

2015 충남 연구원 세미나

# Avian brood parasitism

*a model system  
for coevolution and macroecology*

The evolution of host-specific races in avian brood parasites



이진원





Food chain  
Ecosystem  
Biodiversity  
Evolution





# Coevolution 공진화





# Avian brood parasitism 탁란





# Counter adaptation by hosts



# Evolutionary arms race

## 진화적 군비 경쟁



**CUCKOO**

Better trickery



**HOST**

Better defences



# Host-specific races (gens, gentes)

## 숙주 특이적 품종



Cuckoo



Host

# A Key Question

How do the host-specific races maintain within a species of avian brood parasite?

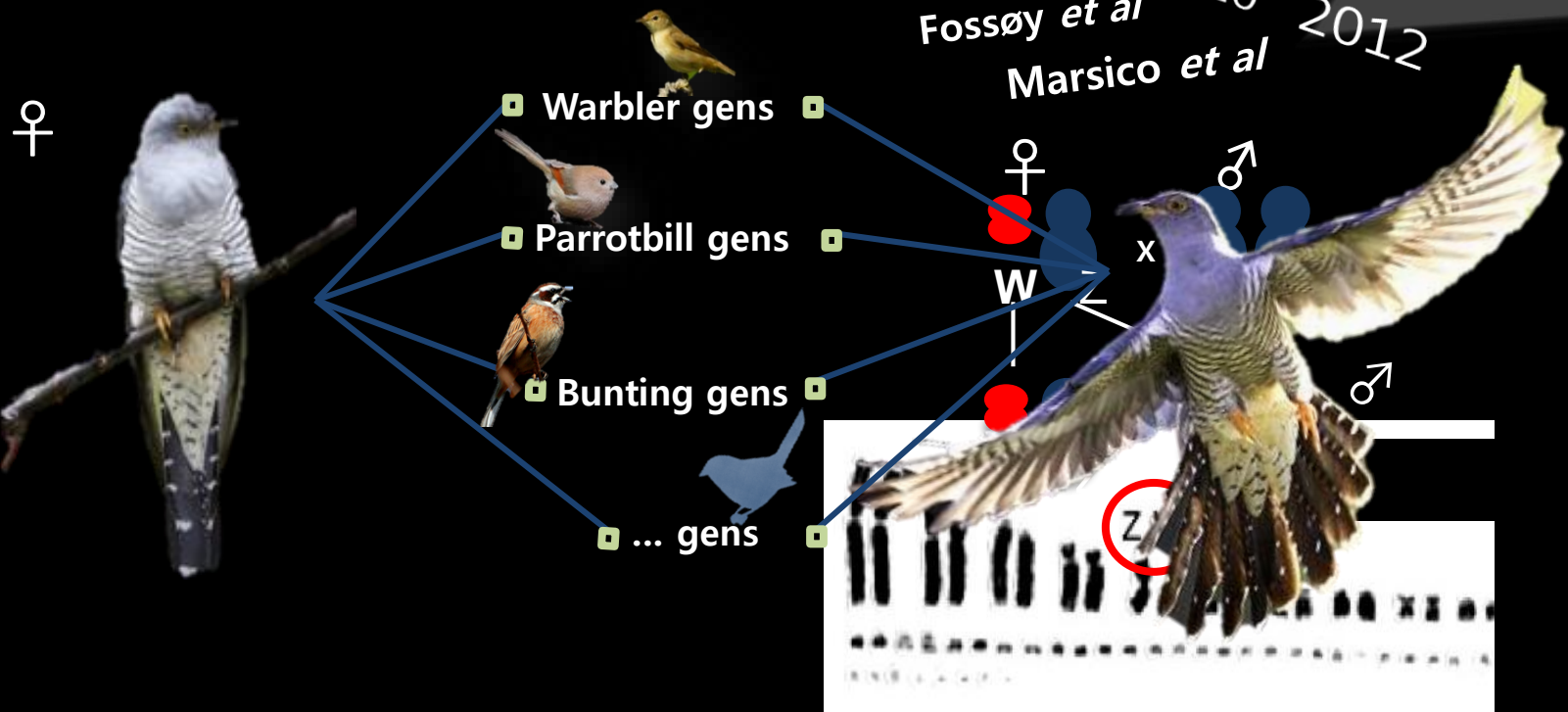
어떻게 숙주 특이적 품종이 유지되는가?







