International Journal of Applied and Natural Sciences (IJANS)
ISSN(P): 2319-4014; ISSN(E): 2319-4022
Vol. 4, Issue 3, Apr - May 2015, 1-8

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

GEOGRAPHICAL VARIATION IN THE STRUCTURE OF SONGS OF THE ASIAN KOEL (*EUDYNAMYS SCOLOPACEA*) INHABITING TWO DIFFERENT LOCATIONS

MANJUNATH. K[1], BHASKAR JOSHI[2], RENUKA KHAPLE[3] & SHRAVANKUMAR N T[4]

[1,2,3]Department of Post Graduate Studies and Research in Zoology, Gulbarga University, Gulbarga, Karnataka, India

[4]Department of Research and Studies in Zoology, S. B. College of Science, Gulbarga University, Gulbarga, Karnataka, India

ABSTRACT

The study involves recordings of birdsongs of koel (*Eudynamys scolopacea*) from two different regions, Gulbarga and Ainoli. Recordings were carried out from March 2009 to May 2010. Twenty species from each (two) regions were recorded. The results show that variations exist in this bird species. Comparison of sonogram obtained from two regions of Gulbarga and Ainoli revealed both similarities and differences among population in song phrase. Minimum (Low) frequency was higher in Ainoli region when compared to Gulbarga with significant difference. Maximum (High) frequency of Gulbarga was higher when compared to Gulbarga which is also significant. Similarly song duration, length of song duration of Gulbarga is more when compared to the song duration of Ainoli which was also significant.

KEYWORDS: Eudynamys scolopacea, Gulbarga, Ainoli

INTRODUCTION

Song is a key component of territorial defense, mate attraction, and reproductive stimulation of mates among passerines (McGregor and Krebs 1982). Songs of passerine birds vary considerably, both between, and within species. Song differences may prevent the hybridization of species that could otherwise produce viable and fertile offspring (Grant and Grant 1997, Baker and Boylan 1999). Therefore, species-specific songs can be an important isolating mechanism among bird species (Payne 1986, Grant and Grant 1996). Different songs in the same species may lead to reproductive divergence and potential speciation (Baker and Mewaldt 1978). Studying the geographic variation of bird songs can provide information on the extent of interaction among individuals in different locales (Kroodsma 1996) and on the possible evolutionary processes the populations had experienced (McCracken and Sheldon 1997, Baptista and Krebs 2000).

Variations in bird songs have been examined either micro- or macro-geographically (Sensu Mundinger 1982). Factors attributed to causes of geographic variation in bird songs include environmental variations (Morton 1975) and genetic differences (Marler and Pickert 1984, Kroodsma and Canady 1985, Baptista 1996). Song variation may also result from miscopying during the learning process (Mundinger 1982, Nelson and Marler 1994, MacDougall-Shackleton and MacDougall-Shackleton 2001).

Previous studies of geographic variation in bird songs often examined the geographic patterns of whole songs or compared song repertoire sizes of different populations. However, bird songs usually have a hierarchical structure: repertoires are composed of different songs, songs are made up of phrases, phrases have strings of distinctive syllables, and

syllables are made up of notes (Catchpole and Slater 1995). Different song levels may be affected by different factors and result in different patterns of geographic variation (Tracy and Baker 1999). How notes are organized into syllables, and how syllables are arranged into songs may also vary geographically (Mundinger 1982, Balaban 1988). Analyzing only the higher levels in the song hierarchy may overlook variations of finer structures, but few studies have analyzed all the features of bird songs.

Several aspects of Red-vented bulbul *Pycnonotus cafer* behavior and ecology have been well studied (Vijayan 1978), (Vijayan 1978), little is known about vocalizations (Kumar and Bhatt 2000) in India; whereas vocalization in Asian koel is little is known. The Asian koel (*Eudynamys scolopaceus)* (David, N & Gosselin, M 2002) (Penard, TE 1919) is a member of the cuckoo order of birds, the Cuculiformes. It is found in South Asia, China, and Southeast Asia. It forms a super species with the closely related Black billed and Pacific koels which are sometimes treated as subspecies. The Asian koel is a brood parasite that lays its eggs in the nests of crows and other hosts, who raise its young. They are unusual among the cuckoos in being largely frugivorous as adults (Corlett, RT & IKW Ping 1995). The name *koel* is echoic in origin with several language variants. The bird is a widely used symbol in Indian poetry (Yule, Henry, Sir 1903).

