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THE AUTUMN MIGRATION OF THE CITRINE WAGTAIL, MOTACILLA CITREOLA, IN THE LVIV REGION (W. UKRAINE) DURING ITS RANGE EXPANSION

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ABSTRACT

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The Citrine Wagtail has been gradually expanding its breeding range from Asia westward into Europe since the middle of the last century. New breeding records of this species further to the west of Europe have emerged during the last several decades. The distribution of the Citrine Wagtail in Western Ukraine began at the end of the last century. A total of 48 Citrine Wagtails were ringed in August 1995–2016 at the Cholgynskyy ornithological reserve (West-Ukrainian Ornithological Station). The birds were recorded mainly in the first half of August, peaking from the beginning of the second decade to the middle of the month. At the beginning of August there were wagtails in different stages of moult. Adult moulted birds were recorded from the beginning of the second decade of August, while juvenile birds underwent partial moult during the first part of the month. The mean weight of adult moulted birds was higher than that of juveniles. At the beginning of August many Citrine Wagtails were lean, without fat reserves, with the mean fat class increasing by the end of the month. The autumn passage of *M. citreola* took place in W. Ukraine. Birds stay in the shallow waters, pastures, and reed beds to feed, overnight, moult and gain fat reserves for migration.

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of Ukraine hosts *M. citreola werae*. This subspecies inhabits a range from Eastern Europe (expanding westward; it is now a regular breeder in the Baltic Republics, northern Poland, Belarus and Ukraine) eastward to the Russian Altai Mountains, northern and eastern Kazakhstan, and NW China (NW Xinjiang), and (probably this race) central and eastern Turkey. Breeding of this subspecies has also been recorded in Armenia and Syria. It winters on the Indian subcontinent and in SE Asia. The Citrine Wagtail is a long-distance migrant. It flies to its wintering grounds (Indian subcontinent) along the Central Asian flyway (Cramp 1992).

During the second half of the 20th century the Citrine Wagtail gradually expanded its breeding range westward (Meissner and Skakuj 1997). The general work *Birds in Europe* (Tucker and Heath 1994) provides no information on the distribution and population trends of the Citrine Wagtail. The second edition (2004) provides data on the population increase of the species into the north, east and centre of Europe.

The first report of nesting of *M. citreola* in eastern Poland appeared in 1994, and in 1998 there were 26 cases of nesting (according to the data of the Polish Avifaunistic Commission, Ściborska 2004). The first nesting attempts in Lithuania were recorded in 1987, in Latvia in 1989, in Estonia in 1991, in Switzerland in 1997, and in Slovakia in 1997. Then, in 2006 (after nine years), the first nest group of 20 individuals of this species was observed in Slovakia (Wilk *et al.* 2009). Consequently, from the east to the west of Europe, a new breeding area of *M. citreola* was formed.

Since then the number of breeding pairs in European countries has been notably increasing, especially in the countries along the Baltic Sea (Burfield *et al.* 2004). The increasing number of breeding pairs in Eastern Europe has contributed to the formation of migration after the breeding period.

Records of the species after the breeding period in the western part of Ukraine before 2007 are scarce. Since 1950 the species occurred in Ukraine as vagrant (Novak 1996). After that, breeding pairs have been found in various regions in Ukraine (Klestov and Gavrys' 1991, Matveenko 1977, Novak 1996, Panchenko and Lesnichiy 2009, Romenskyy and Chugay 1998). The first breeding of the Citrine Wagtail in Western Ukraine was recorded in 1985 (Horban *et al.* 1991). After Fesenko and Bokotey (2007), in Ukraine the species has the status 'scarce breeding' and 'scarce migrating'. Observation of the species at a time which can be attributed to autumn migration (mid-August), was recorded in the foothills of the Upper Dniester Beskyds (Ukrainian Carpathians) in 1986. One *M. citreola* individual was observed by D.M. Drozd (Khymyn 1991) in the vicinity of the village of Susoliv (Sambir district, Lviv region, W. Ukraine).

Records of young and adult birds in the pre-migratory period are more numerous: in the Khmelnytskyi region 16 individuals in late July 1993 (Letychivsky district, village of Mytkivtsi and village of Yaroslavka; Khymyn 1995) and four individuals in 1998 (Letychivsky district, village of Mytkivtsi, Khymyn 2011), and in the Rivne region one individual in 2006 (Sarny district, Ban'ky forest tract, Karasynets forestry, Rivne Natural Reserve; after Zhuravchak and Dobrynsky, 2011).