## Female-oriented genes



# Background 연구배경



빠꾸기  
*C. canorus*



두견이  
*C. poliocephalus*



붉은머리오목눈이



멧새

전남

제주



섬휘파람새





# Objective 연구목적

- 숙주 이용의 차이를 이용한 종간 비교연구

- 유전자 구조
- 형태적 적응
- 음성 분화
- 월동지 이용



숙주 특이적 품종의 유지 기작 및  
자매종의 존재 여부 확인

# Male cuckoo call

*Jung et al. 2014, PLoS ONE*

- Individually recognizable but
- Lack of host specificity
- Female??

OPEN ACCESS Freely available online

PLOS ONE

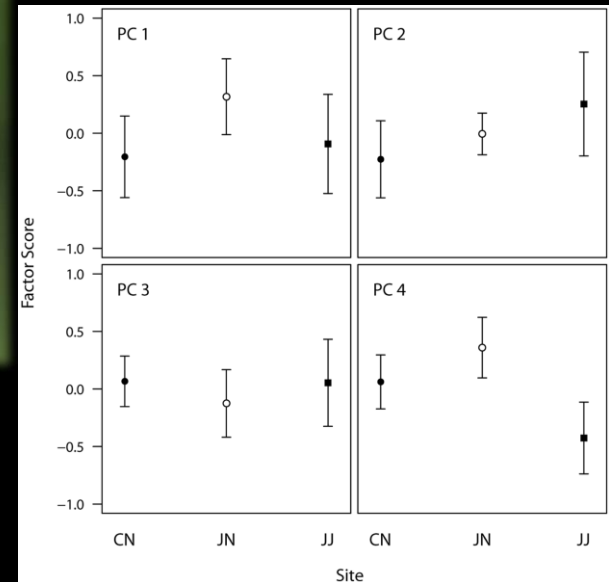
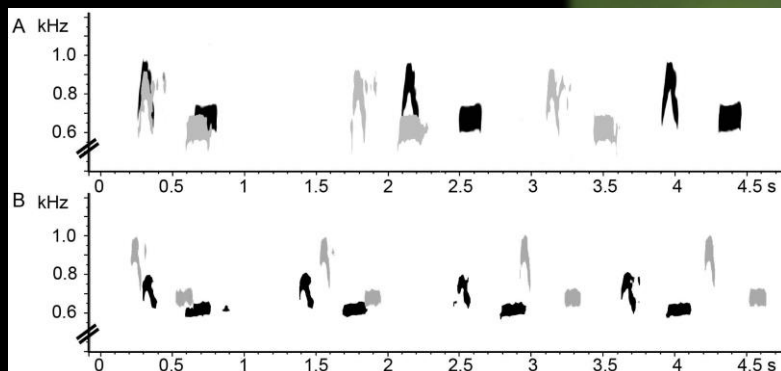
## "cu-coo": Can You Recognize My Stepparents? – A Study of Host-Specific Male Call Divergence in the Common Cuckoo

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### Abstract

The presence of multiple host-specific races in the common cuckoo *Cuculus canorus* has long been recognized as an evolutionary enigma but how this genetic divergence could be maintained is still equivocal. Some recent studies supported