Therefore the present study was undertaken to record and analyse song of Asian koel inhabiting two locations of north Karnataka; Gulbarga and Ainoli.

MATERIALS AND METHODS

The Asian koel is a large, long-tailed, cuckoo measuring 39–46 cm (15–18 in) and weighing 190–327 g (6.7–11.5 oz). (John B, 1992) The male of the nominate race is glossy bluish-black, with a pale greenish grey bill, the iris is crimson, and it has grey legs and feet. The female of the nominate race is brownish on the crown and has rufous streaks on the head. The back, rump and wing coverts are dark brown with white and buff spots. The underpart are whitish, but is heavily striped. The other subspecies differ in colouration and size. (Payne, RB 2005) The upper plumage of young birds is more like that of the male and they have a black beak (Ali S & Ripley, SD 1981).

The present study (recording) was carried out in two regions from March 2009 to May 2010. The study area Gulbarga lies between 17 04’ -77 42’ longitude and 16 12’ -17 46’ latitude. Gulbarga possesses a typical climate of south Indian peninsula with semi-arid conditions, with temperature between 14- 45º C and the average rainfall being 702 mm. Ainoli village which is just 5km from Chincholi taluk (80 km distance from Gulbarga district which lies between 77 25’ 48’ E latitude of 17 28’ 12’ N) which itself represents 50% of the forest and possess teak, rosewood trees (Manjunath and Bhaskar Joshi 2012).

Approximately songs of twenty species from each (two) regions were recorded (Figure 1). From each locality, songs of were recorded once or twice every month, between early morning and late evening. For photographs a SONY DH7 handycam camera with 15× optical zoom lens (8.1mp) used. Songs were recorded in the field using SONY ICD- U50 (IC recorder). Recording was made in disturbed suburban, rural areas where this species is well adapted and commonly found.

Recordings of individual’s songs were recorded until either it stopped singing or flew out of recording range. After each individual was recorded, location was noted. Because birds were not individually marked, songs recorded from different locations were considered to represent different samples analyzing microgeographic pattern of songs.

Recording were digitized and analyzed using (Raven pro 1.4 beta version standard permanent license software, The Cornell Lab of Ornithology), with a sampling rate of 22.5 to 48 kHz, and 16-bit resolution, and FFT (Fast Fourier Transform) - length of 512 points. In the present study, minimum frequency, maximum frequency and duration of song were measured. Results were expressed as mean ±SE.

A

B

Figure 1: Map Showing Locations where Asian koel (*Eudynamys scolopacea*) were Recorded. A) Gulbarga B) Ainoli

RESULTS & DISCUSSIONS

Songs from twenty individual species from each study area were recorded. For statistic six readings were taken from each region (Table 1). A 2-5 min recording was analyzed per individuals. (Figure 2) illustrating the terminology used in describing different parts of song, Min. Freq, Max. Freq, and song duration. Song duration and and Min. Freq, Max.

Freq of both regions shows variation in spectrogram. Anioli (Figure 3B) region, which shows variation from that of Gulbarga region (Figure 3 A).

Minimum (Low) frequency was higher in Ainoli (995±0.763) region when compared to Gulbarga (957.5±0.763) with significant difference (Mann-Whitney test) (P<0.005). Maximum (High) frequency of Gulbarga (1575±0.577) was higher when compared to Gulbarga with (1552.5±0.76) which is also significant (Mann-Whitney test) (p<0.005). Similarly song duration, length of song duration of Gulbarga is more (0.469±0.015) when compared to the song duration of Ainoli (0.36±0.0152) which was also significant (Mann-Whitney test).

