

The Rufford Small Grants Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Dr. Ratna Ghosal
Project title	Hormonal and behavioural correlates of musth in male Asian elephants (<i>Elephas maximus</i>)
RSG reference	8350-1
Reporting period	September 2010 to November 2011
Amount of grant	£6,000
Your email address	rghosal@ces.iisc.ernet.in
Date of this report	29th November 2011

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Standardisation and establishment of ELISA assay system for non-invasive measurement of faecal androgen (male reproductive hormone) and glucocorticoid (stress related hormone) metabolites in the dung samples of male Asian elephants			✓	For the first time, ELISA systems were successfully established for monitoring quantitative changes in androgen (epiandrosterone) as well as glucocorticoid metabolites with a 5 β -3 α -ol-11-one structure in faeces of free-ranging male Asian elephants.
Assessment of musth and non-musth stages of male Asian elephants based on measurement of faecal androgen and glucocorticoid metabolites			✓	Musth state is associated with elevated levels of immunoreactive epiandrosterone, lending support to the existing literature on both Asian and African elephants, which describes musth as a heightened state of sexual activity associated with increased androgen levels. However, musth was not associated with quantitative changes in glucocorticoid metabolite output, thus showing that the state of musth may not incur much stress on male Asian elephants.
Behavioural musth related pattern and its endocrine correlates in male Asian elephants, irrespective of the phenotype		✓		Musth males can be characterised into two different categories based on the presence of two main physical signals - secretion from the swollen temporal glands (TGS) and dribbling of urine from the penis (UD). Usually, musth bulls' show initially TGS without UD (TGS+ UD-), followed by a more advanced stage of musth including UD (TGS+UD+). Our hormone analyses indicate that androgen levels were highest in TGS+UD+ musth bulls. In contrast, levels of glucocorticoid metabolites were low and remain unchanged during the two different stages of musth. Males in full musth (TGS+UD+) usually rove long distances, thus

				collecting dung samples from them is even more challenging, and subsequently led to a smaller sample size compared to the other sub-groups.
Behavioural musth related pattern and its endocrine correlates in the two phenotypes of male Asian elephants- the tusked (tuskers) and the tuskless (makhnas) males		✓		<p>In both phenotypes, epiandrosterone levels were elevated during musth, with TGS+UD+ males showing highest levels. Although we detected a numeric increase in epiandrosterone levels in tuskless bulls as compared to tusked bulls in musth, no statistically significant differences were found with our sample size.</p> <p>A marginal effect of phenotype on glucocorticoid metabolite levels were found, which was more pronounced by comparing animals in musth. A visual trend in tuskers shows higher levels of stress metabolites during non-musth than during the musth stage. However, the trend in tuskless bulls is just the opposite, with higher glucocorticoid metabolite levels during musth conditions.</p> <p>Since the sample size is relatively low for all the sampling categories, firm conclusions could only be drawn by increasing the respective number of samples for each category.</p>

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

One of the objectives of the project was to investigate whether there are any differences in the endocrine correlates of male Asian elephants with respect to the two phenotypes – tusked and tuskless bulls. To fulfill this, the Kaziranga National Park (Assam, India) was chosen as the field site as it supports almost an equal ratio of tusked to tuskless bulls, both in captivity as well as in the wild. However, when we visited the field site, we found that the captive males are treated with certain tranquilisers to suppress the expression of musth as part of the management strategy of the forest department to control potentially aggressive musth males under captive conditions. Since the application of such tranquilisers might also alter the endocrine output of the males, we abandoned sample collection from these captive males. We only focused on collecting dung samples from wild

males, during both the periods of musth and non-musth. Since we sampled only the wild males, the overall number of collected samples was lower than originally expected.

3. Briefly describe the three most important outcomes of your project.

- 1) The study is the first to establish an ELISA technique to non-invasively measure the levels of faecal androgen and glucocorticoid metabolites in wild male Asian elephants.
- 2) Hormone analyses indicate that androgen levels measured in wild Asian elephant faeces are significantly higher in musth males than the non-musth ones. This finding is consistent with the published data available on plasma testosterone levels of Asian elephants as well as with data available for African elephants.
- 3) A striking finding is the unchanged levels of glucocorticoid metabolites during musth and non-musth. Our data shows for the first time that musth in wild Asian elephants is not associated with increased levels of stress hormones.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

Since inception of project local communities like the forest department staff and the elephant mahouts were involved in each and every step of project activity. To collect dung samples from wild male elephants, field surveys were made regularly to search for a male elephant. During these surveys a lot of help and information was provided by the department staff. In course of the project, they also got educated about the elephant biology, especially with respect to the significance of musth behavior.

