

An Observation on the Birds Utilizing Nest-Boxes in Korea —With Special Reference to Relation of Birds to Forestry Practice—

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人工巢箱利用鳥類에 관한 觀察

—특히 山林實際와의 關係에 대하여—

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摘 要

1. 本調査는 1955年 부터 1958年 까지 約 4年間 서울 淸涼里 林業試驗場 試驗林內 約 5ha 範圍에 架設한 100餘個의 巢箱에 繁殖한 山林鳥類의 繁殖經過 및 利用成績을 觀察한 것이다.
2. 巢箱利用鳥類 5種中 박새 *Parus major uladiwostokensis*, 북방외제르레기 *Sturnia sturnina sturnina*, 흰눈섭 황금새 *Muscicapa narcissina zanthopygia* 가 優占種으로 利用率이 높았다.
3. 박새는 針葉樹林內의 優占種으로 特히 他種의 利用圈外의 林相의 環境, 소나무, 잣나무 針葉樹林內의 巢箱에서의 利用率이 좋았다.
4. 북방외제르레기는 針葉樹보다는 潤葉樹와의 混淆林, 特히 都市附近 平地의 疎林을 好棲息處로 하며 栽植한 種子植物 *Sambucus latipinna* 딱총나무, 뽕나무열매를 즐겨 採食하므로 前記 栽植種子植物은 本種의 誘致繁殖上 效果의 이었다.
5. 흰눈섭 황금새는 潤葉樹나 混淆林內의 優占種으로 巢箱의 規格 및 口徑이 제일 작으므로 他種의 侵害를 받을 憂慮도 적을뿐더러 앞으로 보다 높은 利用率을 豫想할 수 있다.
6. 巢箱利用鳥類中 特히 優占種에 대한 繁殖經過를 觀察記錄하였다.
7. 巢箱侵害動物을 調査 觀察하였다.

Introduction

The increase of damage in forest caused by insects has been a serious problem in industry in our country. insecticides have been introduced here in order to get rid of harmful insects. It is difficult, however, to eliminate these insects only by spraying insecticides, especially in Korea where the environment is very complex. In this respect the protection measures should be established here for insectivorous birds. In addition, the forestation is equally important as definite vegetation is required for the birds to live and breed within there. From this point of view, the author carried out a census about the nest-boxes set up in the experimental forest of the Forest Experiment Station, Chongyang-ri, Seoul, in 1955. The process of investigation and the results obtained will be described below.

Three protection areas were established for setting about 100 nest-boxes in the experimental forest of approximately 140 ha. (Fig. 1). Two water points exist in the area. The experimental forest mostly consists of

broad-leaved and coniferous trees with a preponderance of the latter. In the second protection area conifers are predominating, including *Pinus*, *Larix*, *Abies*, *Taxus*, *Juniperus*, *Biota*, etc. Broad-leaved trees are represented there by *Alnus*, *Phododendron*, *Quercus*, *Rhus*, *Robinia*, *Fraxinus*, *Prunus*, *Styrax*, *Acer*, *Carpinus*, *Betulla*, etc.

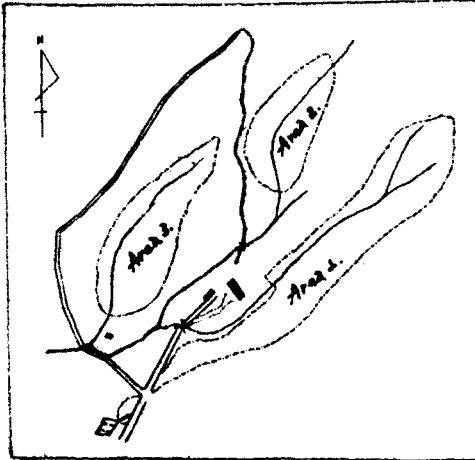


Fig. 1. Sketch map of the experimental forest of Forest Experiment Station, Chongyang-ri, Seoul, Korea, showing three areas of bird protection.

(1) *Sturnia sturnina sturnina* (PALLAS)

Mori, T. (1928, 104) first reported that three examples of nest-boxes were utilized by *Sturnia* which were set up in the forest in Kyongsung, Hamkyong-bukdo. Since then, Won, H.K. also observed the same fact at Anju, Pyongan-namdo and Pakchon, Pyongan-bukdo. Next, Adachi (1941) reported that the same bird laid 3 to 5 eggs in the nest-box in low trees in Hamkyong-bukdo.

