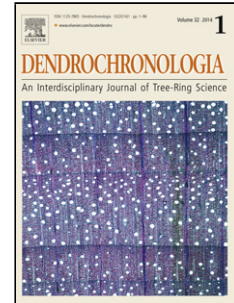


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## Does insect induced defoliation affect anatomical structure of oak wood?

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### Abstract

We counted the intra-annual density fluctuations (IADFs) of oak (*Quercus robur*) tree rings sampled in a deciduous broadleaf forest near Kozelsk (Kaluga region) in the Ugra National Park, Central Russia. Three sites in the same forest massif were sampled. We also sampled ash (*Fraxinus excelsior*) trees in one of these sites as a non-host species for the identification of insect outbreaks. In total, 49 oak and 21 ash trees were sampled and analyses were performed for the period 1878 – 2015. Within the selected time framework, we observed numerous cases with: 1) high percentage of IADFs, 2) decreased oak tree ring widths compared to that of ashes, 3) considerable quantity of oak trees with abrupt growth changes (AGC), and 4) statistically significant differences in counts of IADFs and AGC between the three sampling sites. These traits were characteristic for several consecutive years, and we interpret these as evidence of the insect herbivory causing growth interruptions during the period of the oak leaf expansion. Other external stress factors including summer droughts and late spring frosts can intensify IADFs manifestations during insect outbreaks, but did not affect oak growth strongly enough to cause growth interruptions without insect interference.

**Key words:** IADFs, tree-rings, wood anatomy, dendrochronology, pointer years, Central Russia

### Introduction

Various external factors including seasonal drought, late frost, cold summer, and/or defoliation by herbivorous insects can cause temporal interruption of tree growth and changes of cambial activity. Subsequent growth resumption frequently results in formation of wood anatomical features variously called false rings, double rings, growth zones, intra-annual rings or intra-annual density fluctuations (IADFs). Battipaglia et al. (2016) and De Micco et al. (2016)

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