CONTRIBUTIONS TO THE STUDY OF POSTEMBRYONIC DEVELOPMENT OF CHIFFCHAFF NESTLINGS (*PHYLLOSCOPUS COLLYBITA*, SYLVIIDAE)

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Abstract. *Our study followed the postembryonic development of chiffchaffs nestlings during the period when they are into the nest. We also studied some behavior aspects in this period, corresponding with the cavity type of the nest. We analysed the data gathered in two recreation areas between 2007 and 2009; 28 nestlings from 7 nests were under our observation. Parents attended, fed and protected nestlings during 12 days, time necessary for their development into the nest. In the case of the chiffchaff as in other nidicolous species, it can be noticed a correlation between behavior peculiarities, formation of sonorous and motor reaction with specific ecological condition of the nestling type, even in early period of postembryonic development.*

Keywords: *chiffchaff, postembryonic development, nestling, body mass, plumage.*

Rezumat. Contribuţii la studiul dezvoltării postembrionare a puilor de pitulice mică (*Phylloscopus collybita*, Sylviidae). *Lucrarea de faţă prezintă descrierea morfologiei externe, modificărilor, abilităţile motorii şi de percepţie ale puilor în perioada dezvoltării lor postembrionare. De asemenea sunt prezentate şi unele aspecte de comunicare părinţi-pui. Studiul s-a realizat în anii 2007-2009; măsurătorile biometrice au fost efectuate sistematic la 28 de pui. Încă din perioadele timpurii ale dezvoltării postembrionare a puilor de pitulice mică, cât şi la alte specii de păsări nidicole, se observă interdependenţa dintre particularităţile comportamentului puilor, termenii de formare a reacţiilor sonore şi motorii cu condiţiile ecologice ale cuibăritului caracteristice speciei.*

Cuvinte cheie: *pitulice mică, dezvoltare postembrionară, pui, masa corporală, penaj.*

INTRODUCTION

Some aspects about postembryonic development of Passerine and biometric indices of this period were separately investigated more times and interested many authors (PORTMAN, 1938; POZNANIN, 1948; SERPOKRIIL, 1985). Although this phenomenon has been well documented, precedent studies established fundamental regularities of growth. Relatively few studies have been systematically accomplished, but not detailed studies were performed to clear up the biological peculiarities of postembryonic development. Moreover, there were not described and studied certain behaviour aspects in the period when nestlings are into nest, corresponding to the cavity type of nest. It would be important to make a comparative analysis between related species.

Phylloscopus collybita (VIEILLOT, 1817) is a common species widespread on the territory of the Republic of Moldova; it has relatively high density. Being a less cautious species, we managed to observe and analyse growth and behavior peculiarities of chiffchaff nestlings during twelve days.

METHODS AND MATERIALS

Our field observations were made within the green periphery of Chişinău city (2007) and cemetery "St. Lazar" (2008-2009). Seven nests were under our observation permanently: five with 5 nestlings and two with 4. Biometric measurements and length of feathers were made by means of the compasses. Nestling behaviour and measurements were done daily. We took into account the average values of the nestlings' morphology, which indicate growth. The average length of the most important pterylae (feathers tracts) – flights feathers (primary and secondary remiges, primary and greater coverts), rectrices and contour feathers were also included.

RESULTS AND DISCUSSIONS

The obtained results gave us the possibility to describe external morphology, occurred modifications, behaviour and motor abilities of nestlings in each of the twelve days, when nestlings are into the nest. Postembryonic development includes three periods (ILICEV et. al. 1982): - the 1st early postnatal period – till hatching from appearance of chemical thermoregulation, it is about 6-8 days at chiffchaff nestlings; - the 2nd late postnatal period – appearance of major elements of homoeothermy, development of nervous system, complexity of activities and behavior responds (9-12 day). These two periods correspond with nestlings' staying into the nest; - the 3rd period – offspring get away from nest, but parents continue feeding them for another 7 days. In the early postnatal period, the female spent more time with the nestlings, for warming them up.

The first day

The skin colour of just hatched chiffchaff nestlings is light pink-yellowish with orange nuance, the legs and claws are yellow and the bill is yellowish-grey. The nostrils have oval shape. The membrane around the bill is obviously yellow and quite big (0.4 mm). Its size is in direct dependence with the nestlings' growth biometric indices. All morphological elements are in correlation with the type of nesting. In the period when they are in the nest, the size

of the membrane is bigger than in the case of the blackap nestlings. This could be explained through the closed type of the nest, which is quite common at hollow species (MALCEVSKII, 1959). Each nestling has three downy feathers in the back of eyes, nape and wings. Pterylae were not clearly noticeable; external auditory meatus and eyelids are closed, but not jointed. In the first day, chiffchaff nestlings produce very weak sounds sporadically, when they want food, sounds that human auditory perception can hardly perceive. Nestlings beg for food more in response to parental calls, less to nest vibration and very rarely at touching stimulants. Female produces several types of calls, short and muffled, alike with "uit-uit". We can speak about acoustic communication held by parents and their nestlings. Calls produced by brood are orientated to stimulate parents to supply food. Parents also call to stimulate nestlings to beg for food. The presence of vocal communication system between nestlings and parents has an important biological function (MARTY et al., 1997; KUMAR, 2003), especially at the species that have a terrestrial nestling type.

