

Consequences of herbivory and climate for the life-history of a northern orchid, *Calypso bulbosa*

Kirsi ALAHUHTA^{1,*}, Elisabeth CRONE², Anne JÄKÄLÄNIEMI¹, Juha TUOMI³

¹ Department of Ecology and Genetics, University of Oulu, Oulu, Finland

² Department of Biology, Tufts University, Medford, MA, USA

³ Department of Biology, University of Turku, Turku, Finland

* kirsi.alahuhta@oulu.fi

In terrestrial orchids, individual plants do not always sprout every year, but a proportion of the population can remain belowground. This prolonged dormancy can be an adaptation to avoid adverse conditions, e.g. periodic stress or herbivore outbreaks. However, perennial plants can store and reallocate resources across years, so the effects of these environmental drivers can be difficult to detect. Functional linear models (FLM) provide a method to detect short- and long-term effects of these factors. We studied the effect of herbivory and climate factors (monthly temperature and precipitation) on the life-history of an orchid, *Calypso bulbosa*, with demographic and climate data from Finland (2002-2017). We estimated the change in the number of observed plants and vital rates (survival, emergence, flowering) by fitting FLMs with lags 0-5 years in herbivory and 0-24 months in climate factors. In the shortterm, herbivory decreased the number of observed plants and emergence. Warmer fall conditions two years prior increased survival, and one year prior increased the number of observed plants. Warmer conditions in the growing season decreased dormancy the next year. Together, these patterns suggest that dormancy increases under stressful conditions, and that plants respond to environmental drivers at varying time scales.