10±2.01 50
	t-prob (1988) one-way ANOVA	t=3.09, d.f.=134 P<0.05	P>0.05	F=5.88, d.f.=333 P<0.01	F=10.14, d.f.=125 P<0.01	F=5.98 d.f.=313 P<0.01
E-index	1.		53.97±5.36 81	54.67±5.22 75	58.82±6.80 36	54.36±9.63 113
	2.	54.03±5.62 80	53.66±4.85 97	55.16±4.82 66	57.14±5.20 31	53.88±6.49 60
	3.		56.35±5.21 84	55.30±11.07 115	57.58±4.77 22	55.16±4.88 91
	4.	59.76±7.74 56	55.67±4.48 101	55.32±5.56 73	56.09±5.36 38	55.33±4.67 50
	t-prob (1988) one-way ANOVA	t=4.72, d.f.=134 P<0.05	F=6.3, d.f.=359 P<0.01	P>0.05	P>0.05	P>0.05
Symmetry	1.		9.63±3.15 81	10.40±3.15 75	11.15±2.30 36	10.05±2.81 113
	2.	10.39±2.70 80	9.93±2.99 97	10.71±2.70 66	10.76±2.58 31	10.0±2.94 60
	3.		10.98±2.69 84	10.92±2.82 115	10.98±3.02 22	10.40±2.99 91
	4.	11.09±3.05 56	10.14±3.10 101	9.82±3.27 73	10.99±2.98 38	10.17±3.05 50
	t-prob (1988) one-way ANOVA	P>0.05	F=3.12, d.f.= 360 P<0.05	P>0.05	P>0.05	P>0.05

direction of migration averaged 182°, the median capture date was 15 August for adults and 24 August for juvenile birds. (Csörgő & Ujhelyi 1991). These findings are very similar to results of studies on migration dynamics in Sumony. Migration peak of adult birds in late July and early August might be in connection with migration of Central-European populations, but adult birds of northern populations might be present as well. During a later period of the migration season, adult birds that migrate in smaller numbers are from the northern populations.

There is a slight geographical variation in wing length of Sedge Warbler. The wing length increases from Britain towards Kazakhstan and from eastern Europe towards Northern Europe (Cramp 1992). Our results showed that during the first half of migration season (until mid-August) there were more juvenile birds with short wings in the study areas. These birds probably belonged to the breeding populations of Central Europe. During the second half of the migration season (after mid-August) there are more birds with longer wings in the reedy parts of Sumony. Taking into account the hypothetized relation between the wing length and the distance of migration (Kipp 1958, Gaston 1974), it is supposed that these birds fly a longer distance to their winter sites in Africa. The median date when juvenile birds (which were ringed in Southern-Scandinavia and the Baltic region) fly across Hungary is usually 24 Aug (Csörgő & Ujhelyi 1991). In Finland the migration peak of Sedge Warbler is in early August (Koskimies & Saurola 1985). The wing pointedness and wing symmetry of Sedge Warblers migrating across Hungary usually did not increased significantly from the first period to the last autumn migration period. Therefore these data did not support our conclusions on the distribution of wing length of Sedge Warblers ringed in different periods.

Using biometrical data we indirectly proved that northern migratory populations have a rest in Hungary. How much time do they spend in this area? Do they only rest or do they take nourishment here? Which direction do they continue their migration? Where do they stop next after leaving Hungary? Where are the winter sites of local and northern populations? Answer to these questions might reveal the reasons for the decline in the number of birds.

Acknowledgements. We are most grateful to J. Tiainen for valuable suggestions. We wish to express our gratitude to the members of the Hungarian Ornithological and Nature Conservation Society who helped in the field work.

Összefoglalás

A foltos nádiposzáta (*Acrocephalus schoenobaenus*) őszi vonulásának és szárnyalakjának vizsgálata Dél-Magyarországon

Kutatásunk során korcsoportonként vizsgáltuk a Dél-Magyarországon, ősszel átvonuló foltos nádiposzáták vonulásának dinamikáját, és összehasonlítottuk a különböző vonulási időszakban befogott fiatal madarak átlagos szárnyhosszát és szárnyalakját.