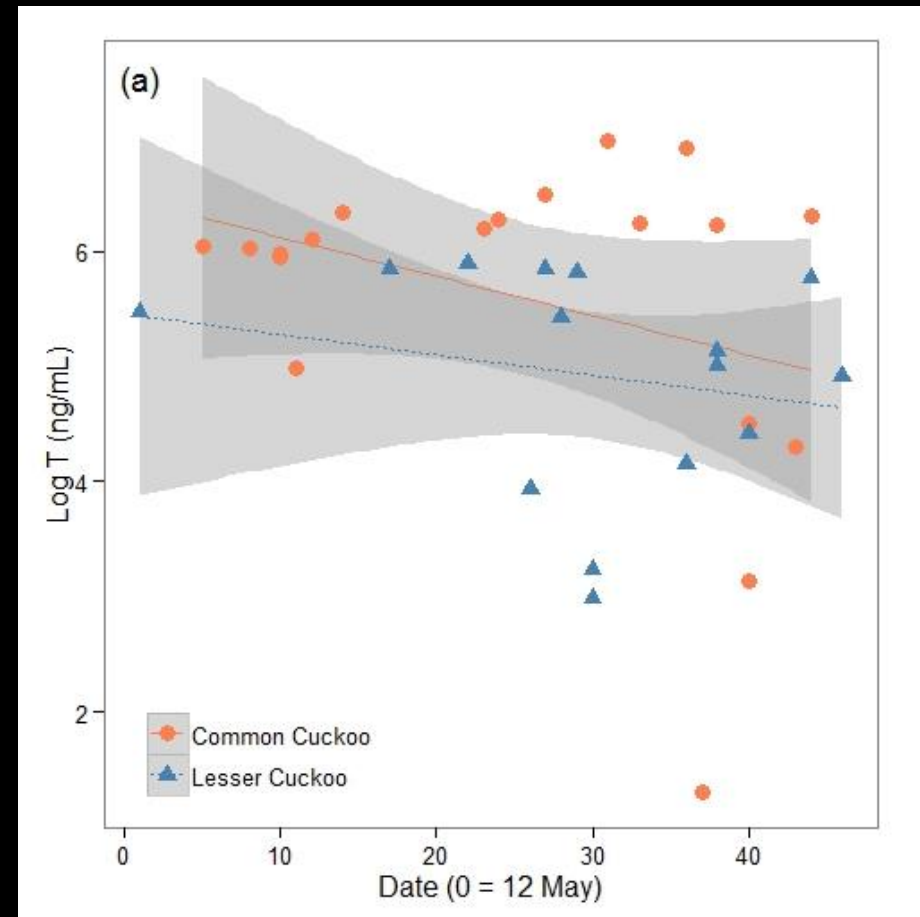
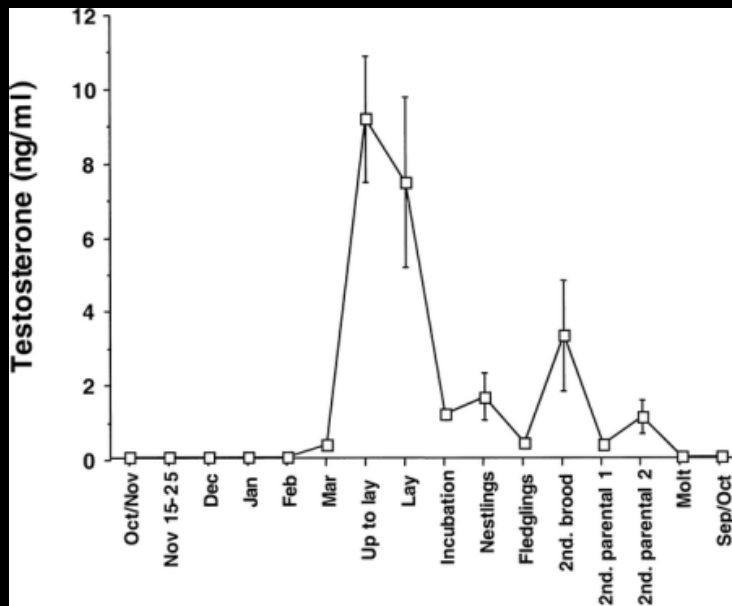