All information about the distribution and breeding biology of the Citrine Wagtail in Western Ukraine is presented in Senyk *et al.* (2012).

Information about the migration of this species is available for its main breeding area in Asia. The seasonal migrations of the Citrine Wagtail in European countries are still unexplored. The population increase of the Citrine Wagtail and expansion of its breeding range to the west of Europe could result in the formation of an autumn migratory route in the plains of Western Ukraine. In this article we analyse the available data about the stay and behaviour of the Citrine Wagtail after the breeding period and during autumn migration in the Cholgynskyy ornithological reserve (W. Ukraine).

MATERIAL AND METHODS

The data for this study was collected mainly by catching and ringing birds. Literature sources and notes of some ornithologists were also taken into account. Birds were ringed at the Avosetta ornithological camp (Western-Ukrainian Ornithological Station). Mist nets in the reed (Phragmites australis) thickets and walking traps for waders in the shallow water of abandoned settling basins of the former Yavorivsky State mining and chemical enterprise Sirka were used. Today the settling basins and adjacent territory belong to the Cholgyskyy ornithological reserve, of local significance (vicinity of the village of Cholgyni, Yavorivskyi district, Lviv region, W. Ukraine). The site is highly suitable for watching the migration of open-landscape birds. Large numbers of bird migrants feed here during the stopover. There are suitable places available here for birds to feed and roost.

The birds were caught in August 1995–2016. Ringing and measurements of birds were conducted according to the standard routine (Busse 2000). Wing length was measured with a ruler (to within 1 mm), and the tarsus and bill length with a calliper (to within 0.1 mm). Bill length was measured from the distal end to the plumage. The birds were weighed on a Soehnle Ultra 200 scale (to within 0.1 g). The status of the birds, state of plumage, course of moulting and visible fat load were determined according to Busse (2000).

RESULTS AND DISCUSSION

One Citrine Wagtail individual was caught and ringed here for the first time at the end of August 1995 (the first year of the camp's ringing activity). Since then, 48 individuals of the species have been caught and ringed in the reserve: one in 1995, 19 (24 catches = 19+5 caught more than once) in 2007, four (six) in 2008, 13 (15) in 2009, three (nine) in 2011, six in 2012, one in 2014, and one in 2015). Four of them (8.3%) were caught in subsequent years (after a year – B116253: 15 Aug. 2007-15 Aug. 2008, B116116: 13 Aug. 2007-13 Aug. 2008; after two years – B 115660: 7 Aug. 2007-11 Aug. 2009; and after four years – B 115992: 12 Aug. 2007-15 Aug. 2011, B 116116: 13 Aug. 2007-13 Aug. 2008-11 Aug. 2011 from the date of the first catch).

A few birds were re-trapped in the year of ringing (Table 1, Fig. 1). Re-trapped juvenile birds that stayed in the reserve for 3-4 days from the day of the first catch showed no change in fat score and only a slight change in weight: two of them lost

0.1 g and 0.6 g of body weight (one was partially moulting, changing its body cover feathers), while two others gained 0.1 g and 0.6 g (not moulting). A bird re-caught after 12 days increased its fat score (from 2 to 3) and gained 3.6 g (22.8% of its previous body weight). One re-trapped adult bird, caught after one day, showed no change in fat score but slightly increased its weight (by 0.3 g). Another bird (an adult female with the remnants of the brood patch at the intermediate stage of complete moult) remained in the reserve longer and was caught three more times after the ringing. In early August the bird had changed more than half its fly feathers. Evidently, the complete moult had begun in the beginning of the third decade of July. During its stay in the reserve (up to 10 days), the bird gained 1.7 g and increased its fat score (from T0 to T2), but over the next three days it lost 1.9 g of body fat (from T2 to T0), which could have been due to weather conditions (showers).