Vizsgálatainkat 1988-1992 között az őszi vonulás fő időszakában a Sumonyi Madárvártán (É 45°58', K 17°56') végeztük. Az öt év átlagából számolt fogási értékek alapján megállapíthatjuk, hogy az öreg madarak vonulási csúcsa július végén, augusztus elején alakul ki,

utána a vonulásuk kisebb intenzitású (medián dátum: aug. 10). A fiatalok vonulásában négy periódust különíthetünk el, vonulásuk augusztus második felében, szeptember elején is intenzív (median dátum: aug. 17).

A szárnymorfológiai elemzések azt mutatták, hogy augusztus második felében, szeptember elején a hosszabb szárnyú madarak tartózkodtak nagyobb számban a sumonyi nádasokban. Ez a megállapítás jó egyezést mutat a gyűrűzési eredményekkel, a Dél-Skandináviában és a Balti térségben gyűrűzött példányok többsége ugyancsak augusztus második felében került meg Magyarországon. Az északi populációkra jellemző átlagos szárnyhossz értékek is alátámasztották a feltevésünket. A szárnyhegyességi index és a szárnyszimmetria értékek alapján viszont nem lehetett egyértelműen trendet megállapítani.

References

Alatalo, R., Gustafsson, L. & A. Lundberg. 1983. Why do young passerine birds have shorter wings than older birds? – Ibis 126: 410-415.

Albu, T. 1983. Post-juvenile growth in passerines. – Fauna norv. Ser. C, Cinclus 6: 53-56.

Bibby, C. J. & R. E. Green. 1981. Autumn migration strategies of Reed and Sedge Warblers. – Ornis Scand. 12: 1-12.

Bibby, C. J. & R. E. Green. 1983. Food and fattening of migrating warblers in some French marschlands. – Ringing and Migration 4: 175-184.

Bibby, C. J., Green, R. E., Pepler, G. R. M. & P. A. Pepler. 1976. Sedge Warbler migration and reed aphids. – Brit. Birds 69: 384-399.

Cramp, S. (ed.). 1992. Handbook of the Birds of Europe, the Middle East and North Afrika. – Oxford University Press. 6: 130-145.

Csörgő, T. & P. Ujhelyi. 1991. Migration strategies of *Acrocephalus* species based on analysis of recaptures. Pp. 111-122. In: Gyurácz, J. (ed.). The 3rd Scientific Meeting of the Hungarian Ornithological and Nature Conservation Society, Szombathely. (In Hungarian with English summary.)

Csörgő, T., Miklay, G. & Z. Czeglédi. 1991. Where do the Chiffchaffs migrating through the Carpathian basin originate from? Pp. 123-131. In: Gyurácz, J. (ed.). The 3rd Scientific Meeting of the Hungarian Ornithological and Nature Conservation Society, Szombathely. (In Hungarian with English summary.)

Gaston, A. J. 1974. Adaptation in the genus *Phylloscopus*. – Ibis 116: 432-450.

Gyurácz, J. & L. Bank. 1994. Population dynamics of the migrating birds in autumn migration season from 1983 to 1993. P.60. In: Peregovits, L. & L. Lőkös. (eds). The 3rd Hungarian Ecological Congress, Szeged. (In Hungarian.)

Gyurácz, J. & T. Csörgő. 1991. Differences between autumn migration of adult and juvenile birds in four reed warbler (Acrocephalus spp.) species. Pp. 164-171. In: Gyurácz, J. (ed.). The 3rd Stientific Meeting of the Hungarian Ornithological and Nature Conservation Society, Szombathely. (In Hungarian with English summary.)

Haland, A. & Burkjeland, S. 1982. Distribution and breeding habitat of the Sedge Warbler. – Fauna norv. Ser. C, Cinclus 5:65-72.