# Hormone & brood parasitism

- Proximate mechanism
- Pioneering study

*Jung et al. under revision, Ibis*



# Sexual size dimorphism in cuckoos

*Noh et al. submitted*

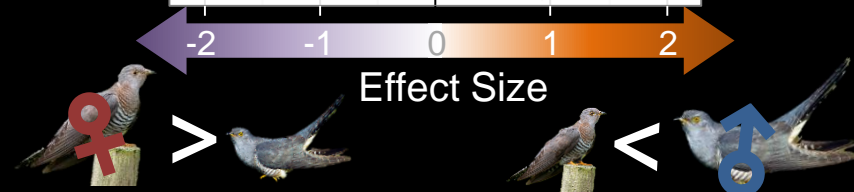
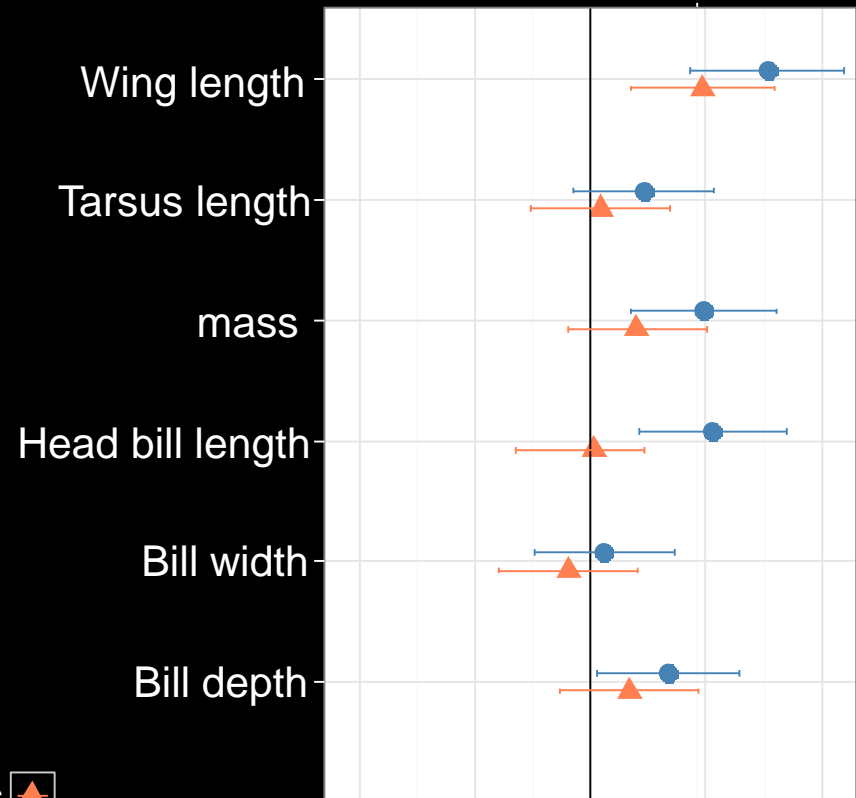
- greater in larger species
- selection for small egg and body size on female