Table 1
Retraps of Citrine Wagtails

Ring	Sex/Age	Ringing date	Retrapped date	Days	*T*-score difference	Body weight difference
B 153107	*F Ad.*	4 Aug. 2011	13 Aug .2011	9	+2	+1.7 g
		>	14 Aug. 2011	10	+2	–
		>	17 Aug. 2011	13	0	–0.2 g
B 115715	*Juv.*	8 Aug. 2007	12 Aug. 2007	4	0	–0.6 g
		>	20 Aug. 2007	12	+1	+3.6 g
B 115770	*Juv.*	9 Aug. 2007	12 Aug. 2007	3	0	–0.1 g
B 115919	*Juv.*	11 Aug. 2007	14 Aug. 2007	3	0	+0.1 g
B 116112	*Juv.*	13 Aug. 2007	16 Aug. 2007	3	0	+0.6 g
B 115992	*Ad.*	14 Aug. 2011	15 Aug. 2011	1	0	+0.3 g

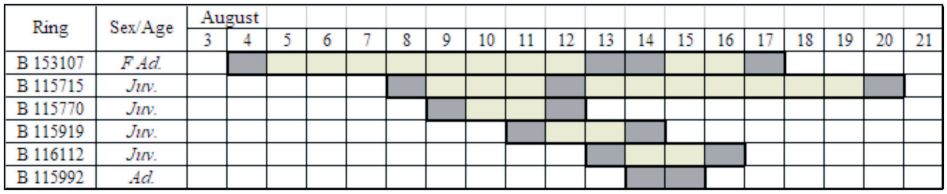

Fig 1. Minimum stage time of retrapped Citrine Wagtails at the Cholgynsky Reserve

Most of the Citrine Wagtails caught were juveniles (Fig. 2). The majority of birds were caught in the first half of August – from the beginning of the second decade to the middle of the month. In the third decade of August, the number of caught birds decreased, and only juvenile birds were caught. Adult birds were noted by the end of the second decade of August. Solitary Citrine Wagtails probably occur in the area in September, but we cannot confirm this as ringing took place only in August.

It should be noted that one pair of Citrine Wagtails bred in the area and remained in the vicinity during the pre-migration period (July to early August).

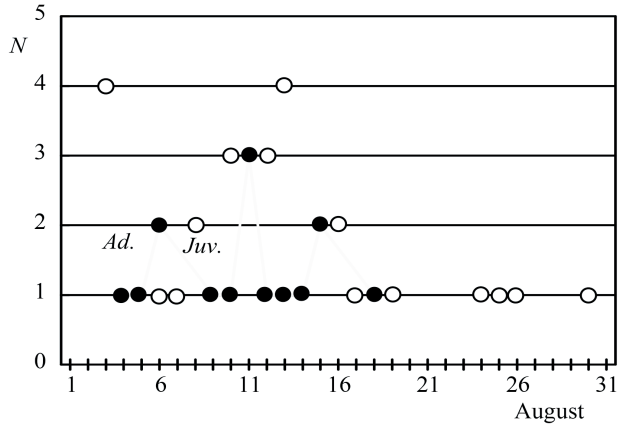

Fig. 2. Distribution of Citrine Wagtails caught by age

The modern literature contains practically no information on the timing of Citrine Wagtail occurrence during autumn migration from recently inhabited territories. Most information concerns territories where the species has been distributed for a long time. Migration of the species in Eastern Europe and Northeast Asia takes place in August and September (Dementiev and Gladkov 1954). The majority of birds migrate from the end of August to mid-September, and the last of them migrate from the end of September to mid-October.

In Eastern Siberia (southern part, the Baikal region), pre-migration aggregations of the Citrine Wagtail form in early August, and migration proceeds from mid-August to the third decade of September (Sonina 2005). The subspecies *M. c. werae* in Central Siberia has peaks of migration in mid-July (pentades 39–40) and the first decade of August (pentades 44–45), resulting from the pre-migratory aggregation, as well as in the last decade of August (pentades 47–48), when it is most likely moulted birds and birds from other populations of the subspecies that are migrating. The last migrating *M. c. werae* individuals were recorded at the end of August (48th pentade). Autumn flight of the nominative subspecies *M. c. citreola* begins in late August and continues until the beginning of October (pentades 54–55) (Savchenko and Temerova 2011). In Western Siberia (southern part), juvenile birds form a small aggregation in early August and gradually fly away by the beginning of September (Vasylchenko 2005). In the south-eastern part of Western Siberia *M. c. werae* flies to its winter quarters from the end of July to the first half of August, and *M. c. citreola* (apparently migrants are represented only by individuals of northern populations) pass noticeably later, mainly from August to early September (Kovalevskiy *et al*. 2017). The last migrating Citrine Wagtails in central Ukraine were recorded from 28 August to 9 September (Lyubushchenko and Tabachyshyn 1996).

