

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a Confirmed

- | | | |
|--------------------------|-------------------------------------|--|
| ☐ | ☒ | The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement |
| ☐ | ☒ | A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| ☐ | ☒ | The statistical test(s) used AND whether they are one- or two-sided
<i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i> |
| ☐ | ☒ | A description of all covariates tested |
| ☐ | ☒ | A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| ☐ | ☒ | A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals) |
| ☐ | ☒ | For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
<i>Give P values as exact values whenever suitable.</i> |
| ☐ | ☒ | For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| ☐ | ☒ | For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| ☐ | ☒ | Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated |

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection No software was used for data collection.

Data analysis Statistical analyses were conducted in R. Packages used include: MASS v7.3-61; glmmTMB v1.1.10; emmeans v1.8.7; phytools v.0.7.47; PMCMRplus v.1.9.6; ape v.5.7; and bipartite v.2.18. Acoustic analyses were conducted in Luscinia v.2.16.10.29.01. Recordings were created using Raven Pro v.1.6.4.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

The datasets generated and analysed in support of this study have been provided to the Editor.

Research involving human participants, their data, or biological material

Policy information about studies with [human participants or human data](#). See also policy information about [sex, gender \(identity/presentation\), and sexual orientation](#) and [race, ethnicity and racism](#).

Reporting on sex and gender N/A

Reporting on race, ethnicity, or other socially relevant groupings N/A

Population characteristics N/A

Recruitment N/A

Ethics oversight N/A

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences ☐ Behavioural & social sciences ☒ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	The aim of this study was to explore whether brood parasite-host interactions could account for the recurrent convergent evolution of vocalizations across a phylogenetically and geographically diverse array of host species. We achieved this using acoustic analyses, phylogenetic analyses, ancestral-state reconstructions, field experiments, and field surveys.
Research sample	Field research was conducted on superb fairy-wrens (<i>Malurus cyaneus</i>), purple-crowned fairy-wrens (<i>Malurus coronatus</i>) and white-browed scrubwrens (<i>Sericornis frontalis</i>) in Australia; common tailorbirds (<i>Orthotomus sutorius</i>) and rufescent prinias (<i>Prinia rufescens</i>) in China; and yellow warblers (<i>Setophaga petechia</i>) in the USA. Other data were obtained from open-access data sources (e.g. xeno-canto) and directly from researchers from all continents except Antarctica. No laboratory animals were used.
Sampling strategy	Sampling for field experiments and field surveys were conducted in Australia, China and the USA. Sample sizes were determined based off a combination of pilot studies in the field and estimates based off recent behavioural research.
Data collection	Field data were conducted by research groups in Australia (led by WEF), China (led by WL) and the USA (led by MEH). Other data were provided by research groups from all around the world (e.g. DW, NT, SL, JKE, BZ, MA, RG, VDF, SAG, AP, MH, and CNS). Data used in comparative analyses were obtained from publicly available resources (e.g. xeno-canto) and the phylogeny used in our analyses were generated from previously published datasets (Jetz et al. 2012 Nature).
Timing and spatial scale	Experiments were conducted between 2015 - 2019.
Data exclusions	A single species, the fork-tailed drongo (<i>Dicrurus adsimilis</i>), was excluded from our acoustic analyses for two reasons: 1) the calls recorded in each context are highly diverse and the recordings contain calls from multiple individuals, making it difficult to identify which calls were associated with the model presentation, 2) drongos are known acoustic mimics (Flower et al. 2012 Science), challenging inferences about the species-specificity of the calls they produce. No other data were excluded from the study.
Reproducibility	The study combines multiple discrete components to tell a cohesive story. Most parts were led by different researchers, and the lead author (WEF) ensured that none of them knew the results of other parts until their data had been collected. This helped ensure that the lines of evidence used in the study were not influenced by each other, and in effect helping ensure the reproducibility of the overall argument. Some field experiments were extensions of previous work (e.g. model presentation experiments, and audio playback experiments), and to help ensure our results (and those described in previous research – e.g. Feeney et al. 2013 Science) were robust, we replicated parts of these studies as part of our experimental design.
Randomization	The order of all treatments within field experiments were randomised prior to them being conducted, and any potential order effects were considered in the analyses.