## Species

*C.canorus* 

*C.poliocephalus* 





# Molecular analysis 유전자 분석

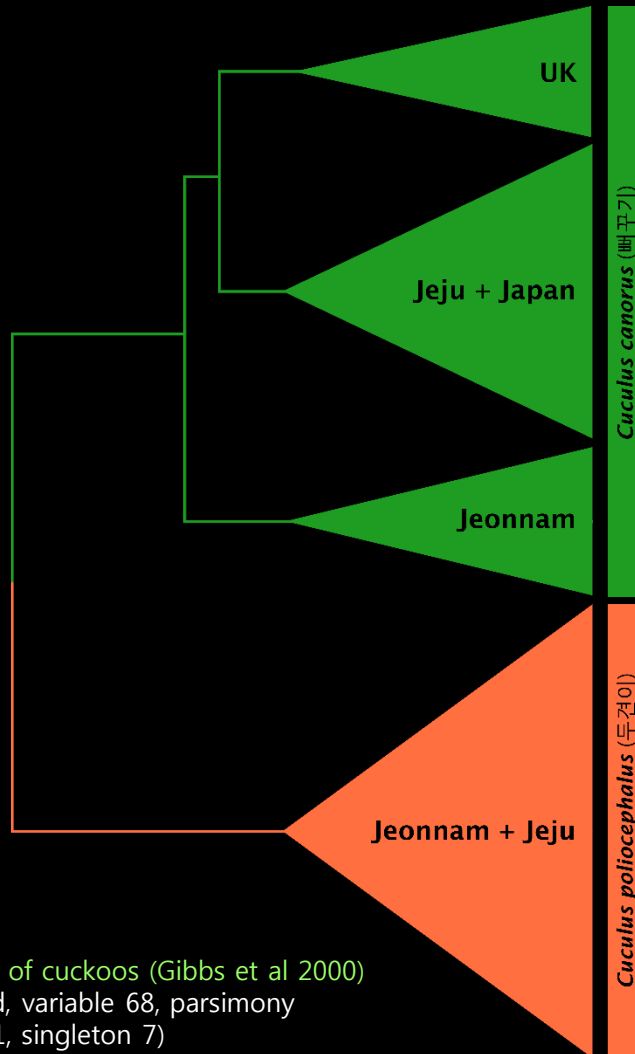
- Mitochondrial (mt) DNA - 모계유전
- Microsatellite (ms) DNA – 양성유전  
(Gibbs et al. 2000, Fossøy et al. 2011)
- Adopting new techniques (e.g., RAD sequencing)

## - Simple Prediction

지역간 분화	H1 모계유전		H2 양성유전	
	빠꾸기	두견이	빠꾸기	두견이
mtDNA	O	X	O	X
msDNA	X	X	O	X

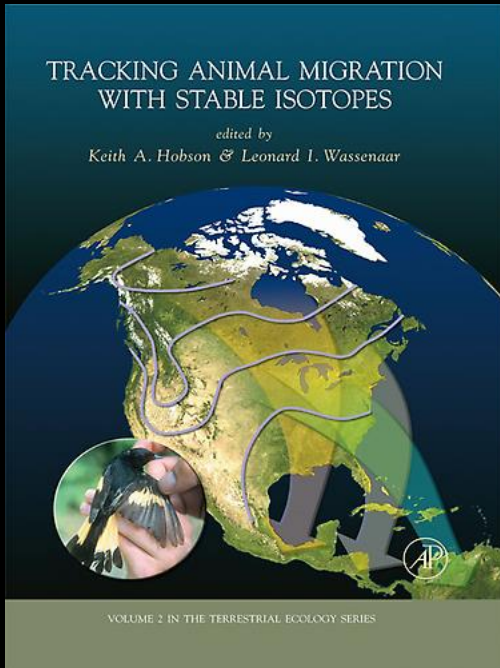
# Evolutionary relationship of cuckoos

(Preliminary results: NJ tree based on mtDNA)



mtDNA control region of cuckoos (Gibbs et al 2000)  
391 bp (309 conserved, variable 68, parsimony  
informative variable 61, singleton 7)

