COMPARATIVE EVALUATION OF PHYLLOXERA ISOLATIONS, WHICH ORIGINATED FROM 10 HUNGARIAN VINE DISTRICTS

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ABSTRACT

The development of resistant rootstocks bred from North American species (e.g. *V. berlandieri* Planch., *V. riparia* Michx, *V. rupestris* Scheele) enabled the redevelopment of European viticulture after the destruction of our vineyard by grape phylloxera (*Dactulosphaira vitifoliae* Fitch, Homoptera: Phylloxeridae). These rootstocks often allow limited growth and reproduction of root-feeding phylloxera without observable vine damage, but may host large numbers of leaf-feeding forms. Three habitats are now commonly inhabited by European phylloxera: commercial vineyards on rootstocks (root-feeding), rootstock mother block (leaf- and root-feeding), and abandoned vineyards, in which rootstocks overtake the *V. vinifera* scions (leaf-feeding). Studies show genetic variations among the phylloxera population exist in California, in Australia, in Europe, also within Hungary. In our study the evolution, development, reproduction of phylloxera from ten Hungarian vine districts are presented on the root of *Vitis vinifera* cv. Chardonnay and on the root of rootstocks of *V. berlandieri* x *V. riparia* Teleki 5C, *V. berlandieri* x *V. rupestris* Georgikon 121 in vitro observations. Our experiment was established according to the method of Granett (1996) and Kocsis (1998) using root bioassay. The eggs were collected in 6 days interval for infestation. The development of the insects was followed from egg hatching stage to adult stage. When phylloxera reached the adult stage than eggs were collected in weekly period. Means are compared by ANOVA. The number of phylloxera eggs was increased rapidly from 18th day. The strains originated from Tokaj and Keszthely (380 and 801 eggs on 32nd day) had higher reproduction and were more aggressive than the others (average production 189,87 eggs). It can be concluded from the results, that Georgikon 121 rootstock as highly phylloxera resistant as *V. berlandieri* x *V. riparia* Teleki 5C. We have used *V. vinifera* cv. Chardonnay for susceptible control, on what the development and reproduction of phylloxera was intense.

IZVLEČEK

PRIMERJAVA POPULACIJ TRTNE UŠI (*Dactulosphaira vitifoliae* Fitch) IZ 10 VINORODNIH OBMOČIJ MADŽARSKE

Razvoj odpornih podlag, vzgojenih iz severnoameriških trt (npr. *V. berlandieri* Planch., *V. riparia* Michx, *V. rupestris* Scheele) je omogočil ponovni razvoj evropskega vinogradništva po uničenju, ki ga je povzročila trtna uš (*Dactulosphaira vitifoliae* Fitch, Homoptera: Phylloxeridae). Te podlage pogosto zavirajo razmnoževanje trtne uši na koreninah, zato škoda ni očitna. Lahko pa se veliko število uši naseli na listih. V Evropi so s trtno ušjo naseljeni trije habitati: gospodarski vinogradi na podlagah (koreninska oblika uši), matičnjaki za podlage (listna in koreninska oblika uši) in opuščeni vinogradi, v katerih odganjki podlag prerastejo cepiče *V. vinifera* (listna oblika uši).
Raziskave kažejo, da med populacijami trtne uši v Kaliforniji, Avstraliji, Evropi in tudi znotraj Madžarske obstaja genetska variabilnost. V prispevku je opisana evolucija, razvoj in razmnoževanje trtne uši iz 10 vinogradnih območij Madžarske na koreninah *V. vinifera*, cv. Chardonnay in na koreninah podlag *V. berlandieri* x *V. riparia* Teleki 5C, *V. berlandieri* x *V. rupestris* Georgikon 121 v poskusih *in vitro*.
Poskus smo izvedli po metodi Granett (1996) in Kocsis (1998) tako, da smo trtno uš naselili na korenine. Trtna uš se je na koreninah uspešno hranila in razvijala. Jajčeca za naselitev korenin smo zbirali v 6 dnevnih presledkih. Razvoj žuželk smo spremljali od izleganja iz jajčec do odraslih osebkov. Ko so se pojavili odrasli osebki, smo jajčeca zbirali v tedenskih presledkih. Povprečja smo primerjali z metodo ANOVA.

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Število jajčec trtne uši je od 18. dne dalje zelo hitro naraščalo. Rase, ki so izvirale iz Tokaja in Keszthelyja (380 in 801 jajčece 32. dan) so se hitreje razmnoževale in so bile bolj agresivne kot druge (povprečno število jajčec 89,87). Iz rezultatov lahko povzamemo, da je podlaga Georgikon 121 na trtno uš enako tolerantna kot *V. berlandieri* x *V. riparia* Teleki 5 C. Za kontrolo smo uporabili *V. vinifera* cv. Chardonnay, na kateri se je trtna uš razvijala in razmnoževala intenzivno. Iz tega sledi, da naše vinograde lahko zavarujemo pred trtno ušjo, če bomo neprestano pozorni na preživetje, razvoj in razmnoževanje tega škodljivca in z razvojem programov žlahtnenja podlag, tolerantnih na trtno uš, z vključevanjem novih vrst iz rodu *Vitis*.

