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Sanitary status of the Eurasian wild grapevine in the South Caucasian region

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Summary

A prospecting on the sanitary status of the aerial organs and roots of the Eurasian wild grapevine, *Vitis vinifera* L. ssp. *sylvestris* (Gmelin) Hegi, was carried out on 14 natural populations situated along river bank forests, floodplains and colluvial positions in Georgia (Marneuli, Mtskheta and Gori districts, Gardabani Protected area and Lagodekhi Reserve), Armenia (Akhtala and Tavoush regions) and Azerbaijan (Quba region). These zones are included within the Holarctic kingdom, Eurosiberian region, and to the Caucasian, Euxine and Hyrcanian biogeographical provinces. The results of study indicate that roots are free of symptoms caused by phylloxera, rot fungi and root-knot nematodes. Symptoms caused by the erineum strain of *Colomerus vitis* (Pagenstecher) and *Calepitrimerus vitis* (Nalepa) (Acari, Eriophyidae) are frequent. On the other hand, damages caused by powdery and downy mildews, *Erysiphe necator* (Schweinitz) Burrill and *Plasmopara viticola* (Berkeley and Curtis) Berlease and de Toni), respectively, show an irregular intensity on leaves belonging to different vines from each location.

K e y w o r d s : *Vitis sylvestris*; mites; nematods; phylloxera; Oidium; Mildew.

Introduction

Vitis vinifera L. ssp. s*ylvestris* (Gmelin) Hegi constitutes the only taxon of the cited genus growing in natural ecosystems of Eurasia from Afghanistan to the Iberian peninsula (Arnold 2002) and the African Maghreb (Ocete *et al.* 2007). Fossils of grapevine from Upper Pliocene were found in the territory of Azerbaijan (Negrul 1959). The South Caucasian region constituted a refuge for this dioecious parental of grapevine during ice ages of the Pleistocene (Musayev and Akparov 2013).

The first confirmation of grape domestication is evident in the Shulaveri – Shomu Tepe culture (Georgia and Azerbaijan) archaeological findings, where wine vessels and seeds from cultivated grape, from around 8,000 B.P. were discovered (Chilashvili 2004). This process of human selection developed almost 800-900 cultivars existing in the South Caucasian area (Negrul 1970), considered the region to be the main cradle of viticulture and winemaking (Vavilov 1926). Wild grapes still constitute a resource for countryside people living in the region to produce medicines, wine, including a flavored dessert one adding aromatic male inflorescences at flowering time (Babayev 1988, Oganesyan 2005, Rivera *et al*. 2012). These inflorescences are also used for artificial pollination of functionally female cultivars (Efendiyev 1972, Cholokashvili 1983). The flowers are good honey organs (Cholokashvili 1983) and their boiled mixture has been suggested as a method to preserve the wine by Alishan (1877). The unripe fruits are used for preparation of a marinade (Sosnowski 1947, Cholokashvili 1983) or for a special sauce (Pruidze 1974).

The coexistence of such plant material with pests and diseases for years could be a source of environmental adaptation. So the aim of the present paper was to study the sanitary status of wild grape populations situated in alluvial and colluvial positions in Armenia, Azerbaijan and Georgia with the idea to evaluate the current situation for its protection in the South Caucasus.

Material and Methods

The sanitary prospection of natural populations of wild grape was organized in Georgia, Armenia and Azerbaijan in October 2013. These zones are included within the Holarctic kingdom, Eurosiberian region, and to the Caucasian, Euxine and Hyrcanian biogeoghraphical provinces. The location based on GPS coordinates and the habitats of the different populations studied is shown in Tab. 1. To detect the presence of symptoms caused by parasitic organisms on roots, they were unearthed up to 40 cm of depth - minimum one plant per population was observed. Samples of fine roots were observed under binocular in order to monitor damages caused by phylloxera, *Daktulosphaira vitifoliae* (Fitch) (Homoptera, Phylloxeridae), root-knot nematodes and rot fungal diseases (Tab. 2). In the aerial part of the all inspected vines, samples of 30 leaves per plant were observed from the available shoots up to 4 m height to examine symptoms caused by parasitic species**.**