# Stable isotope analysis 안정성 동위원소 분석

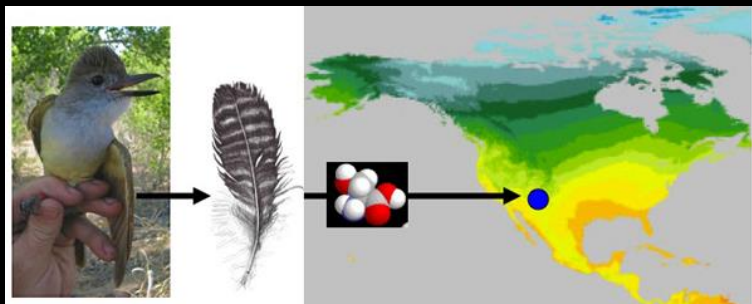


- 월동지 파악 및 숙주 특이적 차이  
유무 검증



*Bird Life International*

❖ 빼꾸기



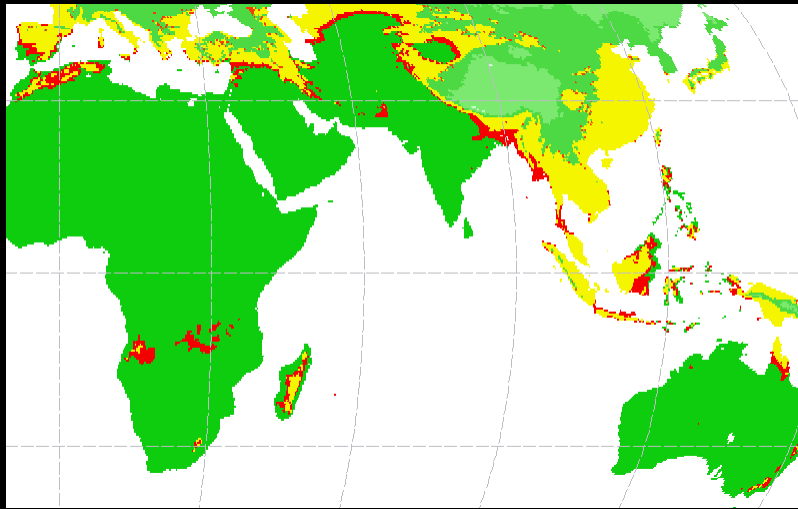
❖ 두견이



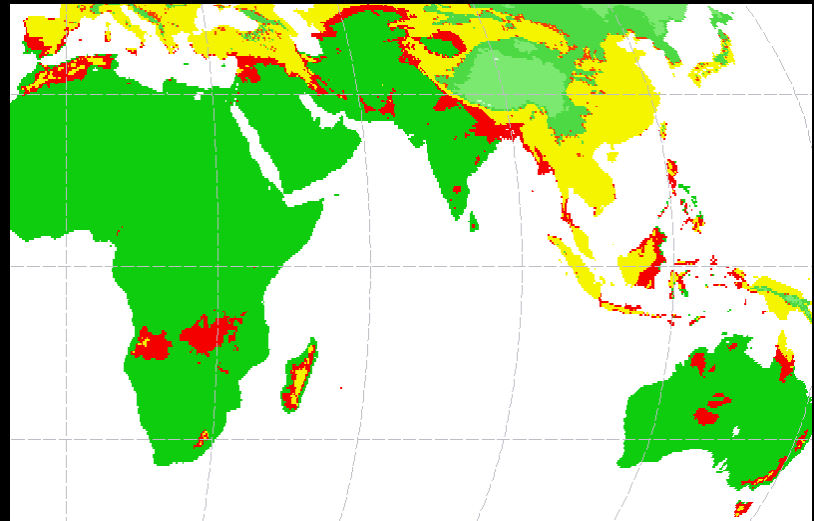


# Preliminary results using $\delta^2\text{H}$

## ❖ 뼈꾸기



## ❖ 두견이



# Avian brood parasitism in macroecology

- Avian brood parasitism and niche evolution
- Avian brood parasitism as an environmental indicator
- Climate change and avian brood parasitism



# Searching for host species in Korea

- Determining current state
- Suggesting future direction



**Table 1.** Host species used by the five brood parasites breeding in Korea. Data were based on web search (59 cases), and personal observation (three cases). Numbers indicate occurrence frequency in the search.