We observed breeding pairs of the species in the study area each year during the years 2009–2013. One breeding pair with juvenile birds remained in the summer near the overgrown water surface in a wet meadow bush habitat, feeding in the shallow waters. In addition, a stable aggregation of breeding Citrine Wagtails formed in the

surrounding territories (in the valleys of the small rivers Vereshchytsya and Stavchanka in Roztochcha) over the last decade. Every year at least 3–4 pairs of *M. citreola* bred here (Senyk *et al.* 2012). We assume that these birds can also use this habitat to accumulate high fat stores for migration.

More than three quarters of *M. citreola* individuals were caught in walking traps while feeding on the shallow waters during the day (from 6:00 to 21:00). Birds collect food from the ground or water surface on shallow waters. They often feed around cows and horses in pastures. The village cattle have grazed here for many years, although the number of cows significantly decreased over the past 20 years. On the shallow waters of the reserve, *M. citreola* was caught more often in the morning and evening, which coincides with periods of increased daily activity of insectivorous birds. Less than a quarter of individuals were caught in the mist nets in the reed beds, most of them in the evening (20:00–21:00, seven birds). These are birds that spend their nights in reed beds (as mentioned by Whitehead 1909 qtd by Cramp 1992). There the Citrine and Yellow Wagtails have common night lodging. The latter species has used these reed beds for overnight stays during the post-breeding and migration periods for several decades (Shydlovskyy 2002). Cases of a common night lodging of these two species are known from the literature (Cramp 1992; Zavyalov *et al.* 2008). Five birds were caught in the reed bed during the day; three of them were moulting. We suppose that during complete moulting of birds the reed thickets are a safer place for them to feed, although moulting birds were also caught in the shallow waters near a reed thicket patch. Proximity to high grass and reeds provides better protection against predators, which for small passerines in this area are the Great Grey shrike (*Lanius excubitor*) and the harriers Circus sp. As more birds were caught in the mist nets after sunset than after sunrise, we can assume that birds move a certain distance through the reed thickets to reach their night lodging (perhaps looking for other birds or a better place).

All Citrine Wagtails caught in the reserve in August had a fat score from T0 to T4. There were no birds with the highest fat score (T5). The distribution of birds by fat score, as low (T0 and T1), medium (T2) and high (T3 and T4), was 23:19:17. Nearly one third of individuals had no visible subcutaneous fat (T0), while half were in various stages of complete moulting. If we do not take into account these complete-moulting birds, the distribution by fat score (low:medium:high) is almost equal: 13:15:16 (Fig. 3), but excluding partially moulting birds it is 7:13:16. Therefore, among non-moulting Citrine Wagtails 44.4% have a higher fat score (T3 or T4).

Adult moulting birds had approximately the same average fat score 2.0±0.5 ($m \pm SE$, $n = 9$) as juveniles 1.8 ± 0.2 ($n = 31$), while adult birds in new plumage (after complete moult) had higher scores 3.0±0.4 ($n = 4$). According to Lincoln (1935), long-distance migrants can significantly increase their subcutaneous fat (by 30–50% of their weight) during migration. Among all individuals caught in the reserve, subcutaneous fat reserves accounted for more than 15% of the weight of only 14.6% (7 birds, after the middle of August) and for more than 30% of the weight of only 2.1% (one bird, caught at the end of August). The average fat score generally increased by the end of the month (Fig. 4). The majority of birds caught in the first five days of August had no fat deposits. Adult birds in practically all stages of complete moulting

had no fat deposits (T0), while birds with higher fat scores (T3 and T4) had already completed or practically completed moulting. Having data on the moulting rate (re-trapped moulting birds), we can assume that adult birds complete their moult by the end of the second decade of August, and juvenile birds complete partial moult by mid-August.

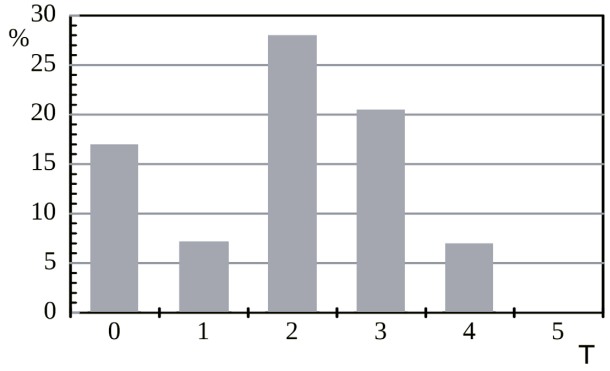

Fig. 3. Fat scores of Citrine Wagtails (without the moulting adult birds)

