Communication signals and sexual selection in amphibians

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Female mate choice is an important determinant for male reproductive success in anurans. The advertisement call of the males contains information for species recognition. These calls are used by the females to distinguish between heterospecifics and conspecifics and further to discriminate among conspecifics to choose the fittest male for the purpose of mating. In *Polypedates leucomystax*, the female responds by its feeble reciprocal call to the first calling male of the colony, which also is the largest and heaviest male amongst all other calling males. This male calls persistently throughout the night, or till amplexus is reached, without changing its call pattern. It increases the intensity of its call after the response of the female. The increase in the intensity, increase in the length of the individual call and persistent calling throughout the night make the call of this first calling male conspicuous. The call contains more acoustical energy which is indicative of good physical condition and the responding female chooses this male. Thus mating in *P. leucomystax* is non-random and influenced by female mate choice.

FEMALES of various groups of vertebrates use communication signals produced by the males to choose the fittest male for the purpose of mating. It was this selection pressure which resulted in sexual signals of males to contain information far in excess than that was needed for species recognition. Male sexual displays allowed females to pick more vigorous males and this female choice thus caused further elaboration of male sexual displays[1]. The idea was further extended by Fisher's theory of Runaway Selection[2]. Thus there exists an important relation between communication signals and sexual selection.

Female mate choice has been demonstrated as an important determinant of male reproductive success in anurans. The advertisement calls[3] produced by the males, contain information encoded spectrally and/or temporally important for species recognition[4]. These calls potentially provide a receptive female with information pertaining to species identity, sex and reproductive fitness of the advertising male[5–8]. These signals are used by the females to distinguish between heterospecifics and conspecifics, and further, to discriminate among conspecifics. Based on these informations, the female decides to accept or not to accept the calling male as a potential mate.

Till recently it was believed that it was for the male frogs to produce advertisement calls and act as senders, while the females act as receivers of the acoustic signals to choose the fittest male. As a result, most works were focused on male vocalization and female phonotaxis experiments. Female vocalization due to its feebleness and the secretive nature of the female, had mostly escaped the attention of researchers.

Female reciprocal call

The significance of female reciprocal call in the breeding biology of amphibians was highlighted by Roy *et al.*[9]. They demonstrated the 'catalytic' role of the female reciprocal call for the enhancement of the reproductive activity of the breeding colony. While studying anuran acoustic communication in northeast India and comparing male advertisement call with female reciprocal call in *Limnonectes limnocharis, Euphlyctis cyanophlyctis and Polypedates leucomystax* (Figures 1, 2 and 3), many interesting observations were made. Out of the 3 species, *P. leucomystax* due to its perching habit and its responsive, active and alert nature, was chosen for in depth study of its communication signals and breeding behaviour.

Reciprocal call and courtship display in *Polypedates leucomystax*

The role of female reciprocal call has been studied in detail in *P. leucomystax* for 3 consecutive years (1994–1996) both in the field and laboratory. These frogs are mostly found perched on creepers which entwine bamboo fencing or on tall grass in the vicinity of water. Their perching habit makes them easier to observe than terrestrial or aquatic species and to follow their elaborate breeding behaviour (Figure 4 *a*, *b*).

Weather condition seems to play an important role on the timing of beginning of the first male advertisement call. On dry hot days with temperature ranging between 26 and 37°C, the first male call is heard around 1800 h. On