The author also has found Daurian myna occurring in broad-leaved trees planted in the playgrounds of the Sung Kyun Kwan University, Ewha Woman's University, Baehwa Girls' High School, and Sajik Park in Seoul. In June 1957, the author had a chance to observe nesting and breeding behavior of a pair of birds in the nest-boxes set up in chestnut trees planted in Baehwa Girl's High School. Apart from these, there are many records about Daurian myna which have utilized nest-boxes set up in the experimental forests.

Migration Period and Habits

The earliest dates of arrival of this species in our country, recorded in the experimental forest, are 10 May 1956, 12 May 1956, 9 May 1957, 9 May 1958, and 9 May 1959. The birds live in small flocks from 10 to 15 around trees such as *Zelkova*, *Pinus*, *Abies*, *Prunus*, etc.

The cultivated tree garden is very convenient to establish permanent nesting and breeding station, since there are many seed trees such as *Sambucus*, *Hypericum*, *Coriaria*, *Tilia*, *Ligustrum*, *Crataegus*, *Pterostyrax*, *Ilex*, *Eleutherococcus*, etc.

Broad-leaved trees and coniferous trees in the experimental forests cover approximately 400 species of the former and about 50 species of the latter. There are some shrubs and tall trees.

Results Obtained from Experiments of Nest-Boxes

The kinds of birds which have utilized the nest-boxes for their breeding are enumerated as follows:

- (1) *Sturnia sturnina sturnina* (PALLAS)
- (2) *Muscicapa narcissina zanthopygia* HAY
- (3) *Parurus major wladivostokensis* KLEINSCHMIDT
- (4) *Passer montanus dybowskii* DOMANIEWSKI
- (5) *Parus ater amurensis* (BUTURLIN)

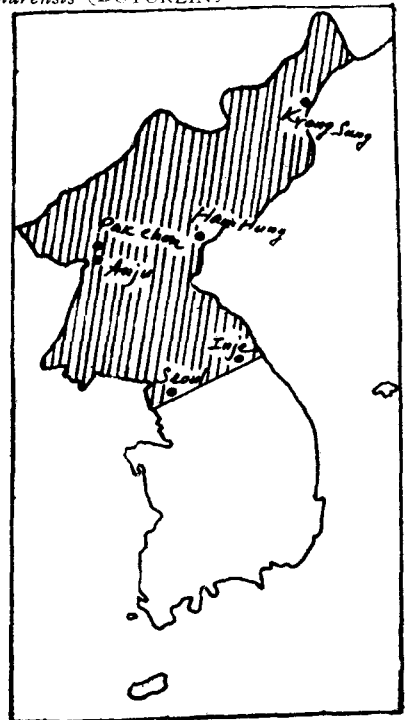


Fig. 2 Distribution of *Sturnia sturnina sturnina* (PALLAS) mentioned in the text. (shaded area indicating approximate range.)

They are found, frequently, in small flocks in the vicinity of urban areas, such as Seoul, where they are observed in the areas of temples, buildings, school playgrounds, etc. Nestboxes set up in the experimental forest are unitedly used by the birds. No nests have been found in heavy forest. On the other hand, the author has found numerous cases of breeding of the birds in hollow trees in the playground of Yungsaeng-Girls' High School and Mt. Banyong Park, Hamhung, Hamkyung-namdo between May and August (1944 and 1945). Several of the birds were seen at the Moranbong Park, Pyongyang, North Korea in May, 1946.

Choi, Y.H. told that a villager was carrying some juveniles of this bird in his hands in Inje, Kwangwondo in August, 1958.

Figure 2 is showing the localities in which this species has been collected.

The data obtained from the author's observations about nestboxes during three years from 1955 to 1958 will be described below. Moreover, special notes on breeding processes observed in 1957 will be given later.

Nesting

During a week after their arrival, they start to build nest after a brief courtship. So far as the observation on the nestbox goes, they started nesting on 16 May 1955, 17 May 1956, and 18 May 1958. A male and female prepared their nest in a nest-box spending 2 to 3 days. In one case they started nest building in hollow trees on 11 May, 1957. They use the hollows of such trees as *Zelkova*, *Alnus*, *Pinus*, *Paulownia*, etc. which are found mostly at the height of 5 to 10 meters. The nestboxes set up in *Pinus*, *Quercus*, *Alnus*, etc. for this species have the height of 3 to 8 meters from the ground.