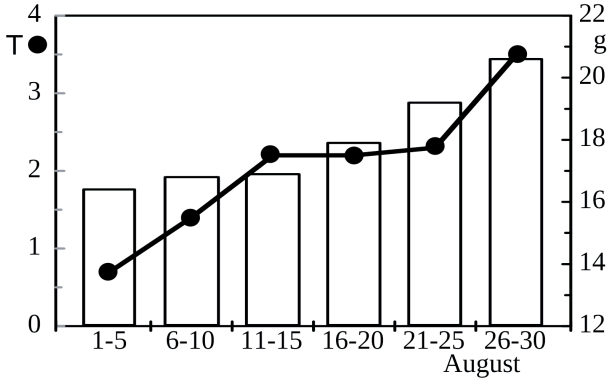

Fig. 4. Changes in average fat score (line, left scale) and average body weight (bars, right scale) of caught individuals over time

The average body weight of adult (including adult moulting birds) and juvenile birds is practically equal: 17.6±0.3 g (*n* = 16, 16.2–20.4 g) and 17.3±0.3 g (*n* = 32, 15.1–22.0 g), respectively. Adult moulted birds seem to have a higher average body weight – 18.7±0.8 g (*n* = 4, 16.9-20.4 g), but as the number of birds is small, no significant difference in the mean values was confirmed. Citrine Wagtails in Siberia in August had a lower body weight. In south-western Siberia (Lake Chany), adult *M. c. werae* individuals in August weighed 16.7±0.97 g (*n* = 5, 15.6–18.2 g), while juveniles weighed 16.1±1.19 g (*n* = 52, 13.4–18.1 g) (Havlín and Jurlov 1977). In the south of Central Siberia birds weighed 16.3±0.4 g (*n* = 45) (Temerova 2009).

Wing length is a good indicator for distinguishing subspecies of the Citrine Wagtail. According to Redkin's measurements (Kovalevskiy *et al.* 2017) of 220 individuals,

the wing length of *M. c. citreola* males is usually more than 84.5 mm, while that of females is > 78.4 mm. The wing length of *M. c. werae* males is usually less than 85.0 mm, and that of females is < 80.3 mm. According to literature data, the difference can reach up to 1.8 mm (Cramp 1992). In adult M. c. werae males in south-western Siberia (Lake Khadin), the average wing length was 82.88±0.39 mm (n = 50) (Savchenko and Temerova 2011).

Among the individuals caught in the reserve there were two birds with long wings: one immature bird (with a wing length of 88 mm, on 30 Aug.) and one adult female in the final stage of complete moult (89 mm, 6 Aug.) There was also one adult bird (sex unknown) and six more immatures (sex unknown) whose wing length bordered on long (wing length of 85 mm). The length of the wing, tail, tarsus and bill of the birds is presented in Table 2. These measurements indicate that most individuals probably belong to the *M. c. werae* subspecies.

Table 2
Measurements of Citrine Wagtails

Measurement	Juveniles		Adults	
	N	*m*, ± *SD*, (min.-max.)	*N*	*m*, ± *SD*, (min.-max.)
Wing	33	81.7±0.5 (76–88)	10	82.3±1.0 (78–89)
Tail	34	71.1±0.8 (63–83)	14	71.6±0.9 (66–76)
Tarsus	32	23.7±0.1 (22.1–25.6)	17	23.7±0.2 (22.1–25.8)
Bill	32	12.2±0.2 (11.1–14.0)	17	12.3±0.2 (10.9–13.5)

The adult moulting birds with low fat scores that stayed in the reserve for a longer time could belong to a local population. Adult birds with new plumage (n = 5, ringed during the second half of August) with higher fat scores may belong to the category of migrants which are likely to come from the north and/or west.

The birds in the partial moulting stage (caught in the reserve up to mid-August) had a significantly (t = 3.6061, p = 0.0007) lower average fat score (0.5±0.9, n = 11) than moulted ones (2.1±1.8, n = 41).

Adult birds (of both subspecies: *M. c. citreola* and *M. c. werae*) undergo complete moult and juveniles partial moult in the breeding area (Swensson 1994). There are reports that complete moult of the Citrine Wagtail in the Western Palearctic begins from early to mid-July and is completed at the middle to the end of August (Dementiev and Gladkov 1954; Piechocki 1958, after Cramp 1992). Adult birds in different stages of moulting of primaries and tail feathers (complete moulting) were recorded in the study area until August 18 (nine birds) (Fig. 5). Adult moulted birds were recorded from the beginning of the second decade of August (12, 13, 14, 15 and 21 Aug., six adult birds with new plumage). If we take into account the moulting rate of an adult female undergoing complete moulting (caught four times in two weeks), we can calculate that the remaining adult birds will have new plumage (finish complete moult) by the middle of the third decade to the end of August.