Blinding

This study combines multiple discrete components to tell a broad story (e.g. acoustic analyses, ancestral state reconstructions, multiple field experiments, and phylogenetic analyses). One measure taken by the lead author (WEF) to ensure that “blinding” was adhered to, was that different researchers led discrete components of the study and none of them knew the results of other parts while conducting theirs. This helped ensure that the results obtained by different researchers were not influenced by knowledge of the emerging story presented in the paper. Regarding blinding of the field experiments in Australia, China and the USA, this was not possible due to work being conducted on wild animals in the field. However, again, these experiments were conducted by several research groups without knowledge of what the expected result would be.

Did the study involve field work? ☒ Yes ☐ No

Field work, collection and transport

Field conditions

All field experiments were conducted in good weather conditions and during relevant ecological conditions (e.g. the study concerned brood parasite-host interactions, and therefore experiments were conducted on hosts during their breeding seasons).

Location

In Australia, experiments were conducted around Lake Samsonvale (27°16'S, 152°51'E) between July and December of 2015–2018

In China, experiments were conducted in the vicinity of Wang Na village (hereafter Wang Na) in south-west Guangxi (22°29'N, 106°58'E), between May and June 2017.

In the USA, experiments were conducted at multiple sites during 2019 in Champaign (40°12'N, 88°14'W), Iroquois (40°46'N, 87°41'W), and Vermillion (40°07'N, 87°41'W) counties in central Illinois.

Access & import/export

Research was conducted with approval from the University of Queensland's Animal Ethics Committee (SBS200/15/UQPF), Griffith University's Animal Ethics Committee (ENV/08/19/AEC), Monash University's Animal Ethics Committee (BSCI/2011/28; BSCI/2015/11), Hainan Provincial Educational Centre for Ecology and Environment's Animal Research Ethics Committee (HNECEE-2012-002, HNECEE-2012-003 and HNECEE-2017-001), the University of Illinois at Urbana-Champaign's Animal Ethics Committee (IACUC 21125) and Cornell University's Animal Ethics Committee (IACUC 2009-0105); as well as the Queensland Government (WISP16200615), the State of Illinois (NH19.6220), and the Zambia Wildlife Authority (receipt number: 521049).

Disturbance

All species used in field experiments are common, recovery periods were allowed between all treatments and individuals were monitored following any experiments to ensure normal behaviour resumed. Experiments comprised presenting birds with taxidermied mounts and audio playbacks, which are common techniques that are similar to circumstances faced by these animals in their everyday lives.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

- n/a Involved in the study
- ☒ ☐ Antibodies
- ☒ ☐ Eukaryotic cell lines
- ☒ ☐ Palaeontology and archaeology
- ☐ ☒ Animals and other organisms
- ☒ ☐ Clinical data
- ☒ ☐ Dual use research of concern
- ☒ ☐ Plants

Methods

- n/a Involved in the study
- ☒ ☐ ChIP-seq
- ☒ ☐ Flow cytometry
- ☒ ☐ MRI-based neuroimaging

Animals and other research organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research, and [Sex and Gender in Research](#)

Laboratory animals

N/A

Wild animals

Experiments were conducted on wild animals in their natural environment during their breeding seasons. Field research was conducted on superb fairy-wrens (*Malurus cyaneus*), purple-crowned fairy-wrens (*Malurus coronatus*) and white-browed scrubwrens (*Sericornis frontalis*) in Australia; common tailorbirds (*Orthotomus sutorius*) and rufescent prinias (*Prinia rufescens*) in China; and yellow warblers (*Setophaga petechia*) in the USA.

Reporting on sex

Sex was not relevant to this study as it looked at responses by host birds at nests (and therefore wasn't concerned with relative contributions of females versus males).

Field-collected samples

N/A

Ethics oversight

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Plants

Seed stocks

N/A

Novel plant genotypes

N/A

Authentication

N/A