Investigations of these nests revealed that the nest materials consist of paper, pine, pine leaves, chicken feather, leaves of broad-leaved tree, moss, and leaves, stem, and root of *Gramineae*, etc. The nest has a look of dish-shape and is very coarse. Its outer framework is made from various feathers, while its inner part is constructed with pieces of grass.

Egg-Laying

The birds laid their eggs in the nest-boxes on 26 May 1955, 20 May 1956, and 18 May 1958. In the hollow trees they were found on 24 May 1957. The number of the eggs varied from 3 to 7 with an average of 5.5 eggs taken from a nest: the average shows 26.16×17.66 mm.; the largest one 25.5×18.0 mm.; and the smallest one 23.0×17.5 mm. We observed, before incubation, the female staying in the nest for about 30 minutes between 3 to 4 p.m.

Incubation

The incubation is usually performed by both male and female alternatively. The interval between the last date of egg-laying and the date of hatching varies from 8 to 10 days (1955), 8 to 12 days (1956), 8 days (1957) and 12 to 16 days (1958), with one notable exception in which 21 days were recorded. As is generally known the female plays the main role in the incubation, while the male helps the work.

Hatching

So far as the observation goes, the hatching of egg takes place simultaneously with the exception of a few unhatched eggs. Hatching rates in a nest-box were 88.2% (1955), 90.5% (1956), 75.1% (1958) with an average rate of 84.6%.

Feeding

Both female and male take share of feeding their juveniles. The diet of juveniles mainly consists of insects detrimental to forest including larvae of *Samaria* sp. When the fledglings grow, seeds of cherry and *Sambucus latipinna*, etc. are also added to the diet.

Table 1. Breeding Result of *Sturnia sturnina sturnina* (PALLAS)

Year	No. of nest-boxes utilized (egg laid)	Start of egg laying	End of egg laying	No. of eggs laid	Date hatched	No. of chicks hatched	Date of nest leaving	No. of eggs unhatched	Loss of eggs or chicks
1955	Area 1. No. 70	June 1	June 3	3	June 12	3	June 26		
	72	May 27	" 1	5	" 10	5	" 24		
	101	" 29	" 1	4	" 8	4	" 21		
	103	" 29	" 1	4	" 10	4	" 24		
	108	" 26	May 31	5	" 7	—	—		Human error
	110	" 26	" 31	5	" 7	—	—		"
	Area 2. No. 1	" 28	June 2	5	" 9	4	" 22	1	
	2	" 28	" 2	5	" 9	3	" 23	2	
	6	" 28	" 3	5	—	—	—		Human error
	9	" 27	" 2	6	" 11	6	" 24		
	Area 3. No. 7	June 2	" 6	4	—	—	—		Human error
	22	May 30	" 2	4	—	—	—		
	27	June 2	" 6	5	" 13	3	" 27	2	
	28	" 3	" 6	4	" 14	3	" 28	1	
	31	" 4	" 6	5	" 15	5	" 29		
1956	Area 1. No. 76	June 2	June 6	5	June 18	5	July 3	2	
	77	" 2	" 5	4	" 16	4	June 29		
	84	May 30	" 3	5	" 14	3	" 17	2	
	104	" 28	" 4	7	" 11	7	" 25		
	108	June 12	" 16	5	" 23	5	July 3		
	105	" 6	" 10	5	" 19	5	" 7		
	Area 2. No. 1	May 20	May 25	6	" 3	6	June 16		
	Area 3. No. 1	June 2	June 7	6	" 14	6	" 18		
	5	" 5	" 7	—	—	—	—		Human error
	8	" 3	" 6	—	—	—	—		"
	10	" 3	" 7	—	—	—	—		"
	4	" 5	" 7	5	" 15	4	" 30	1	
	14	" 3	" 7	5	" 12	5	" 25		
	28	" 1	" 5	—	—	—	—		Human error
	6	" 4	" 7	—	—	—	—		"
1958	Area 1. No. 13	May 21	May 23	3	—	3	—		
	32	" 20	" 24	4	—	—	—		
	35	" 20	" 26	5	June 8	5	June 26		
	65	" 21	" 25	5	" 7	3	" 25	2	
	67	" 24	" 27	3	" 8	3	" 25		
	71	May 22	May 28	5	June 19	3	June 23	2	
	74	" 20	" 28	6	" 10	6	" 26		
	78	" 18	" 24	8	" 6	7	" 25	1	
	79	" 20	" 25	5	" 9	5	—		
	80	" 20	" 26	5	" 11	5	" 36		
	Area 2. No. 2	" 24	" 28	5	" 12	5	" 30		
	4	" 21	" 27	5	" 12	5	" 28		
	5	" 21	" 26	—	5	—	—		
	Area 3. No. 27	" 22	" 25	4	" 8	3	" 25	1	
	36	" 20	" 23	4	" 5	3	" 25	1	
43	June 10	June 14	5	—	—	—			
46	May 30	" 6	5	" 17	5	July 4			
48	" 21	May 25	5	" 15	5	June 22			