	A	B	C	D	E	F	G	H	I	J	K	Total
<i>C. canorus</i>	19		1						28	1 <sup>§</sup>	1	50
<i>C. optatus</i>		1			1		1	2				5
<i>C. poliocephalus</i>	2*					2						4
<i>H. hyperthrus</i>				4								4
Total	2	20	1	4	1	2	1	2	28	1	1	63

A=*Troglodytes troglodytes* (Eurasian Wren; personal communication Prof. Oh, Hong-Sik); B=*Phoenicurus aureus* (Daurian Redstart); C=*Saxicola stejnegeri* (Stejneger's Stonechat); D=*Cyanoptila cyanomelana* (Blue-and-white Flycatcher); E=*Tersiphone atrocaudata* (Japanese Paradise Flycatcher); F=*Horornis diphone* (Japanese Bush Warbler); G=*Phylloscopus tenellipes* (Pale-legged Leaf Warbler); H=*Phylloscopus coronatus* (Eastern Crowned Warbler); I=*Sinosuthora webbiana* (Vinous-throated Parrotbill); J=*Emberiza cioides* (Meadow Bunting); K=*Passer montanus* (Eurasian Tree Sparrow)

<sup>§</sup> Personal observation (Jin-Won Lee)

\* Personal observation (Hong-Sik Oh)

*Lee 2014, Korean Journal of Ornithology*

Kor. J. Orni. Vol. 21, No. 2 : 25-37, 2014

## Searching for hosts of avian brood parasites breeding in Korea

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**Table 2.** Host species of *Cuculus canorus* recorded in China, Japan and Korea. Host information is from Yang *et al.* (2012) for China, from Nakamura (1990) for Japan and from this study for Korea.

Scientific Name	English Name	China	Japan	Korea
Family Laniidae				
<i>Lanius tigrinus</i>	Tiger Shrike		+	
<i>Lanius bucephalus</i>	Bull-headed Shrike		++	
<i>Lanius cristatus</i>	Brown Shrike	++	++	
Family Monarchidae				
<i>Terpsiphone atrocaudata</i>	Japanese Paradise Flycatcher		+	△
Family Corvidae				
<i>Cyanopica cyanus</i>	Azure-winged Magpie	+	++	
Family Alaudidae				
<i>Alauda arvensis</i>	Eurasian Skylark		+	
Family Pycnonotidae				
<i>Hypsipetes amaurotis</i>	Brown-eared Bulbul		+	
Family Phylloscopidae				
<i>Phylloscopus tenellipes</i>	Pale-legged Leaf Warbler	+		
Family Acrocephalidae				
<i>Acrocephalus orientalis</i>	Oriental Reed Warbler	++	++	
<i>Acrocephalus bistrigiceps</i>	Black-browed Reed Warbler	+	++	
Family Cisticolidae				
<i>Cisticola juncidis</i>	Zitting Cisticola	+	+	
Family Sylviidae				
<i>Sinosuthora webbiana</i>	Vinous-throated Parrotbill	++		++