Table 1: Song Characteristics of Asian koel (*Eudynamys scolopacea*) in the Two Regions; Gulbarga and Ainoli

REGIONS	GULBARGA	AINOLI
Individuals (N)	6	6
Minimum frequency (kHz)	957.5±0.76	995±0.76**
Maximum frequency (kHz)	1575.5±0.76	1552.5±0.76**
Song Duration (sec)	0.469±0.015	0.36±0.015**

N- Number of individuals; Mean± standard error *P< 0.05; **P< 0.01

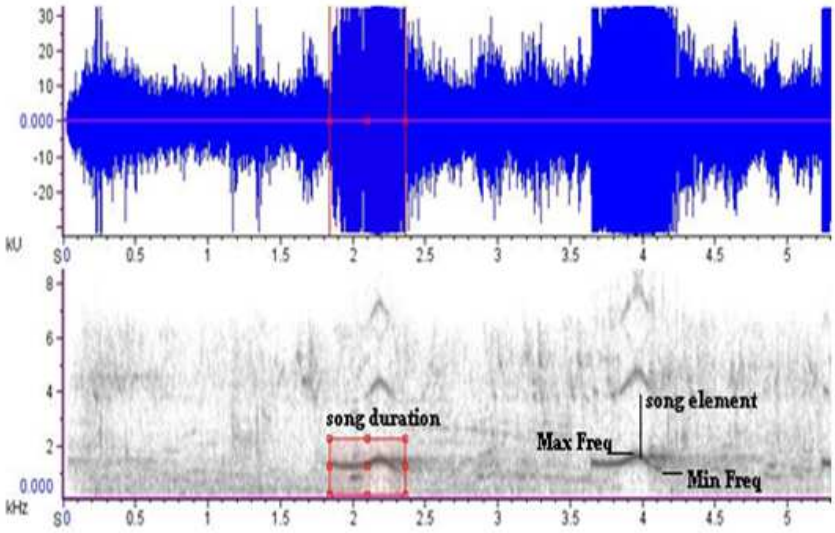

Figure 2: A Sonogram of Asian koel. Illustrating the Terminology Used in Describing Different Parts of Song, Min. Freq, Max. Freq, and Song Duration