The second day

Beginning with the second day, humeral and alar pterylae clearly appear as an agglomeration of grey points mainly in the ventral and crural parts of the body. Those on the head, neck and calf are not visible. Alar pterylae have an interrupted line shape, in case of both primary and secondary remiges. Nestlings are rather mobile; when they are taken out of the nest, they have a tendency to coil. In the most cases their response motions at different external stimulants are chaotic and uncoordinated. Fig.1: Chiffchaff nestling is 2 days old.

The third day

At this age, dorsal and ventral pterylae look like a grey and yellow interrupted line. In the head and neck regions they look like bulging points, as crural pterylae are weakly visible. The sheaths of primary and secondary remiges penetrate skin and appear as small bulges. Auditory meatus is opened; nestlings begin to differentiate sounds and respond with begging just to those sounds which are similar with their parents' calls. Eyelid is very narrow and opening the eyes supposes physical effort.

The fourth day

At this age, on the scapula and the other body parts of the little chiffchaffs there appear sheaths of coverts. Colour of the skin-covered parts does not change greatly – rhamphotheca is grey-yellowish, claws acquire grey nuance, skin is pale pink with orange nuance, and tarsus is light pink-yellowish. Sheaths of primary and secondary remiges have about 1.5-2 mm, primary coverts ~1mm. We present the increasing and development rhythm of some feathers tracts (pterylae); the remiges appear first followed by coverts and rectrices (tail feathers), which appear in the 4th day (Table 1). The feathers increase averagely with about 1.5-3mm daily.

Table 1. The size of pterylae and some feathers at chiffchaff nestlings.
Tabel 1. Dimensiunile pterilelor şi ale unor pene la pitulice mică.

Age/days	Primary remiges length /mm	Secondary remiges/mm	Primary coverts mm	Greater coverts mm	Dorsal pteryla/mm	Femoral Pteryla /mm	Rectrices (tail) mm
I -III	0 – 0.5	0 – 0.5	-	-	-	-	-
IV	1.5 - 2	1.5	1.0	1.0	1.0	1.0	0.2
V	4 -5	5 - 2	2 -3	3 - 2	1.2	1.8	0.8
VI	7 - 9	9 - 3	4 -5	4,5	3	2.5	2.0
VII	11 -13	14 -4	6 -7	6,5	6	3.0	4.0
VIII	15 - 18	14- 5	7 -9	10	7.5	4.5	5.5
IX	20 -23	22 -10	10 -12	13	11	6	8
X	21 -26	22 -8	12 -13	15	12	7	11
XI - XII	23 - 28	27 - 14	12 -14	15	14	10	13

The fifth day

At this age eyelids are more opened, nestlings evince photo sensibility, because they responded with begging if they stay in overshadowed nest. Nestlings are not so active. Tarsus, claws and beak keep yellow-grey nuance. We suppose they are not quite lively because their nervous system undergoes changes (development of the nervous system and visual organs) (MALCEVSKII, 1959). Fig. 2: Four day's chiffchaff nestlings.

The sixth day

Chicks have opened eyes during the entire day, not just when they beg for food. Begging reflex does not last long at visual stimulants. Movements become more coordinated, when it is pulled out from nest. Nestlings try to do crawling motions supported by tarsus and elbows of the wings.

The seventh day

At this age eyes are permanently opened, begging reflex may be prolonged through visual stimulants. This index appeared in chiffchaff nestling one day later than in blackcap nestlings. The explication may be the closed type of chiffchaff nest, which is less illuminated. Also, acoustic communication is present, the female calls produce begging collective reaction, which is actively manifested. Nestlings in their turn make sounds that can be heard between feedings. When we try to move the nestling from place to place it often beat wings and holds itself with the clenched toes. On the ground, they crawl with partially overt wings and support themselves on tarsus and toes. The colour of the beak and tarsus begin to change to grey-yellowish.

