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RTD15 Avian brood parasites and their hosts

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1 Issues

Avian brood parasitism continues to attract great interest not only in ornithology but also general evolutionary ecology because it provides an excellent system for examining co-evolutionary interactions between parasites and their hosts. The aims of this RTD were to (1) provide an opportunity to present and exchange up-to-date research findings in avian brood parasitism, and (2) construct and launch an international network to promote research in avian brood parasitism, especially in Asia where many brood parasite species breed but where their ecology and behavioral features are rarely studied.

Four discussion papers were presented to illustrate current issues:

(1) "Models in avian brood parasitism" (Fugo Takasu) focused on two mathematical models, one for defense establishment in hosts in a host meta-population in structured habitat, the other for co-evolutionary change of egg pattern in host and parasite. In the first model, he analyzed how host defense spreads in situations where some but not all local populations suffer parasitism. In the second, he investigated the theoretical consequences of a co-evolutionary arms race between parasites and hosts (in press). The results of these analyses stressed the value of combining theoretical modeling with empirical field research.

(2) "Battle and co-evolution between cuckoo and host" (Hiroshi Nakamura) concerned a recent shift in the relationship between a host, the azure-winged magpie (*Cyanopica cyana*), and its parasite, the common cuckoo (*Cuculus canorus*), in Nagano, Japan (Nakamura, 1990; Nakamura, Kubota and Suzuki, 1998). He showed that the magpie had been developing defense against cuckoo parasitism (rejection rate of cuckoo eggs) rapidly in recent decades and discussed the co-evolutionary change in the field.

(3) "Mafia or Paisano? — theoretical consequences and empirical evidence for host-brood destruction by female cowbirds" (Mark E. Hauber) developed a game model to analyze which tactic, mafia or paisano, becomes adaptive for brood parasites (Hauber, submitted). Paisano parasites destroy host broods that do not contain parasitic offspring, while Mafia parasites destroy only those host broods from which their offspring are rejected. With experimental evidence, he discussed the relevance of both of these tactics in the brown-headed cowbird (*Molothrus ater*) and other brood parasites.

(4) "Geographic variation in egg appearance and egg rejection behavior by hosts" (Eivin Røskaft and Arne Moksnes) centered on the hypothesis that the spatial structure of breeding habitat reflects various degrees of host defense level, judged by rejection rate etc. (Røskaft et al., 2002a, b). The "spatial structure of habitat hypothesis" applies to host populations segregated into several subpopulations by different habitat type. In test cases, the breeding habitats of the host were separated into three — woodland, open areas and the edges between them — in situations where each subpopulation in each habitat was connected with the others by gene flow. Based on field data, tests of the hypothesis showed that spatial structure is a crucial explanant of the imperfections in host defense commonly observed in many host species.

2 Outcomes

Egg patterning and methods for their quantitative measurement were the focus of much discussion. Studies using models have shown that some hosts reject eggs unlike their own, and that they can recognize subtle differences in egg patterns. Because birds are sensitive to additional spectral colors (e.g. UV), field experiments using artificial eggs painted under the control of the human eye, whether to mimic the eggs of hosts or not, could be biased. The meeting agreed that a standard formula for modeling implanted eggs was a priority need for future field studies.

Another point of debate was the lack of comparative information at larger scales. Field programs are commonly carried out by one researcher on single parasite-host interactions in the one local breeding population or area. To assess the broader operation and functions of parasite-host co-evolution, data needs to be compared from diverse parasite-host interactions over wide regions. For this, it is desirable too that researchers develop standardized methods for measuring basic features of brood parasitism (rejection rate, degree of mimicry etc.). Building an international net-

work of researchers would facilitate such studies. So far, research on avian brood parasitism has been centered in Europe and North America, leaving enormous gaps waiting to be filled in Asia, Australasia and South America.

The combining of empirical and theoretical research was also needed, particularly in view of increasingly theoretical approaches to avian brood parasitism. Better collaboration between field ornithologists and mathematical biologists can only improve our understanding of the details of behavioral and population-level interactions between brood parasites and their hosts.

In summary, the group looked forward to launching a worldwide network of researchers in brood parasitism, with two immediate objectives: to facilitate the development of standardized methods of experimentation in the field, and to expand research outside Europe and North America into and beyond Asia.

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