

Spatial distribution of *Cynips quercusfolii* galls on a leaf and on tree crown level

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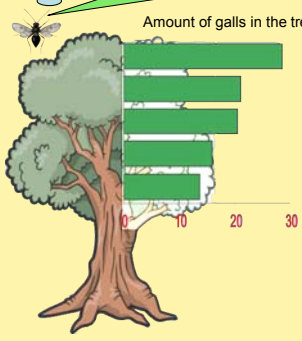


Where will be the best place for my offspring?

I am going to lay out my eggs evenly in the oak crown. The higher dispersion will probably be more advantageous.

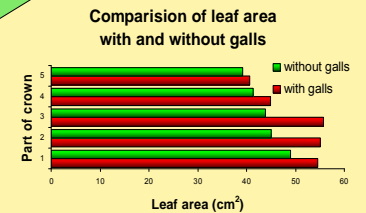
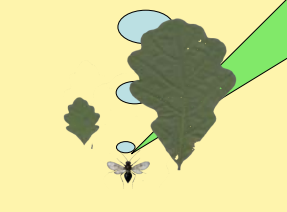
Which leaves should I choose? Small or big?

Bigger are better! Even if other oak leaf lovers choose the same leaf, my babies have a greater chance to complete their development.



Summary ANOVA results for amounts of *Cynips quercusfolii* galls depending on age of tree stand, part of crown and interaction.

Source	df	dffDen	F	p
Age of tree stand	3	43.11	2.41	NS
Part of crown	4	52.75	0.43	NS
A x P	12	52.75	2.04	0.04



Results from logistic regression analyses on the relation between gall presence and leaf area [$y=e^{a+bx}/(1+e^{a+bx})$, x=leaf area; y=gall presence, a=-2.569; b=0.011, $\chi^2=11.05$; p=0.0009]

Introduction
 The cause of spatial distribution of galls is poorly recognized. This concerns also the gall wasps species occurring on oaks (Kampichler and Teschner 2002). Oviposition and development of galls can depend on many factors: phenology of host species, diversity of food quality, place of wintering of the previous generation, risk of parasitism and predation. In some papers there is only short information that lower branches are more infested because larvae hibernate in their galls at the soil level (Skuhrahy and Skuhrava 1996). The placement of *Cynips quercusfolii* L. galls on oak leaves also was not investigated. We decided to test the hypothesis that regardless of tree age the agamic generation of *Cynips quercusfolii* (Hymenoptera) will be randomly distributed in the oak crown and that placement of galls on the leaf surface is also at random.

Material and Methods
 The study was made in central Poland in July 2009 on 16 pedunculata oak (*Quercus robur* L.) trees differing in age (38-95). We used trees cut for other studies. Each crown was divided into 5 parts, and then all leaves were picked and weighed. All leaves with galls were selected out and also weighed. A part of the leaves was weighed and dried to count the dry mass of all leaves. Using WinFolia Pro software we measured the area of 1738 leaves including 195 leaves with galls and the distances along the vein from galls to leaf edge and from galls to petiole.

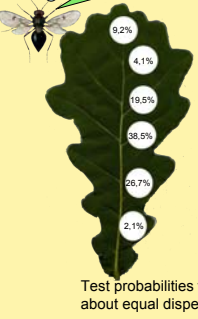
Results
 The number of galls in a particular part of the tree crown is no significantly differentiated, but depends on tree age (significant interaction of part of crown x tree age). In older trees more galls were in the lower part of the crown. Similar results were achieved when the number of galls was counted relative to leaf mass. Regardless of crown part the leaves with galls were significantly larger (3-30%) than controls. An analyses of placement of almost two hundred galls of *Cynips quercusfolii* on pedunculata oak leaves indicated that irrespectively of leaf size the galls are placed at a fixed distance from leaf edge (23.7±0.7mm), however the distance from the gall to the leaf petiole depends significantly on leaf size ($r^2=0.42$; $p<0.0001$; N=195).

Conclusion
 Summarizing the galls of *Cynips quercusfolii* are evenly distributed in oak tree crown and only in the oldest trees the highest infestation is in the lower part of the crown. The large dispersion of galls can limit the influence of parasitism and predation on the population. Agamic females prefer larger leaves and precisely choose a place on the leaf to put their eggs. This is probably dictated to ensure the developing gall a right amount of assimilates.

References and acknowledgement
 Kampichler C., Teschner M. 2002. The spatial distribution of leaf galls of *Mikolia fagi* (Diptera: Cecidomyiidae) and *Neuroterus quercusbaccharum* (Hymenoptera: Cynipidae) in the canopy of a Central European mixed forest. Eur. J. Entomol. 99: 79-84.
 Skuhrahy V., Skuhrava M. 1996. Betrachtung der Gallmücken (Diptera, Cecidomyiidae) an dominanten Forstgehölzen Eurasiens nach ihrem Schädlichkeitsgrad mit einigen besonderen taxonomischen Problemen. Anz. Schädlingskd. Pflanzenschutz, Umweltschutz 69:56-58.
Cynips quercusfolii – picture <http://www.latvijasdaba.lv/kukaini/cynips-quercusfolii/>
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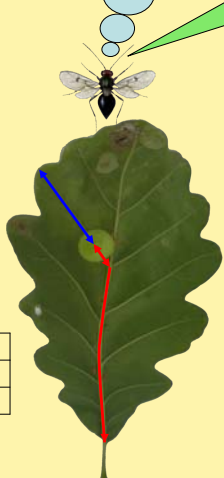
On which part of the leaf must I lay my eggs? I have only a few veins to choose.

I will entrust to the middle veins the care of my offspring.

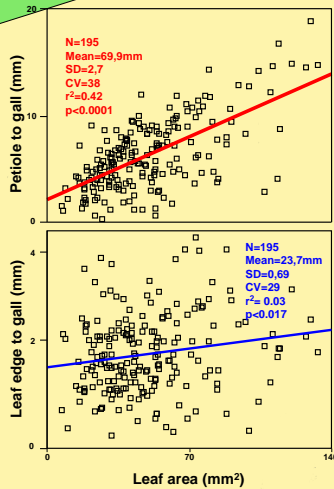


Test	ChiSquare	DF	P
Likelihood Ratio	125.74	5	<0.0001
Pearson	118.14	5	<0.0001

The vein is chosen but at exactly which place should I initiate a gall?



I know that irrespectively of leaf size it has to be at exactly 23,7±0,7mm from the leaf edge but why? This is an assignment for plant-insect interaction researchers.



It was a good choice, Mum!