# Interspecific competition & spatial use

- No sign of antagonistic interaction between the species of cuckoos

*Lee et al. 2014, Ecology and Evolution*

## Ecology and Evolution

Open Access

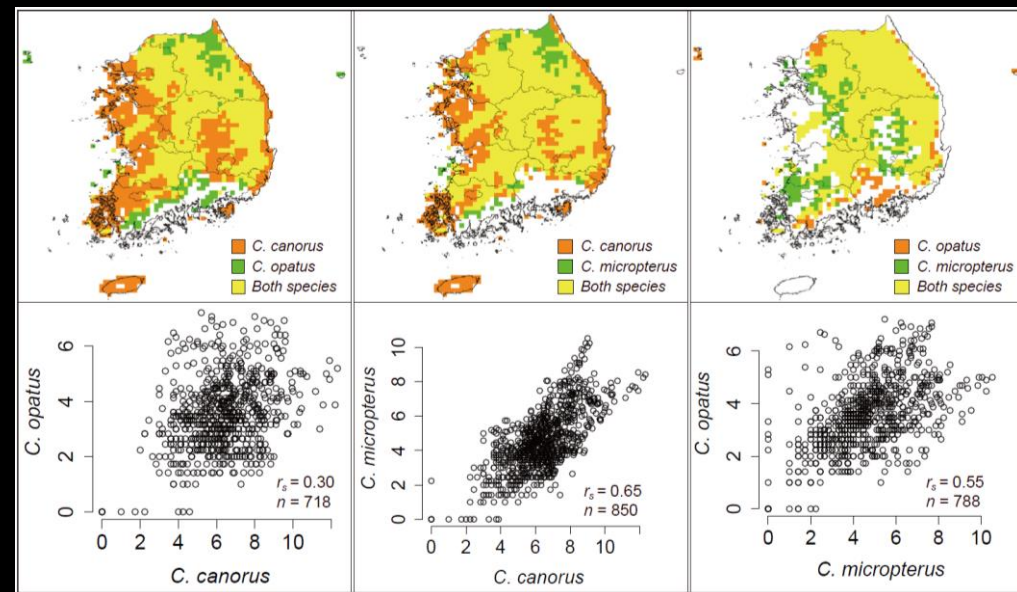
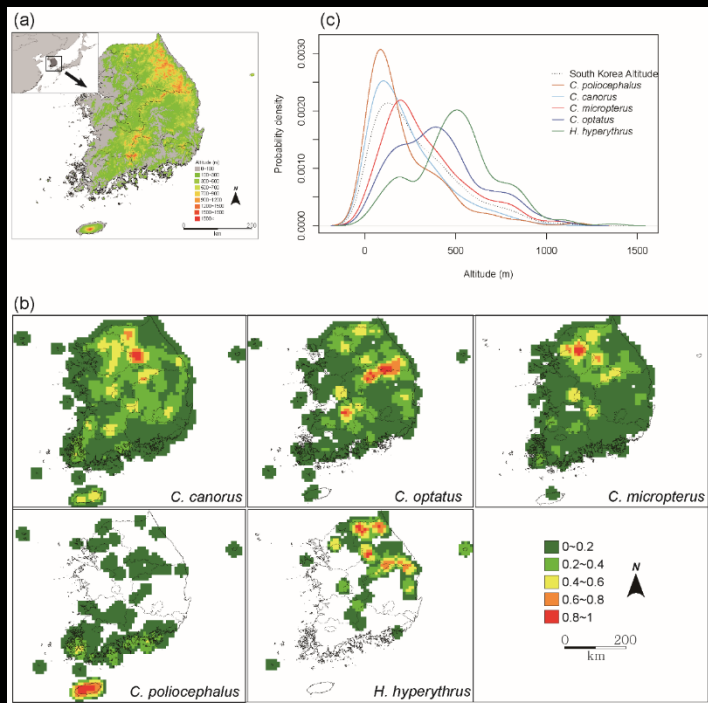
### Spatial patterns, ecological niches, and interspecific competition of avian brood parasites: inferring from a case study of Korea

Jin-Won Lee<sup>1</sup>, Hee-Jin Noh<sup>1</sup>, Yunkyoung Lee<sup>2</sup>, Young-Soo Kwon<sup>3</sup>, Chang-Hoe Kim<sup>2</sup> & Jeong-Chil Yoo<sup>1</sup>

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# 향후 연구방향



- 공진화

Coevolution



- 사회 행동

Social behavior



- 생활사 전략

Life history strategy



- ❖ 생물다양성의 유지
- ❖ 인간 사회 문제 해법
- ❖ 인간과 자연의 공존

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감사합니다!