Hanski, I. K. & J. Tiainen. 1991. Morphological variation in sympatric and allopatric populations of Europeas Willow Warblers and Chiffchaffs. – Ornis Fennica 68: 1-16.

Hildén, O. & P. Saurola. 1982. Seed of autumn migration of birds ringed in Finland. – Ornis Fennica 64: 137-143.

Holyñski, R. 1965. Metod analizy zmiennisci skrzydla ptaków. – Notaki Ornitologicz-ne 6: 21-25.

Hussell, D. J. T. 1991. Fall migrations of Alder and Willow Flycatchers in Southern Ontario. – J. Field Ornithol. 62: 69-77.

Insley, H. & R. C. Boswell. 1978. The timing of arrivals of Reed and Sedge Warblers of south coast ringing sites during autumn passage. – Ringing and Migration 2: 1-9.

Ketterson, E. D. & V. J. R. Nolan. 1983. Behaviour of migratory Dark-eyed Juncos following release in the winter range during the breeding season. – J. Field Ornithol. 54: 387-393.

Kipp, R. A. 1958. Zur Geschichte des Vogelzuges auf der Grunlage des Flügelsanpas-sungen. – Vogelwarte 19: 233-242.

Koskimies, P. & P. Saurola. 1985. Autumn migration strategies of the Sedge Warbler *Acrocephalus schoenobaenus* in Finland: a preliminary report. – Ornis Fennica 65: 145-152.

Lövei, G. 1982. Study of bird migration using indirect mehods. Pp. 73-76. In: Kárpáti, L. (ed.). The 1st Scientific Meeting of the Hungarian Ornithological Society, Sopron. (In Hungarian.)

Lövei, G. 1983. Wing shape variations of Chiffchaffs on autumn migration in Hungary. – Ringing and Migration 4: 231-236.

Miklay, G. & T. Csörgő. 1991. Migration dynamics and wing shape characteristics of Willow (*Phylloscopus trochylus*) and Wood Warblers (*Ph. sibilatrix*). Pp. 140-148. In: Gyurácz, J. (ed.). The 3rd. Scientific Meeting of the Hungarian Ornithological and Nature Conservation Society, Szombathely. (In Hungarian with English summary.)

Moreau, R. E. 1972. The Palaearctic-African bird migration system – Academic Press, London.

Ormerod, S. J. 1990. Possible resource partitioning in pairs of *Phylloscopus* and *Acrocephalus* Warblers during autumn migration through a South Wales reed-swamp. – Ringing and Migration 11: 76-85.

Pennycuick, C. J. 1975. Mechanics of flight. Pp. 1-73. In.: Farner, D. S., King, J. R. & K. C. Parkes (eds). Avian Biology. Vol. V. – Academic Press, New York.

Shennan, N. M. 1986. Habitat and its influence on pairing in the Sedge Warbler *Acrocephalus schoenobaenus*. – Bird Study 33: 109.

Sitters, H. P. 1972. An analysis of the ringing data for the Sedge Warbler at Slapton Bird Observatory. – Devon Birds 25: 2-19.

Spina, F. & E. M. Bezi. 1990. Autumn migration and orientation of the Sedge Warbler (*Acrocephalus schoenobaenus*) in Northern Italy. – J. Orn. 131: 429-438.

Svensson, L. 1984. Identification Guide to European Passerines (3rd ed.) – Naturhistoriska Riskmuseet, Stockholm.

Tiainen, J. & I. K. Hanski. 1985. Wing shape variation of Finnish and Central European Willow Warblers *Phylloscopus trochilus* and Chiffchaffs *P. collybita*. – Ibis 127: 365-371.

Zwicker, E. 1982. Postbreeding movements of the Sedge Warbler (*Acrocephalus schoenobaenus*) and Reed Warbler (*A. scirpaceus*) in the Pannonian region. Pp. 65-67. In: Kárpáti, L. (ed.). The 1st Scientific Meeting of the Hungarian Ornithological Society, Sopron. (In Hungarian.)