The eight day

Fright reaction and ability to crouch on the bottom of nest, especially, are quite obvious in the eight day. When approaching the nest, they largely open the mouth and produce short, shrill sounds like a hiss of enemy. It is so unpleasant, that every time heard it provokes a wince. All these are meant to frighten the enemy and, probably, are determinated genetically. Fear is provoked by objects of different shapes (microphone, finger, hand, etc.) and less by branches. If enemy is insistent or tries to draw them out of the nest, the nestlings' hiss changes into a screech for help. This draws parents' attention, which become very excited and try to do different strategies, to make the enemy leave away from their nest and territory. Little chiffchaffs have in their sonorous vocabulary contact call, but it is short, hoarse and creaked. With contact calls nestlings find each other and the parents. Their orientation and mobility increase very much, nestlings which just crawled days ago, try to run even on all four "legs". Eyelids' opening has an oval-ellipse shape. Fig. 3: Eight day old chiffchaff nestling.

The nine day

As nestlings grow they become noisier. Begging reflex is accompanied by murmured peeping and shrill whistling, which is observed not just at fright reaction. Starving nestlings produce shrill sounds, which can be heard 1-2 m away from the nest. In this period they are very alive, movable, they can jump, propped on tarsus, and slightly raise the thoracic region. When they are taken from the nest, they have a specific behavior – they try to find shelter no matter where (box, bag, sleeve, etc.) and gather together using contact calls. Only when they are together they become quiet. Such reflexes and reactions are observed at the age when not just visual but and these motor abilities reach more advanced development stage.

The ten day

In their sonorous vocabulary, there appear new contact calls with high notes, clearly, resounding but whining, such as a "uit". This contact call is used by nestlings to announce parents about their place. We also observed a clear trend to get away from the nest. When one of them is taken out from the nest, the others immediately spread in different directions through jumping, crawling motions and produce shrill calling sounds, although, in this period nestlings usually do not abandon the nest.

The eleven-twelve days

In this time little chiffchaffs abandon the nest. The most developed nestlings, with the greatest body size spread, while the smallest can stay for another day. Offspring can do short flights, but at low height, often fluttered with wings. Most of flights are done from branch to other, accompanied by specific squeaky calls. Nestlings permanently produce contact calls and gather on one branch. The feathers are going out from sheaths; the juvenile plumage has the same colour as that of the adults.

Biometrical data of 23 nestlings are presented in Table 2. According to the data we can establish that body mass increases very fast, about 1,000 mg per day until the age of 5-6 days, after that, growth is about 400-600 mg. In the same upward rhythm the plumage develops. Fig. 4: Chiffchaff nestling is 12 days old.

Table 2. Dynamics of the chiffchaff nestlings' growth during the period they stay in the nest.
Tabel 2. Dinamica creşterii puilor de pitulice mică în perioada aflării în cuib.

Age/day	No. nestlings	Body mass/g	Total length/mm	Wing length /mm	Tarsus length /mm	Beak length /mm
I	28	1.2-1.5	21.3- 26.1	5.2- 9.6	6.7 -7.1	3
II	28	1.8	27.2	6.7	7.8-8.0	3.3
III	28	2.9	32.4	8.2	9.6- 11.2	3.9
IV	28	3.7	39.1- 44.5	9.1-11.2	11.8 – 12.4	4.6
V	28	4.35	50.5	12	12.5	5.0
VI	28	4.85 – 5.0	46.9	12.3-13.2	14.5 – 16.4	6.3
VII*	28	5.4	47.3	13.6	16.4	6.5
VIII	27	6.1	48.5	13.9-14.1	17.4	6.9
IX	27	6.8	48.9	14.1-14.8	18.2	6.9
X	27	7.2- 7.8	50.2- 53.5	15.1- 15.7	20.1- 21.1	7.1
XI**	17		57.2- 59.4	13.9-15.6	20.5 – 21.8	7.3

* a nestling disappeared from the nest in next day

** in two nests, nestlings have spread when one of them was taken out

CONCLUSIONS

Parents attend, feed and protect nestlings during 12 days, time (interval) necessary for their development into nest.

Increase of body mass is about 800-1,000 mg in the first 5-6 days, after that 400-600 mg daily, while the plumage increases with about 1.5-3 mm.

Communication between parents and nestlings begin since the first day of postembryonic development and helps the coordination of both their behaviour.

11-12 day old nestlings get outside the nest and can make short flights on small distances, about 2-3 m, and low height staying together.

Even in the early period of postembryonic development, in the case of chiffchaff as well as of other nidicolous species there was observed a correlation between behavior peculiarities, formation of sonorous and motor reaction and the specific ecological condition of nestling type.

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Received: May 26, 2009
Accepted: August 18, 2009

Figure 1. Baby chiffchaff (2 days old).
Figura 1. Pui de pitulice mică (vârsta de 2 zile).

Figure 2. Baby chiffchaff (4 days old).
Figura 2. Pui de pitulice mică (vârsta de 4 zile).

Figure 3. Baby chiffchaff (8 days old).
Figura 3. Pui de pitulice mică (vârsta de 8 zile).

Figure 4. Baby chiffchaff (12 days old).
Figura 4. Pui de pitulice mică (vârsta de 12 zile).