According to Jenni and Winkler (1994), complete moult of long-distance migrants ends before the beginning of autumn migration. Therefore, we can assume that adult

birds could begin to gain fat reserves from the beginning of the second decade of August (an adult bird with new plumage was recorded on 12 Aug.). If we accept the calculated dates of the end of complete moult and add several days for gaining fat, then the departures of adult birds could take place from the end of the second decade of August. No adult bird with all nine old primaries was caught in August. Complete moult of adult birds which migrate through W. Ukraine (including the local population) probably begins about mid-July. All adult birds caught in the first decade of August were undergoing active complete moult; in the second decade nearly three quarters of them had completed moulting; and in the last decade all had new full-grown primaries and tail feathers (Fig. 5).

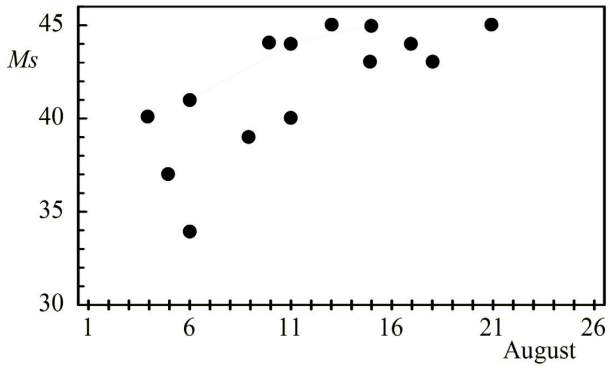

Fig. 5. Individual moulting scores of adults in August (*Ms* – moulting scores 34–44 = active moulting, 45 = moult completed)

One adult bird with one old primary feather in the state of active complete moulting was recorded on 6 Aug. (female with remnants of the brood patch, apparently late breeding; moulting score 34; Fig. 5). This female was recorded in the reserve three times in two weeks and at last record (17 Aug.) had practically completed its moulting. Evidently, the moulting process begins in the breeding area immediately after or at the end of breeding and proceeds for about a month. During this time *M. citreola* stays in the territory and does not fly a long distance. The juvenile birds undergo post-juvenile partial moult. It begins shortly after they leave the nest, so it is highly variable in time (Cramp 1992). Seven juvenile birds had changed their body cover by mid-August.

CONCLUSIONS

The Citrine Wagtail has been a breeding and migratory species in Western Ukraine for several decades. Due to expansion of the breeding range of *M. citreola* to the northwest and the increase in the population in Europe, the species has formed its migration stream through the plains of Western Ukraine.

About 80% of the *M. citreola* caught in the Cholgyni ornithological reserve were recorded in the first half of August (predominantly juveniles and moulting adult

birds). The ringing data suggest that adult Citrine Wagtails (as in the case of many species) could fly earlier than juveniles. In the second half of August fewer birds were caught, and they had higher fat scores.

Nearly 9% of *M. citreola* (ringed as juveniles) were caught in the reserve after one and two years, and one of them after one and four years. These could be birds of the local population that return to the hatching ground or migrating birds that use the same stopover location year after year. The second explanation is supported by the fact that the ringing-control dates are very close (see above – p. 42).

During the first five days of August almost no juvenile birds had visible subcutaneous fat reserves, which may indicate that intensive post-breeding dispersal takes place at this time. Adult birds in the beginning of August were moulting (complete), which could indicate that they belong to the breeding population. Such individuals, as a rule, had no fat reserves. But by the end of August there was a significant increase in the average fat score, indicating typical preparation for seasonal migration and the start of migration. At this time, the average fat score increased fivefold compared with the first five days of August (0.7 versus 3.5).

After the breeding season, at the beginning of August, moulting Citrine Wagtails with no fat reserves were noted in the Cholgynsky reserve. The complete moult of individual adult birds had finished by the beginning of the second decade to the middle/end of the third decade of August, while the partial post-juvenal moult of the juveniles was completed by mid-August.

Based on the data we assume that the migration of *M. citreola* in Western Ukraine takes place predominantly in the last decade of August and perhaps in September.

The shallow waters, pastures and reed beds of the Cholgynsky reserve were important habitats for feeding and accumulation of fat reserves, moulting and night lodging of the Citrine Wagtail after breeding and during autumn migration.

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