

Research/Management Study Proposal

Audubon National Wildlife Refuge Coleharbor, ND

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1. *Title:* GENETICS OF OPHRAELLA LEAF BEETLES

2. *Project Number:*

3. *Objectives:* To collect samples of each species of Ophraella leaf beetle encountered, not to exceed 50 specimens per species, for genetic analysis using DNA sequencing.

The research is directed at three questions: (1) How recently have these species spread into the region, and from where? (2) Are there genetic differences among populations of a species in various geographic areas? (3) Do species that feed on different plants hybridize with each other? (Specifically, do Ophraella bilineata and Ophraella communa, which feed respectively on golden-aster and on ragweed or poverty-weed, interbreed?) All these questions should be answerable by comparing variation in DNA sequences among individuals from different localities and host plants.

4. *Justification:* This activity will contribute to my research on the genetics, ecology, and evolution of this group of beetles, which has been supported by the National Science Foundation for 7 years. The genus includes 14 species, of which 3 or 4 are likely to occur within the region of the refuge. The research accomplished so far has raised new questions about the history by which these species have spread into regions that had been covered by the glacial ice sheet, and on the processes by which insect populations adapt to new kinds of plants. It has also revealed several previously undescribed species. The project does not address any management problems.

5. *Procedure:*

A. Methods and materials: Beetles are collected by gently sweeping patches of their host plants with an insect net. They will be preserved in alcohol for transport and later DNA analysis. Collection will be by myself and a student assistant. Because these species are typically abundant in the sites they occupy, a sample of at most 50 specimens will not impact the population. The collecting procedure will have no other environmental impact. The first two

research questions listed above will be answered by phylogenetic analysis of variant DNA sequences within and among populations of a species from multiple geographic regions, using about 10 specimens per population; the statistical significance of the results will be assessed by the bootstrap technique, using the 95% confidence interval. Hybridization between co-occurring species will be evaluated by analysis of larger samples (40-50), with at least two variable loci used to detect hybridization if it occurs.

B. Results. Results will be published in peer-reviewed scientific journals, as previous results of this research program have been.

C. Interpretation: The hypotheses investigated are not related to management of the refuge.

6. *Cooperators:* The research is supported by the National Science Foundation. No other individuals or agencies participate in the project.

7. *Responsibility:* As principal investigator, I bear sole responsibility for this effort.

8. *Cost:* No costs are to be borne by the Fish and Wildlife Service.

9. *Schedule:* June 18, 1997 - August 31, 1997. I expect to visit the area in late June or early July, and possibly again in August if necessary.

10. *Reports:* I will submit a report on the outcome of the collecting effort by December 31, 1997, or as otherwise required, to the Refuge Manager or other USFWS personnel as required.

11. *Publication:* Results of the research will be published in peer-reviewed scientific journals such as The American Naturalist, Journal of Molecular Evolution, or Annals of the Entomological Society of America, and may be verbally presented at annual meetings of scientific societies. A short curriculum vitae, including a list of some recent publications, is appended.

Submitted By: Douglas J. Futuyma



Date: April 28, 1997

Endorsement: _____

Date: _____

Refuge Manager Approval: _____



Date: 6/4/97

Regional Office Concurrence/Approval: _____

Date: _____

Regional Office Disposition:

Born 24 April, 1942, New York City.

Education: B. S. Cornell University 1963, M. S. University of Michigan 1966, Ph. D. University of Michigan 1969 (Zoology; advisor L. B. Slobodkin)

Positions held: State University of New York at Stony Brook, Dept. of Ecology and Evolution, Asst. Prof. 1969-76, Assoc. Prof. 1976-1983, Professor 1983 - present. Visiting Professor Univ. of California (Berkeley) 1977, Cornell University (1984-5 a.y.), Padova (Italy) 1992, Miami 1994 (Distinguished Visiting Prof.)

Awards, grants: SUNY Chancellor's Award for Excellence in Teaching 1974; John Simon Guggenheim Fellow 1992-93; Fellow, AAAS 1985; Fellow, American Academy of Arts and Sciences, 1996; National Science Foundation grants 1974-76, 1976-79, 1979-81, 1983-85, 1986-89, 1989-93, 1995-9.

Professional positions: Society for the Study of Evolution Councilor 1980-82, President 1987; American Society of Naturalists President 1994; Editor of *Evolution* 1981-83; Reviewing Editor for *Science*, 1985; *Journal of Evolutionary Biology*, corresponding editor 1995-97; *Annual Review of Ecology and Systematics* editorial board 1987-1991, Associate Editor 1992 - present; American Institute of Biological Sciences Board of Directors 1995-96.

Educational service: Undergraduate courses, Stony Brook (within last 10 years): Evolution, Entomology; Graduate courses: Evolution (part), graduate seminars in evolutionary biology. Instructor in Tropical Biology for Organization for Tropical Studies, Costa Rica (at least 10 courses, full or part-time, 1971-1994). Major advisor for 15 Ph. D. students, completed, and 2 current.

Publications: Books written or edited

Evolutionary Biology (First edition 1979, second 1986, Sinauer; translations into Italian, German, Portuguese, Greek, Japanese)

Science on Trial: The Case for Evolution (First edition 1982, Pantheon; second ed. 1995, Sinauer)

Coevolution (ed. Futuyma and M. Slatkin, 1983, Sinauer)

Oxford Surveys in Evolutionary Biology (ed. Futuyma and J. Antonovics, vol. 7-9, 1992-94, Oxford Univ. Press)

Publications: Selected recent articles

Futuyma, D. J., M. C. Keese, and D. J. Funk. 1995. Genetic constraints on macroevolution: The evolution of host affiliation in the leaf beetle genus *Ophraella*. *Evolution* 49:797-809.

Funk, D. J., D. J. Futuyma, G. Orti, and A. Meyer. 1995. A history of host associations and evolutionary diversification for *Ophraella* (Coleoptera: Chrysomelidae): new evidence from mitochondrial DNA. *Evolution* 49:1008-1017.

Futuyma, D. J., M. C. Keese, and S. J. Scheffer. 1993. Genetic constraints and the phylogeny of insect-plant associations: responses of *Ophraella communa* (Coleoptera: Chrysomelidae) to host plants of its congeners. *Evolution* 47:888-905.

Futuyma, D. J., and M. C. Keese. 1992. Evolution and coevolution of plants and phytophagous arthropods. In G. A. Rosenthal and M. R. Berenbaum, *Herbivores: Their interactions with secondary plant metabolites*, pp. 439-475. Academic Press, N.Y.

Futuyma, D. J. 1995. Speciation. *Encyclopedia of Environmental Biology* 3:353-368. Academic Press, N.Y.

Futuyma, D. J., and C. Mitter. 1996. Insect-plant interactions: The evolution of component communities. *Phil Trans. Roy. Soc. Lond. B* 351:1361-1366.