Year	No. of Nest-boxes utilized (eggs laid)	Laying period	Incubation period	Feeding period	No. of chicks left nest	Direction of the entering hole	Dia. of the entering hole	Height from ground	Tree nest-boxes set up	Distance between nest boxes
1958	Area 1. No. 13	3	—	—	—	E.	3.5cm	4.0m	<i>Pinus densiflora</i>	10m
	32	—	—	—	—	E.	5.0	4.0	"	8
	35	7	10	19	5	E.	5.0	4.0	"	10
	65	5	13	19	3	E.	5.0	3.5	"	5
	67	4	12	18	3	E.	5.0	4.0	"	5
	71	7	13	14	3	N. E.	5.0	4.0	"	20
	74	9	13	17	6	S. W.	5.0	5.0	"	8
	78	7	13	29	7	W.	5.0	6.0	<i>Quercus serrata</i>	20
	79	6	15	—	—	E.	5.0	8.0	<i>Alnus japonica</i>	12
	80	7	16	16	5	N.	5.0	8.0	"	12
	Area 2. No. 2	5	15	19	5	N.	5.0	3.5	<i>Pinus densiflora</i>	6
	4	7	16	17	5	E.	3.5	3.0	"	15
	5	—	—	—	—	E.	3.5	4.0	"	15
	27	4	14	18	3	E.	3.5	4.5	"	
	Area 3. No. 36	4	13	18	3	S. E.	5.0	4.5	"	
	43	—	—	—	—	S. E.	5.0	4.5	"	
	46	8	11	18	5	S.	5.0	4.0	"	
	48	8	11	18	5	S.	5.0	4.0	"	

Juveniles use to remain in the nest-boxes or nests in the hollow trees only at their early state of development. They soon become to be fed at the entrance of their nests or hollow trees. Feeding behavior would be observed frequently between 11 and 12 a.m. and 12 and 1 p.m. Feeding period ranges from 13 to 19 days, with average of 18 days and 17 days in 1957 and 1958 respectively. During this period, food is gathered, generally, within 300 to 400 yards from the nest. The excrements of juveniles are usually cleaned out from the nests after feeding by parents.

Nest-Leaving

Even after flying out of their nests, the juveniles follow their parents during most of their times, and they return to their nests at night. They sometimes stay outside over night. For a time being, there is a period in which the juveniles are fed by their parents and then they follow parents or gather by themselves around seeds of plant of *Sambucus latipinna* NAKAI var. *coreana* NAKAI. In September, they usually start their migration, but they sometimes can be seen early October.

(2) *Muscicapa narcissina zanthopygia* HAY

This species arrives in our country at the end of April. They, after spending from 4 to 5 days, immediately mate and begin the preparation for nest-building. Nests are usually found in the moss, which provides definite frame-work. The inner side of the nest is usually composed of roots of *Gramineae* or of leaves of pine-tree.

Table 2. Breeding Result of *Muscicapa narcissina zanthopygia* HAY

Year	No. of nest-boxes utilized (eggs laid)	Start of egg laying	End of egg laying	No. of eggs laid	Date hatched	No. of chicks hatched	Date of nest-leaving	No. of eggs un-hatched	Loss of eggs or chicks
1958	Area 1. No. 3	May 16	May 20	5	June 4	4	June 12	1	
	43	" 25	" 30	6	" 13	6	" 28		
	54	" 5	" 8	4	May 24	3	" 4	1	
	81	" 1	" 5	5	" 19	5	" 2		
	Area 2. No. 1	" 3	" 8	6	" 23	6	" 6		One chick starved
	Area 3. No. 7	" 5	" 9	5	" 23	5	" 9		
	50	" 21	" 26	6	June 11	5	" 28	1	
	51	" 2	" 9	6	May 24	6	" 9		
	58	" 4	" 8	5	" 25	4	" 12	1	
	62	" 2	" 7	5	" 22	4	" 6	1	