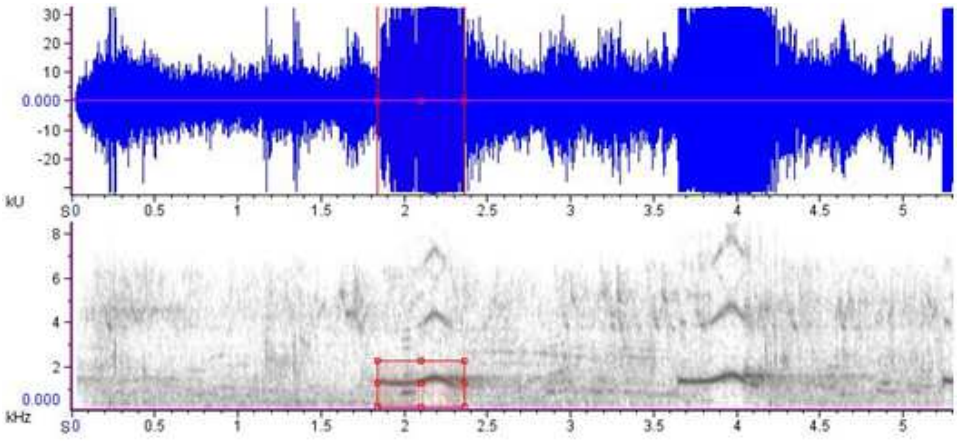

Figure 3: A. A Sonogram of Asian koel of Gulbarga

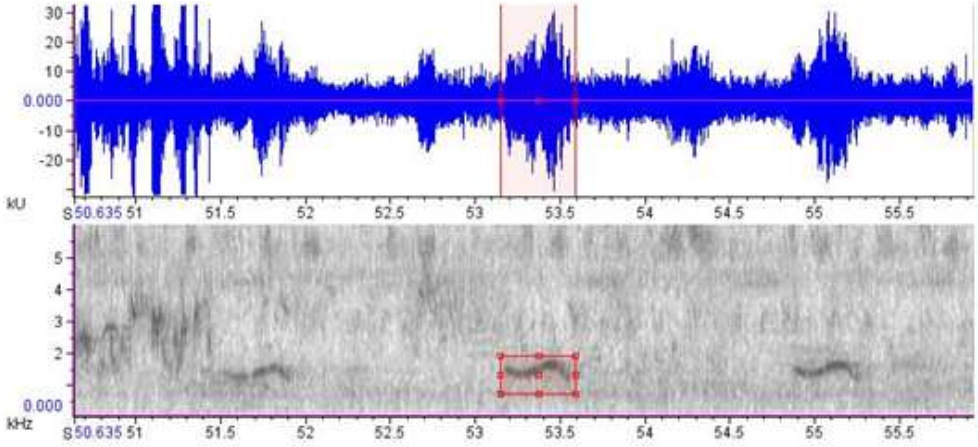

Figure 3: B. A Sonogram of Asian koel of Ainoli

Comparison of sonogram obtained from two regions of Gulbarga and Ainoli revealed both similarities and differences among population in song phrase. The specific frequency of the song and the pattern at the beginning of each element 'introductory note' can be considered as species recognition. Several studies have shown that geographical divisions influences on the song syntax in each population and causes the difference in territorial songs (Glaubercht, 1989; Martens and Meincke, 1989; Helb and Dieter, 1994; Jesse, 1994; Martens et al., 1994; and Steil, 1997).

Geographical variation has been demonstrated in the songs of many species (Benson, 1948; Borror, 1961) and in a few cases there is evidence that the variation is manifest as a series of local song 'dialects' In European Chaffinch (Fringilla coelebs) one of the best studied examples (Promptoff, 1930; Poulsen, 1951; Marler, 1952; Thorpe, 1958). (Marler and Tamura 1964) used the variation in the pattern of introductory whistle, the fine structure of the trill in the strophe to identify the pattern of dialect of white-crowned sparrow, *Zonotrichia leucaphrys*. Alternatively, (Marten and Steil 1997) used the number and character of elements and song syntax to identify the song dialect of lesser whitethroat, *Sylvia curruca*.

The present study shows that there were significant difference between two populations and the occurrence of variations in two populations of the Asian koel (*Eudynamys scolopaceus*) is evident. The dissimilarity is a result of alteration and variation in some Frequency i.e. max and min and in song duration.

REFERENCES

1. Ali S & Ripley, SD (1981). *Handbook of the birds of India and Pakistan. Volume 3* (2 ed.). Oxford University Press. pp. 227–230.
2. Baker, M. C. & Boylan, J. T. 1999 Singing behaviour, mating associations and reproductive success in a population of hybridizing lazuli and indigo buntings. Condor 101, 493–504.
3. Baker, M. C. & Mewaldt, L. R. 1978 Song dialects as barriers to dispersal in white-crowned sparrows, *Zonotrichia leuco-ophrys nuttalli*. Evolution 32, 712–722
4. Balaban E. 1988. Bird song syntax: learned intraspecific variation is meaningful Proc. Natl. Acad. Sci. USA 85: 3657-3660.

5. Baptista LF, R Krebs. 2000. Vocalizations and relationships of Brown Creepers Certhia americana: a taxonomic mystery. Ibis 142: 457-465.

6. Baptista LF. 1996. Nature and its nurturing in avian vocal development. In DE Kroodsma, EH Miller, eds. Ecology and evolution of acoustic communication in birds. Ithaca, NY and London: Cornell Univ. Press, pp. 39-60.