1 INTRODUCTION

Phylloxera is a very small insect, which lives only on the leaves and on the roots of the vine. Phylloxera could not live on any other host. The pest was imported from America with grapevine roots between 1854 and 1860. The insect then spread rapidly across Europe and had destroyed two-thirds of the vineyards of the continent.

It's life cycle has sexual and asexual portions with forms that feed from leaf and root galls. Individuals forming galls on leaves are called *gallicolles* and on roots are called *radicicoles.* Phylloxera feed under the bark of the vine root and so cause the dead of the rootlets and the roots, finally the whole root system. The root galls are termed *tuberosities,* if they occur on mature-suberized roots. They are called nodosities when occurring near root tips.

Not all forms occur throughout the insect's range. Root forms predominate on *Vitis vinifera* cultivars. Leaf forms predominated on other *Vitis* species characteristic of the American native range.

We use grafted vine for a long time in Europe, but second half of the XX. century phylloxera has killed the vine over again. In 80-100 years of preparing grafts phylloxera could adapt oneself to the circumstances so the insect can be present again as an expressive vine damage.

2 MATERIAL AND METHODS

The research was conducted at the Research Plant of the Department of Horticulture at Veszprém University of Agricultural Sciences in Keszthely.

We collected the eggs of the phylloxera from ten Hungarian vine districts and cultured two generations on *V. vinifera* roots before infection. The plant material was obtained from the research station Kecskemet (Chardonnay) and from Cserszegtomaj (Teleki-Kober 5C, , Georgikon 121).

Our experiment was established according to the method of Granett (1996) and Kocsis (1998) using root bioassay. Grape phylloxera feed and develop well on excised roots. The eggs were collected in 6 days interval for infestation.

All the roots were washed with tap water and then rinsed with distilled water. We used 10 cm diameter Petri dish, in which 2 pieces of 8 cm length roots were placed. We prepared cotton wool in distilled water and then coil on each of the end of the roots, where we made a fresh cut. We placed 10 phylloxera eggs on one root and repeated 10 times.

We have noted the number of phylloxera adults, developmental forms of pest, the number of the eggs. We made records on the 12^{th}, 18^{th}, 25^{th}, 32^{nd}, 39^{th}, 46^{th} days from infestation. The number of phylloxera eggs was increased rapidly from 18^{th} day. We choose 25^{th} and 32^{nd} days as the development of the insect was very variable on these days. Means are compared by ANOVA**.**

3 RESULTS AND DISCUSSION

On the diagram can be found by horizontal the phylloxera strain and vertical the number of phylloxera. The dark grey column shows the root of *V. berlandieri* x *V. rupestris* Georgikon 121, the light grey *V. berlandieri* x *V. riparia* Teleki 5C and the white shows *Vitis v.* cv. Chardonnay.

On the 25th day there were only a few larvae. The most adults and eggs were by strain from Tokaj on the root of *Vitis vinifera* cv. Chardonnay.
The phylloxera from Badacsony and Villány could develop well on the root *V. berlandieri* x *V. rupestris* Georgikon 121. The strain from Tokaj reproduced the most eggs on the roots of *V. berlandieri* x *V. riparia* Teleki 5C rootstock.
Means are compared by ANOVA. By roots it can be seen, that Chardonnay is significantly different from Teleki 5C and Georgikon 121. The most significant different was by Tokaj strain.

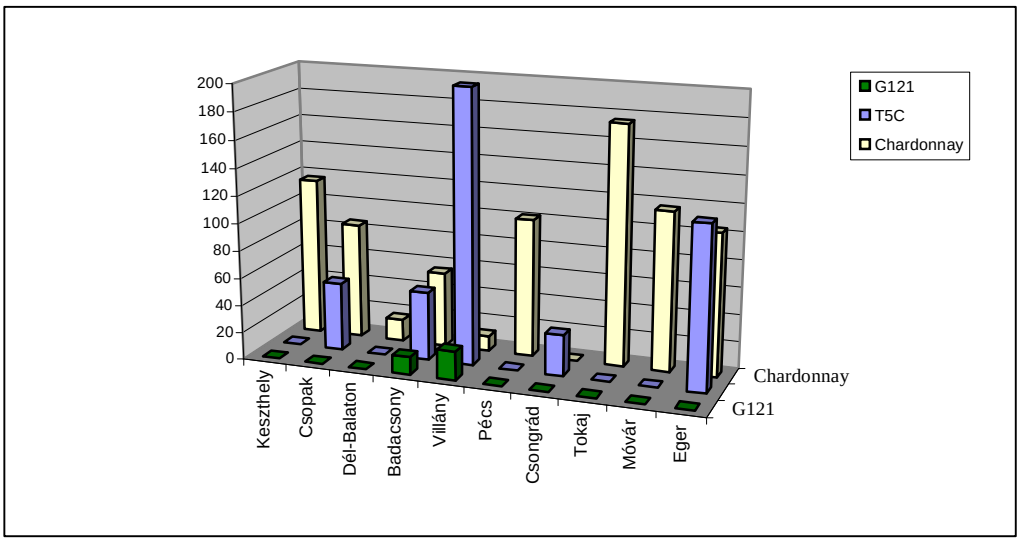

Figure 1: The number of phylloxera eggs on roots (Georgikon 121, Teleki 5C, Chardonnay) on the 25th day.