Year	No. of Nest-boxes utilized (eggs laid)	Laying period	Incubation period	Feeding period	No. of chicks left nest	Direction of entering hole	Dia. of entering hole	Height from ground	Tree nest-boxes set-up	Distance between nest-boxes
1958	Area 1. No. 3	3	15	19	4	S.	3.5cm	5m	<i>Pinus strobus</i>	12m
	43	6	14	16	6	S. E.	3.5	4	<i>Pinus densiflora</i>	10
	54	4	16	12	3	E.	3.5	4.5	"	30
	81	5	14	15	5	S.	3.5	4	"	15
	Area 2. No. 1	6	15	15	6	S. E.	5.0	4	"	5
	Area 3. No. 7	5	14	18	5	S. E.	2.8	4.5	"	5
	50	5	16	18	5	E.	2.8	3.5	"	15
	51	8	15	17	6	S.	2.8	3.5	"	10
	58	5	17	19	4	S.	3.5	3.5	"	20
	62	6	15	16	4	W.	3.5	4	"	5

Table 3. Breeding Results of *Parus major wladivostokensis* KLEINSCHMIDT

Year	No. of nest-boxes utilized (egg laid)	Start of egg-laying	End of egg-laying	No. of eggs laid	Date hatched	No. of chicks hatched	Date of nest-leaving	No. of eggs unhatched	Loss of eggs or chicks
1958	Area 1. No. 9	May 9	May 18	10	June 1	9	June 17	1	
	29	" 2	" 10	8	May 24	4	" 7	—	
	Area 2. No. 17	" 20	" 28	9	June 12	6	July 3	3	
	Area 3. No. 61	—	—	10	—	10	—	—	

Year	No. of nest-boxes utilized (egg laid)	Laying period	Incubation period	Feeding period	No. of chicks left nest	Direction of entering hole	Dia. of entering hole	Height from ground	Tree in which nest-boxes set-up	Distance between nest-boxes
1968	Area 1. No. 9	10	14	17	9	W.	3.5cm	4.5m	<i>Larix Kaempferi</i>	10m
	26	9	14	15	4	E.	5	3.5	<i>Pinus densiflora</i>	25
	Area 2. No. 17	9	15	22	6	E.	3.5	4	"	20
	Area 3. No. 61	—	—	—	10	W.	3.5	3.5	"	15

This species usually lays eggs from 5 to 6 in number (4 is rare). The date of hatching ranges from the middle of May to early June; the juveniles leave their nests during June. The rate of hatching is 84% and nesting period in 1958 ranged from 36 to 45 days.

(3) *Parus major wladivostokensis* KLEINSCHMIDT

The birds generally build their nests during the period from late April to early May. The materials of nests are moss. The nest is built more tightly than in *Narcissus* flycatcher as they use fine feathers for inner part. About 8 to 10 eggs are laid in most cases. The incubation period normally ranged from 14 to 15 days. Its feeding period ranged from 15 to 17 days, but sometimes it reaches up to 22 days. This species is said to breed twice a year, but its breeding process has not yet been observed in details. In addition to this, *Parus ater amurensis* and *Passer montanus dybowskii* can be enumerated as the species which often make use of nest-boxes for breeding. However, the records on this account are not available at present.

Animals Invading Nest-Boxes

During the breeding period, some other birds and animals are found in the nest-boxes. The kinds of animals are as follows:

- (a) Grey-starlings, *Sturnus cineraceus* TEMMINCK, frequently lay their eggs in the nest of Daurian myna

during feeding period, invading the nest and suppressing Daurian myna. Daurian myna are forced to incubate the eggs laid by grey starling, as the latter disturb and interfere the performance of feeding of Daurian myna by snatching diet.

(b) The nest of Hymenoptera sp. has been found in the nest-boxes. It will undoubtedly disturb the bird's breeding in many ways.

(c) *Phyllodromia germanica* was found abundantly in and around moist nest-boxes, giving bad-smelling of the boxes. It brings unfavorable condition for the egg-laying of birds.

(d) Red ants, more than 100 in number, were found in a nest-box. They have killed the chicken.

(e) Snake, *Dinodon rufosonatum*, has invaded in some nest-boxes and eaten bird's eggs.

(f) Chipmunk, *Tamias sibiricus asiaticus*, has disturbed bird's breeding by building its own nest within the nest-boxes.

