

MANIPULATION OF HOST PLANT BIOMASS ALLOCATION AND RESOURCE REGULATION BY THE LARCH BUD GALL MIDGE

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INTRODUCTION

Intensive herbivory may influence the resources available to the next generation of herbivore in three ways: quantity may decrease, be unchanged, or increase. There are now two good examples of the last possibility. One of them concerns *Monochamus* beetles on firs in Siberia (Isaev et al. 1984), and the other a galling sawfly on willow in Arizona (Craig et al. 1986). The highly intimate and sedentary way of life of galling insects should predispose them to evolve the means to manipulate their hosts. Therefore, it is not surprising that a third example which we report herein deals also with a gallmaker.

The larch bud gall midge, *Dasyneura rozkovi* Mamaev et Nykolsky, forms galls in the vegetative buds of Siberian larch shoots, causing gall-bearing buds to die. In South Siberia during persistent and heavy infestations, trees may lose up to 95 percent of their buds. Such trees produce no flower buds, so commercial seed production on infested seed orchards is impossible (Isaev et al. 1988).

RESOURCE REGULATION

Our data deal with sixty, 45-year-old sample larch trees in a single seed plantation near Krasnoyarsk which varied considerably in the level of gall infestation. Though the increasing level of bud infestation decreases the number of flowers, it does not influence the current year's crown biomass production. Forming galls appear to function as metabolic sinks working as "redirectors" of tree resources. The tree translocates nutrients to branch periphery where last year's infested shoots are situated. The biomass of newly formed galls is negatively correlated with the biomass increment of older branches. In spite of a great shortage of living buds on 3- to 4-year-old shoots, the infestation level does not influence the total biomass of needles on the branch. This is because the needles of galled buds are much longer than those of ordinary buds on the same tree: the weight of a single needle may increase by 40 percent and the number of needles in the cluster by 11 percent.

The quantity of galls per shoot correlates positively with the incidence of shoot tip mortality and increasing lateral branching. Newly formed shoots have 10 to 15 percent higher bud density per shoot and increase simultaneously with the level of tree infestation. On galled larches, the growth rate of gall midge population density is limited only by the number of newly appearing buds. So in our case we have an example of resource regulation by the herbivore, i.e. the maintenance of higher food base

by the gall midge that impacts immediately the subsequent generation of the same midge population on the same individual plant.

There is no evidence of induced defenses against gallmaker by the larch even though midge infestation has a large impact on tree growth and reproduction. The reaction of larch to defoliation and shoot tip mortality is unspecific: increased branching and bud density following severe defoliation by needle-chewing insects and frost damage (Pleshanov 1982). By redirection of intershoot supplies of nutrients, the gallmaker stops the apical dominance in the shoot system, and in this way simply stimulates dormant meristems, i.e. provokes the process of general response to damage in larch trees (Haukioja et al. 1990).

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