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Burkovskiy O.A.,* Tiunov I.M (2016) Reuse of Previous Year's Uncompleted Nests by Chinese Penduline Tit *Remiz consobrinus* (Swinhoe, 1870) as a Feature of Species Reproductive Behavior // *Far East. J. Orn.* 5: 3—10.

SUMMARY

From 2011-2015, we noted that 2.8 – 5.6% of male Penduline tits in southwest Primorye, Russia, started the breeding season by repairing nest-baskets unfinished from the previous year. In 55% of these cases, occupation of old nests took place in the first days after males returned from their wintering grounds. After pair formation, both the male and the female finished building the nest together before occupying it. The presence of pendant, basket-like nests in the colony is explained by the polygynous nature of penduline tits. These nests, which sum 34.3% – 35.4% of all nests by the end of the breeding season, are built exclusively by unpaired males. Only 36.6% of the previous year's nests were fully completed. The adaptive meaning of this behavior is discussed.

The referred figures and tables are in the original article in Russian, at pages 3—10

Chinese penduline tit (hereinafter CPT) as a nesting species was introduced to the Russian territory quite recently. The breeding fact was first discovered in the extreme south of Primorsky Territory (Khasan district) in 1996 (Burkovskiy, 1997; Burkovsky, 1998; 2005), but the actual colonization of the region occurred at the turn of 80s - 90s in the twentieth century, according to the results of retrospective analysis of the unpublished data. By 2014 the number of «Khasan» group reached 400-450 conditional pairs (Gluschenko et al., 2014a; 2015). A special feature of the distribution of this species in the Khasan district is its association with the coast. It currently nests from the North Korean border to the estuary of Brusya river on the coast of the Slavyanskiy Bay (Gluschenko et al., 2014b; 2015). As shown by individual banding, structurally the CPT's settlements appear to be scattered colonies in which all adjacent pairs regularly communicate with each other (Burkovsky et al., 2014).

During systematic monitoring of nesting sites in the model colony of CPT on the coast of Aleut Bay in Khasan district in 1997-1998 and in the early 2000s we noticed the clear difference in the timing of the completion of the nest by individual pairs in comparison with the general group of nests in the colony. In the third decade of May - midst of the nest building season - some nests have been fully completed or were in the final stages of construction. Seemingly, this significant lead (8-12 days) from the average time could be caused by an earlier date of return of the advanced part of the population from wintering sites, and, consequently, an earlier start of the breeding activity. Estimated on the basis of standard parameters of breeding phenology in the studied colony, it has been suggested that the start of construction of early nests should fall on the end of the third decade of April, which is much earlier than previously thought. For various reasons we were unable to visit the area of research at the appropriate time to check the validity of this assumption. Later, from 2011 to 2015, during targeted and systematic research of the breeding biology and the structure of CPT settlement, we found out that the early nests belonged to birds among the advanced migrants indeed. However, the cause of the faster completion of the nests in preparation for clutching lies not so much in the earlier dates of the start of construction, but in

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the tendency in individual pairs of using nests from the previous year as a base for a new nest.

MATERIALS AND METHODS

The presented materials were obtained in the study of the breeding biology of CPT in the south of Khasan district of Primorye, on the coast of Aleut Bay. During 3 field seasons (1996 - 1998) we estimated the number of breeding pairs and their status. In the period from 2000 to 2010 short irregular surveys of the colony were performed. We performed the targeted study of the breeding biology and ecology of CPT was between 2011 and 2015. Every year we monitored about 30-40 pairs. The research area included the coastal strip of width up to 1.5 km inland, but the main work was carried out in the coastal zone up to 800 m in width, where the main part of the colony was concentrated. In order to study the territorial distribution and movements of birds, we banded 87 males and 14 females with unique combination of colored rings. Most of them were captured and banded in 2013 and 2014 (42 males and 7 females and 30 males and 6 females respectively). We mapped the nests using a GPS navigator.