Two of the local people, Mr. Deepak Saikia (forest guard) and Mr. Diganta Das (driver) worked with me during the project period. They got exposed to the behaviour and biology of the musth bulls, and also got trained to tracking wild elephants on foot. They shall prove an asset to the forest department while replicating similar work in the field.

5. Are there any plans to continue this work?

Yes, there are defined plans to continue this project. In this regard, we plan to apply for a booster grant from Rufford to further support our envisaged work. We target to continue for at least one more year, in order to increase the number of collected faecal samples for a reliable statistical analysis and subsequently a better understanding of the musth-related endocrine pattern in the two phenotypes of male Asian elephants. By identifying potential differences between tusked and tuskless Asian elephant bulls, regarding musth related hormonal characteristics; we could help to optimize conservation efforts as well as ongoing breeding programmes, critical for the population management of Asian elephants.

6. How do you plan to share the results of your work with others?

We have already taken the initiative to share the findings of the project with the local and as well international scientific community. We have given a detailed report regarding the findings of the project to the Assam Forest Department for their reference. We also provided the concerned forest department with all the observational records, in terms of photographs and videos. These will help them to keep a record of the elephants that were sighted during the project period.

The findings of the projects were also presented at the 2nd Annual meeting of the International Society of Wildlife Endocrinology at Toronto, Canada from 3rd to 4th November 2011. The abstract for the same was published in the form of conference proceedings.

Furthermore, we are planning a workshop titled “Applying non-invasive methods to understand wildlife science” in the month of January 2012 at the Indian Institute of Science, Bangalore, India. In the past 2-3 decades, there has been considerable progress in developing non-invasive methods to assess reproductive endocrine profiles of captive or free-ranging mammals, given the severe constraints in the collection of blood samples from these species, because of legal, ethical and practical reasons, and also because of the inaccessibility of such animals. The method of choice in most cases has been the measurement of either urinary or faecal hormone-metabolites. Although, India is rich in its diverse array of species with an endemic source of endangered species, such advances in the field of wildlife endocrinology are lacking in the subcontinent. Thus the purpose of proposed workshop will be to discuss the scopes and progress of the wildlife endocrine research. The workshop intends to bring researchers together who work in different parts of the relevant disciplines, in wildlife endocrinology and/or the foundations of ecology or closely related fields, so viewpoints can be shared, and new ideas stimulated. The workshop also aims to give training to a few researchers or forest department veterinary staff on the basic principles and methods to carry out the hormonal assays, using non-invasive sampling.

7. Timescale: Over what period was the RSG used? How does this compare to the anticipated or actual length of the project?

RSG was used throughout the project period from September 2010 to November 2011.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Field assistant's and Driver's Salary	724	500	-200	The budgeted amount was for 7 months, but due to heavy rain, field work was continued only for 5 months
Travel expenses for the Principal Investigator for making field trips: £ 84 x 7 (flight/train ticket)	588	588	0	
Lodging & meals at the field site: £ 68 x 12 month	816	950	134	Due to increase in the airfare
Vehicle rent and fuel	960	1250	290	Increase in petrol cost and vehicle rent charges in the field
Digital camera for maintaining behavioral records	600	0	-600	Sony digital camera was provided by the Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India
Dung Collection Bags, Blood collection needles	312	312	0	

and tubes				
Antibodies, Labels and reagents for non-invasive assays	2000	2000	0	
Additional laboratory chemicals, glassware. etc.	0	400	400	Few additional glassware and laboratory equipments were purchased to maintain a sterile condition for establishing the ELISA assay system
TOTAL	6000	6000		

9. Looking ahead, what do you feel are the important next steps?

- 1) To sustain sample collection from the wild bulls, during both the musth and non-musth conditions, in the Kaziranga National Park, Assam, India. There are some interesting findings, which needs a larger sample size to show the statistically significant results. Thus, boosting the sample size will help in concluding the findings.
- 2) To organise the workshop on “Non-invasive approaches in wildlife endocrinology” in the month of January 2012.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

RSGF logo was extensively used in all the reports submitted to the forest department. The logo was also used in the presentation made during the 2nd Annual meeting of the International Society of Wildlife Endocrinology at Toronto, Canada from 3rd to 4th November 2011.

RSGF logo will be further used in the workshop on “Non-invasive approaches on wildlife endocrinology”, that will be taking place in the month January 2012.

11. Any other comments?

I would like to thank RSGF for their timely support and hope for its continued support to carry forward this initiative toward visible impacts.