7. Beme, I. R. 1994. Formation of acoustic repertorie in the Turdidae. *Journal fur Ornithology*, 135: 314.

8. Benson, C. W. 1948. Geographical voice- variation. Ibis, 90: 48-71.

9. Bhatt D, Kumar A, Singh Y and Payne RB: Territorial songs and calls in Oriental Magpie- Robin *Copsychus saularis.* Curr Sci. 2000; **78:** 722- 728.

10. Bigot, E., Hausberger, M. and Clergeau, P. 1994. Dialects and social organization within roosts in starlings. Journal fur Ornithology, 135: 316.

11. Borror, D. 1961. Intraspecific variation in passerine bird songs. Wilson Bull., 73: 57-78.

12. Catchople, C. K. 1979. Vocal communication in birds, London.

13. Catchpole, C. K. and P. J. B. Slater. 1995. Bird song: Biological themes and variations. Cambridge Uni- versity Press, Cambridge

14. Corlett, RT & IKW Ping (1995). "Frugivory by Koels in Hong Kong" (PDF). *Mem. Hong Kong Nat. Hist. Soc.* **20**: 221–222

15. David, N & Gosselin, M (2002). "The grammatical gender of avian genera". *Bull B.O.C.* **122**: 257–282.

16. Fujita, K. 1994. The function of song in varied tits. Who maintain a strong pairbond. *Journal fur Ornithology*. 135: 319.

17. Geoff S: Bird songs and calls of Britain and Northern Europe. London: Harper Collians Publ. 1996.

18. Grant, B. R. & Grant, P. R. 1996 Cultural inheritance of songand its role in the evolution of Darwin's finches. Evolution 50, 2471–2487.

19. Grant, P. R. & Grant, B. R. 1997a Genetics and the origin of bird species. Proc. Natl Acad. Sci. USA 94, 7768–7775.

20. Glaubercht, M. 1989. Microgeographical variation songs of yellowhammer (Emberiza *citronella*) at the dialect in the northern Germany, *Journal fur Ornithology*, 135: 321.

21. http://24timezones.com/onlinemap/india_gulbarga.php March 2010.

22. http://www.maplandia.com/india/karnataka/gulbarga/chincholi/ March 2010.

23. Helb, H. W. and Diieter, W. 1994. Geographic variation of song structure in the scarlet grosbeck. *Journal fur Ornithology*, 135:321.

24. Jesse, A. 1994. Song dialects and origin of insular populations of white crowned sparrows. *Journal fur Ornithology*, 135: 324.

25. John B. Dunning (1992). CRC Handbook of Avian Body Masses by Jr. (ed.). CRC, ISBN 978-0-8493-4258-5.
26. Kroodsma DE, RA Canady. 1985. Differences in repertoire size, singing behavior, and associated neuroanatomy among Marsh Wren populations have a genetic basis. Auk 102: 439-446.
27. Kroodsma, D. E. and E. H. Miller. 1996. Ecology and evolution of acoustic communication in birds. Cornell Unversity Press, Ithaca, New York.
28. Kumar A and Bhatt D. 2000. Vocal signals in a tropical avian species the Red- vented Bulbul *Pycnonotus cafer*: Their Characteristics and importance. J Biosci 25: 387- 396
29. Kumar, A. (2003). Acoustic communication: difference in songs and calls, their production and biological significance.*Resonance.* 2003; **8(6):** 44-55.
30. Kumar A and Bhatt D: Characteristics and significance of song in female Oriental Magpie Robin *Copsychus saularis.* J Bombay Nat His Soc. 2002; **99:** 54- 58.
31. Lambrechts, M. M., Blondel, J., Hurtrez-Bousses, S., Maistre,M. & Perret, P. 1997 Adaptive inter-population differences in blue tit life-history traits on Corsica. Evol. Ecol. 11,599–612.
32. MacDougall-Shackleton, S. A., MacDougall-Shackleton, E. A. & Hahn, T. P. 2001 Physiological and behavioural responses of female mountain white-crowned sparrows to natal- and foreign-dialect songs. Can. J. Zool. 79, 325–333.
33. Marler, P. 1952. Variation in the song of the Chaffinch, *Frinfilla coelebs.* Ibis, 94: 458-472.
34. Marler, P. and Tamura, M. 1964. Song “dialects” in three populations of white- crowned sparrows. Science, 146, 1483- 06.
35. Martens, J., and Meincke, C. 1989. Territorial song of the Siberian chiffchaff (Phyloscopus collybita tristis) and playback experiments within a central European population (*Ph. C. tristis*) *Journal fur Ornithology*, 130: 455-473.
36. Martens, J., Petri, B. and Nazarenko, A. A. 1994. Great Tit vocalizations in the Amus hybrid zone. *Journal fur Ornithology*,135: 331.
37. Martens, J. and Steil, B. 1997. Territorial song and species differentiation in the whitethroat superspecies *Sylvia curruca*. *Journal fur Ornithology*, 138: 1-23.
38. Marler P, R Pickert. 1984. Species-universal microstructure in the learned song of the Swamp Sparrow (Melospiza georgiana). Anim. Behav. 32: 673-689.
39. McGergor, P. K. Krebs, J. R. 1982. Songs types in a population of great tit (parus major): their distribution, abundance and acquisition by individuals. Behaviour, 79, 126-52
40. McCracken KG, FH Sheldon. 1997. Avian vocalizations and phylogenetic signal. Proc. Natl. Acad. Sci. USA 94: 3833-3836.
41. Morton ES. 1975. Ecological source of selection on avian sounds. Am. Nat. 109: 17-34