RESULTS

PT is caused by one of the characteristic features of mating relations of CPT - their polygyny (Burkovsky et al., 2014). After the completion of the first nest in a current season and the formation of a full clutch, which usually happens in the first half of June, the males leave their females and start building another nest at a new site.

Initially the nest looks like a simple basket with weakly expressed upper arch (Fig. 1A). Later, depending on the duration of the construction and the persistence of male in the process of nest building, the basket gets a more correct and rounded bottom and a broad upper crossbar (Fig. 1 B). Upon completion, the males call actively while trying to attract a female, adjust the nest from time to time, occasionally adding some new material. In case of success with attracting a new partner, the nest is being completed jointly by the newly formed pair. Otherwise the process is stopped at an intermediate stage, when the construction resembles a basket with two wide side openings. Unfinished nest can be used by the male

for night roosting, but if the owner has not managed to form another pair, it remains unfinished. Some single males can build sequentially up to three such nests during June and July. For this reason, after the breeding season there are two basic types of nesting constructions in the colony: complete nests that were used in the current season for breeding and unfinished nests-baskets of unmated males. The share of the latter is about a third of the total number of constructions (34.3% in 2013 and 35.4% in 2014). Individual nests left on the intermediate stages of construction due to death of one partner are also found in the colony. They have the shape of an elongated bag with two oval openings in the upper half. Throughout the fall and winter a part of unfinished nests is destroyed and falls from the trees, but the majority (80%) is maintained until the next breeding season. Exposed to rain, wind and sun, they darken, shrivel, and are partially deformed. At touch their walls appear to lose their original elasticity, become stiff and tight. Under the influence of wind, some of the constructions can significantly change their initial angle of inclination in relation to the horizon. However, some of the previous year's nests are preserved until the next breeding season in the state suitable for use as the basis for a new nest.

The Scale of the Phenomenon

According to our observations, annually during the spring season one to three males of the colony (2,8-5,6% of the total population in the colony) started the nesting season with restoration and completion of the nests-baskets of the previous year. Total of 11 such cases were noted - one in 2011, two - in 2013 and 2014., three - in 2012 and 2015. In 55% of the cases the occupation of the old nests-baskets happened in the beginning of May, that is, in the early days of the distribution of males over the breeding areas. Successful completion and hatching of chicks in such nests was observed not always and not every year. Only four (36.6%) of them have been fully completed; in five cases the males left the nests during reconstruction, and in two cases due to poor ductility of the old material, pairs have built new constructions on the side and on the bottom of the old nests-baskets.

We didn't find any significant dependence of the frequency of the reconstruction of the previous year's nests on the species of trees which they were built on. One

nest on each were found on the Manchurian crabapple (*Malus manshurica*), Asian willow (*Salix pierotii*), Manchurian linden (*Tilia mandshurica*), Japanese elm (*Ulmus japonica*), Asian bird cherry (*Prunus asiatica*); in two cases - on the Amur linden (*Tilia amurensis*) and in four cases - on the Manchurian alder (*Alnus hirsuta*). The distance from the sea fluctuated within the width of the colony up to immediate vicinity of the shore, in one case - 2 meters and in another - 10 meters from the coast. It should be emphasized that only in one of the above mentioned cases the male occupied his last year's unfinished nest.

Phenology Notes

In spring males arrive before females, with the first of them appear in the third decade of April. For example, in 2012 individual males were observed in the south of the Khasan district on April 28th (A.B. Kurdyukov, personal communication); in 2013 three males appeared on April 29th on the shores of Aleut bay; in 2014 the first two males were observed on April 27th. In 2015, first individuals returned to the breeding areas in even earlier dates: on April 26, six males and a pair were already present in the bay area. They didn't started occupying the nesting sites (trees) and building nests immediately but did it few days after arrival.