Consideration and Conclusion

The results of utilization of nest-boxes by birds, which were set up in the forest of the Forest Experiment Station, Chong-yang-ri, Seoul, during the period of 1955, 1956 and 1958 are summerized in the following list.

Species	Year		
	1955	1956	1958
<i>Parus major wladivostokensis</i>	21	25	6+X
<i>Sturnia sturnina sturnina</i>	15	15	18
<i>Muscicapa narcissina zanthopygia</i>	8	9	10
<i>Passer mantanus dybowskii</i>	—	1	0
<i>Parus ater amurensis</i>	—	0	1

The experimental forest has an area of approximately 140 ha., but the area in which the nest-boxes were set up covered only 5 ha. It was likely too small to get data of experiments. However, as the forest under consideration is rich in mixed stands and seed plants which are very scanty in the vicinity, adding to the constant flow of stream water which favors the bird life in dry season, many birds are attracted to breed there.

Parus m. wladivostokensis was found in 21 nest-boxes in 1955 and 5 more nests in 1956. It was naturally expected that the utilization might increase by this species in 1958, though it failed this year to get record of exact data. This birds seem to prefer the nest-boxes set up in pure coniferous forest. Further, the birds prefer the nest-boxes set up on pine and larch trees which are seldomly selected by other birds for their breeding.

Sturnia stuanina sturnina was found in 18 nest-boxes; 15 in 1955, and 1956, and 3 more in 1958. A census carried out in the season of nest-leaving revealed that the total number of individuals in nest-boxes reached approximately 118 in the experimental forest. It seems fairly certain that the mixed forest serves better for this species as a habitat than coniferous forest does. The fruit of cultivated seed trees like *Sambucus latipinna* NAKAI is a favorite of the bird. In regards of these points, the experimental forest provides suitable condition for breeding this bird.

Only 8 nest-boxes were utilized by *Muscicapa narcissina zanthopygia* in 1956 and the number has been gradually increased in successive years up to 10 in 1958. High utilization was expected by making small entry hole of the nest-box through which other birds cannot enter the box. As the birds are dominant species

in forests in Korea, both in broad-leaved forest and mixed forest, they must be protected with special care.

In addition, *Passer montanus dybowskii* is a common bird in the experimental forest, but the investigation on this bird is still far from being complete. One instance was known in which *Parus ater amurensis* was found in a nest-box for breeding.

It is regretted to say about the difficulties encountered in our country, one of which is the protection of nest-boxes from children. In this state, the entire area of experimental forest of 140 ha. can not be used for the experiments. The distance between each nest-box can not be fixed at present in consideration with bird's territory.

The nest-boxes of three different sizes were applied in the experiment; the largest one was aimed at the attraction of such big birds as *Ninox scutulata macroptera*, *Otus asio semitorques*, etc. The smallest boxes had flanks of 2.8cm, 3.5cm. and 5cm. From the results of the experiment we came to a conclusion that the proper size of the nest-boxes must be 4cm. in diameter for *Sturnia sturnina*, and 3.5cm. in diameter for *Parus major*, and 3 cm. for *Muscicapa narcissina*. Most of the birds prefer those boxes which face east, or south-east, placed at a distance of 15—20 meters from other nest-boxes, and at 3.5—5 meters above the ground. Nest-boxes both in coniferous and broad-leaved forests are broadly used, although *Parus major* is not fond of a nest-box set up in mixed forest. We used to remove old nests from nest-boxes so as to facilitate the bird's works, namely, we removed old nest materials prior to their nesting; since they do not use old nest materials. New addition of one or two additional water points becomes necessary in the experiment, especially in dry season. It seemed also necessary to set up several nest-boxes of large size (approx. 9.5cm. in diameter) for attracting larger birds. The cultivation of *Sambucus latipinna* var. *coreana* was tried to raise effect of nesting and breeding.

The author presumes that the similar method can be used in any mixed forest in the central part of Korea.

Sturnia sturnina can not be met with in high mountains, while it is very common in thin forest in the vicinity of small towns, even within residential areas of cities. *Muscicapa narcissina* is also frequently seen in forests of low land. *Parus major* is considered to be the most dominant species of forest birds in Korea. The above-mentioned three species are representatives of species which utilize most commonly nest-boxes set up in mixed forest or in environment similar to the experimental forest. The author believes that better results of nest-box utilization can be expected, if only an effective management and operation of nest-boxes are accomplished.

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