42. Mundinger, P. C. 1982 Microgeographic and Macrogeographic graphic variation in the acquired vocalizations of birds. In Acoustic communication in birds, vol. I (ed. D. E. Kroodsma, E. H. Miller & H. Quellet), pp. 147–208. New York: Academic Press.

43. Nelson DA, P Marler. 1994. Selection-based learning in birdsong development. Proc. Natl. Acad. Sci. USA 91:10498-10501.

44. PäCkert, m., MartenS, J. & HofmeiSter, T. (2001): Laut äu ße-run gen der Sommergoldhähnchen von den Inseln Madeira und Mallorca (Regulus ignicapillus madeirensis, R. i. balea- ri cus). – Journal für Ornithologie, 142 (1):16 – 29.

45. Payne, R. B. 1986 Bird songs and avian systematics. In Current ornithology (ed. R. J. Johnston), pp. 87–126. New York: Plenum.

46. Payne, RB (2005). *The Cuckoos*. Oxford University Press.

47. Penard, TE (1919). "The name of the black cuckoo" (PDF).*Auk* **36** (4): 569–570. doi:10.2307/4073368.

48. Poulsen, H. 1951. Inheritance and learning in the song of the Chaffinch (*Fringilla coelebs* L.). Behaviour, 3: 216-228.

49. Promptoff, A. N. 1930. Die geographische Variabilitat dea Buchfinkenschlags (*Frindilla coelebs* L.) in Zusammenhangh mitetlichen allgemeinen Fragen der Saisonvgeluge. Biol. Zentralbl., 50: 478-503

50. Steil, B 1997. Territorial song and species differentiation in the lesser whitethroat superspecies Sylvia currca. *Journal fur Ornithology*, 138: 1-23.

51. Tracy TT, MC Baker. 1999. Geographic variation in syllables of House Finch songs. Auk 116: 666-676.

52. Thorpe, W. H. 1958. The learning of song patterns by birds, with special reference to the song of the Chaffinch *Fringilla coelebs*. Ibis, 100: 535-570.

53. Vijayan VS. 1978. Breeding biology of bulbuls *Pycnonotus cafer* and *Pycnonotus luteolus* (Class: Aves, Family: Pycnonotidae) with special reference to their ecological isolation. J Bombay Nat Hist Soc 75: 1090- 1117.

54. Yule, Henry, Sir (1903). *Hobson-Jobson: A glossary of colloquial Anglo-Indian words and phrases, and of kindred terms, etymological, historical, geographical and discursive.*. John Murray, London. p. 490.