For many males, especially the yearlings breeding for the first time, the presence of old nests or their remains is the signal for selecting a nesting tree. Often, a new nest is built next to the old one, which leads to long-term use of the same tree. Meanwhile, there is an area on the coast close to the lower reaches of the creek (kind of a core of the colony), where the trees are primarily occupied by males for nest construction (Burkovsky et al., 2014). In the period of 2011-2014 in this area the males occupied the trees with last year's nests remaining on them, upgrading and rebuilding them. The nests were constructed on manchurian alder, particularly on the same exact tree for three years. It is noteworthy that it is where the earlier nests were built, which initially attracted our attention in 1997 and 1998.

The attempts of males to rebuild the nests at this site had failed in 2012 and 2013. The birds abandoned them quite quickly and built new ones on the neighboring trees. In 2011 and 2014 the construction was successful. When visiting the coast

of the Aleut Bay on May 3d, 2011, we noted that one of the two males which first appeared in the colony began to restore the previous year's nest. Judging by the quantity of added fresh material, the duration of the construction was 1 or 2 days. It fell into the rare category of nests that were abandoned by a pair on the pre-finishing stage before egg-laying. It had an elongated shape with two small round holes in the top part. With a second visit on May 8, the male which occupied the nest continued to build it alone, updating the external walls of the nest. At the beginning of the third decade of May the nest was fully completed by a formed pair. The female, left by the male, successfully hatched and brought up chicks. In 2014, a male started to upgrade the walls of an old nest-basket in early May at the same site. Soon a female which one of the first returned from the wintering areas formed a pair with that male. The first egg in the nest appeared on May 12th, which was 9 days before the beginning of the mass egg-laying in the colony (May 21st). The pair completed the construction of the nest on May 20th, but the unusual structure had attracted people's attention, and it was taken from the tree.

Method of Restoration and Rebuilding of Nests

At the initial stage of restoration of old nests males have to make an extra effort to insert new material into dense walls. In most of the selected nests, males began to add new plant fibers to the outer and inner sides of the walls, criss-crossing and reinforcing the old structure. In the case where the male started upgrading the nest unfinished by a pair in the previous year, he initially inserted fluff picked from last year's reed panicles (*Phragmites sp.*) into the lower part of the structure (Fig. 2). He later added fluff over the entire surface of the side walls, and the nest took its final shape after the female joined (Fig. 2). After the initial renovation of the walls with newly brought material, the further stages of construction were not different from other nests.

The behavior of males at the nest is individual to a certain extent. In particular, we had noted that when the male who was one of the first to appear in the colony actively "promoted" the last year's nest for two weeks, upgraded its walls, but did not bring any new material. Unable to find a mate, he left the nest and moved to a new site.

At the formation stage of a full-fledged nest from the previous year's the nest-baskets, a male is required to make considerable efforts to expand its internal dimensions by moving apart the sides and draw the bottom down. However, not all previous year's nests, being poorly elastic and often deformed, lend themselves to the extensions required. Some attempts are unsuccessful, and as a result a new nest is built on the old surface, resulting in one of its walls being woven into the new nest (Fig. 3).

In the second half of May, with an increase in humidity and frequent fog conditions in the marine coastal area, the material of old nests is softened, its walls weaken and begin to break down. Therefore, the attempts of males to rebuild previous year's nests failed in the later periods - if the birds did not have time to interweave a sufficient amount of new material that would hold the entire structure. In 2013, the bottom of an almost finished nest dropped due to tension and an increase of weight. In 2014, a previous year's nest, which a male was trying to upgrade had a hole opened at the bottom. (Fig. 4), and he made unsuccessful attempts to patch it up with fresh material.

All noted cases of using the old nests concerned only unfinished nests like nests-baskets left by a male or nests left unfinished by a pair. We have not seen any attempts to restore fully completed previous year's nests, where chicks were hatched. A part of such nests is also preserved till spring, but in most of them the upper wall of the pipe is deformed and falls, closing the inlet opening, which reduces the likelihood of their re-use. Nevertheless, it is possible that in the best of circumstances, it is possible. A similar one of a kind case, have been described for Eurasian Penduline tit - *Remiz pendulinus* (Knysh, 2001).