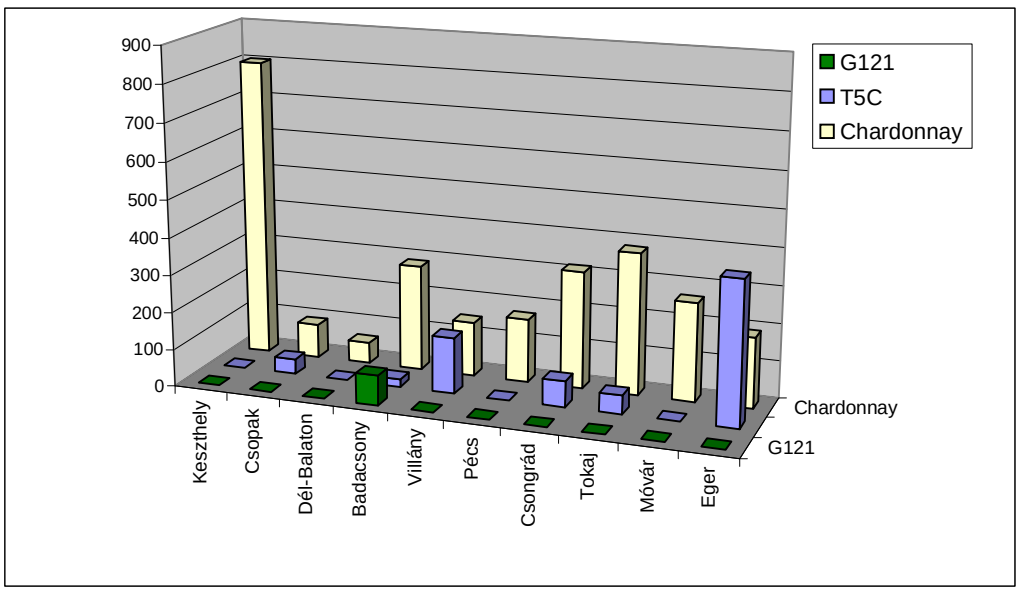

Figure 2: The number of phylloxera eggs on roots (Georgikon 121, Teleki 5C, Chardonnay) on the 32nd day.

On the diagram can be found by horizontal the phylloxera strain and vertical the number of phylloxera. The dark grey column shows the root of *V. berlandieri* x *V. rupestris* Georgikon 121, the light grey *V. berlandieri* x *V. riparia* Teleki 5C and the white shows *Vitis v.* cv. Chardonnay.

On the 32nd day there were larvae small. The number of eggs were by strain from Keszthely the biggest.
The phylloxera from Badacsony could develop well on the root *V. berlandieri* x *V. rupestris* Georgikon 121. The strain from Eger and Villány reproduced the most eggs on the roots of *V. berlandieri* x *V. riparia* Teleki 5C rootstock.
Means are compared by ANOVA. Chardonnay is significantly different from Teleki 5C and Georgikon 121. The most significant different was by Keszthely.
The development of the phylloxera from Badacsony, Villány and Eger were intensive from egg hatching stage to larvae stage on rootstocks (Georgikon 121, Teleki 5C). The phylloxera from Keszthely, Mosonmagyaróvár and Tokaj developed rapidly and aggressively from egg hatching stage to adult stage on root (Chardonnay). At first the phylloxera from Badacsony (80 eggs on the 32nd day) and Villány (21 eggs on the 25th day) developed quickly on Georgikon 121 rootstock, then declined.
The reproduction of the insect from Eger and Villány was on Teleki 5C well (on the 32nd day 385! and 150 eggs). The rootstock Georgikon 121 is proved phylloxera resistant.

4 CONCLUSIONS

The strains originated from Tokaj and Keszthely (380 and 801 eggs on 32nd day) had higher reproduction and were more aggressive than the others (average production 189,87 eggs).
It can be concluded from the results, that Georgikon 121 rootstock as highly phylloxera resistant as *V. berlandieri* x *V. riparia* Teleki 5C. We have used *V. vinifera* cv. Chardonnay for susceptible control, on what the development and reproduction of phylloxera was intense.
The conclusion is, that we can protect our vine from grape phylloxera damage, if attention has paid continuously on survivorship, development, and reproduction of the insect and new *Vitis* sources are involved in breeding phylloxera resistant rootstocks.

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