The Features of the Rebuilt Nests

The size and shape of the rebuilt nests did not differ from the other nests of a respective season, but in some of them the dark spots of the last year's old material stood out on the background of the new interwoven plant fiber and fluff. The weight of the two combined (rebuilt) nests, weighed after the departure of the chicks was 34 and 42 g., which fits into the weight range of the mass of the first spring nests built from scratch (23,8-39,4 g, n = 24) or slightly heavier.

The Premise of Occurrence and the Biological Significance of the Phenomenon of Using Previous Year's Nests

We believe there are a number of preconditions to the use of previous year's nests by CPT. One of the main conditions is the fact of the preservation of such «hibernated» nests until the next breeding season, which is contributed to by a dry autumn and winter with little snow in the south of Primorye. The basis of this phenomenon is a strategy aimed at improving the efficiency of breeding by saving the time for the construction of the nest. According to our data, in the extreme south-west of Primorye the full cycle of building the nest since the beginning of wrapping plant fibers on a branch until the formation of the entrance pipe takes 23 to 29 days, in rare cases - up to 36 days. Rebuilding of old nests reduces this process to 20 days (according to the observations of two nests). Given that in the third decade of May free females in the state of looking for a partner are present in the colony, early nesting increases the chances of a male to form a second pair. Females from the first nests also receive certain benefits. In case of the successful bringing up of offspring, their chicks become independent before other hatches in the colony, and they can participate in the second cycle of reproduction.

On the other hand, the presence of positive experiences on occupying and rebuilding «ownerless» previous year's nests predisposes individual males to capture the nests being under construction and belonging to others. Three such cases were detected by observing the individually banded birds (54 males and 6 females) in summer of 2014. In one case, a male of an already formed pair was substituted with another male, who continued the construction with the same female. In two other cases in end of June new males took the nest-basket just left by previous owners. They actively called on their nesting trees, weaving new material into the basket from time to time and stayed near these nests for some time, but not having formed a couple, moved to other areas.

The trend towards the use of other's nests is also seen in some males, «monitoring» nests adjacent to their sites which are being built by newly formed couples. In addition to the theft of material and attempts to fight off the female (Burkovsky et al., 2014), some

individuals climb into the nests in the absence of hosts and begin to upgrade them as their own.

In conclusion we note that in the course of long-term monitoring of the CPT colony in the Southern Primorye we noted some biology features of adaptive nature. They have been developed gradually and were largely associated with the process of development of the new territory, accompanied by the growth in number and density of this nesting group. As it expanded, the range of tree species used for placing the CPT's nests broadened. All types of microlandscape in the area became occupied, down to nesting on trees growing on the rocks (Gluschenko et al., 2014b; Gluschenko et al., 2015). In breeding biology we noted the expansion of the range of plant materials used in nest building.

The described phenomenon of using old nest-baskets was first recorded at the initial stage of introduction of CPT to the Primorsky Territory in 1997-1998. Later, during more detailed studies between 2011-2015 this phenomenon was observed every year, thus making it common.

Apparently, this phenomenon should be classified not as an adaptive feature of the local group, developing a new and unfamiliar area, but as a species-specific biological feature of the CPT. This phenomenon is not described in the literature available to us, but it certainly is present in other parts of the species range. An indirect proof of that can be found in the oral communication of S.G. Surmach about the good preservation of nests in the continental Northeast China. For example, in March of 2015 the previous year's nests of CPT were not rare in agricultural landscapes of Liaoning Province (80 km north-west of Liaoning: N 42°21'36; E 122°50'11). In some areas of roadside forest belts, represented by artificial poplar plantations, the average number of nests of previous year reached 4 per 1 km of the forest belt. The nests differed by being well preserved and, compared with the nests of Primorye, had less distorted structure of the

material, which appeared to be due to a drier climate. The same as in Primorsky Territory a significant proportion of those nests consisted of unfinished nests-baskets.

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