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Table 1

Location of studded *Vitis sylvestris* populations in Georgia, Azerbaijan and Armenia in 2013

Site name	District	River basin	Interval of latitude	Interval of longitude	Position*
Georgia					
Nakhiduri	Marneuli	Ktsia	41°29′26,5″ - 44°40′ 51″	41°29′13,1″ - 44°41′22,6″	C
Gardabani protected area	Gardabani	Mtkvari	41°22′19″ - 45°4′6,3″	45°4′37,8″ - 45°4′37,8″	Flood plain
Tsitsamuri	Mtskheta	Aragvi	41°52′28″ - 44°43′51,2″	41°52′38,3″ - 44°43′ 57,3″	C
Tedotsminda	Gori	Liakhvi	42°2′4,1″ - 44°3′42,1″	42°2′20,7″ - 44°3′19,4″	C
Skra	Gori	Mtkvari	41°59′11,7″ - 44°2′47,7″	41°59′13,5″ - 44°2′47,3″	C
60s quarter of Lagodekhi presrv	Lagodekhi	Matmiskhevi	41°48′2,7″ - 46°19′12,2″	41°48′45″ - 46°20′24,8″	A
Azerbaijan					
Guruchai-1	Quba	Guruchai	41°24′1,3″	48°26′37,6″	Flood plain
Guruchai-2	Quba	Guruchai	41°26′3,3″ - 48° 33′50,6″	41°26′3,8″ - 48°33′ 41″	Flood plain
Qusarchai- 1 & 2 (Rostov road)	Quba	Qusarchai	41°28′6,3″ - 48° 33′ 59,9″	41°28′9,8″ - 48°33′ 57″	Flood plain
Dellekkend	Quba	Guruchai	41°24′37,8″	48°35′ 13″	Flood plain
Ağbil	Quba	Qusarchai	41°25′32″ - 48°34′4,7″	41°25′35,4″ - 48°33′54″	Flood plain
Armenia					
Akhtala	Akhtala	Debed	41°6′18,3″ - 44°42′23	41°7′15,8″ - 44°45′16,3″	C
Getahovit	Tavush	Getik	40°54′6″ - 45°7′53″	40°54′ 8,7″ - 45°7′ 9,6″	C

* A means alluvial position (riverbank forest); C: colluvial position (slop of a hill).

Table 2

Number and percentage of affected plants (2013)

Site name	N. plants	*Colomerus vitis*	*Calepitrimerus vitis*	*Erysiphe necator*	*Plasmopara viticola*	Phylloxera	Nematodes	Root rot
Skra	4	4 a	0 a	1 a	2 a	0	0	0
Tsitsamuri	7	6 a	2 a	1 a	7 a	0	0	0
Lagodekhi	9	8 a	0 a	0 a	0 a	0	0	0
Nakhiduri	11	1 c	0 a	0 a	1 a	0	0	0
Gardabani	12	8 a	10 c	5 a	10 a	0	0	0
Tedotsminda	19	16 a	0 a	6 a	19 b	0	0	0
Total GEO	62	43 A (69.4 %)	12 A (19.4 %)	13 A (21.0 %)	39 A (62 9 %)	0	0	0
Guruchai-1	4	4 a	4 a	0 a	4 a	0	0	0
Qusarchai-2	4	4 a	4 a	4 b	4 a	0	0	0
Dellekkend	5	5 a	3 a	4 b	5 a	0	0	0
Ağbil	8	8 a	7 a	8 c	8 a	0	0	0
Guruchai-2	11	11 a	9 a	1 a	11 a	0	0	0
Qusarchai-1	11	6 a	10 a	3 a	11 a	0	0	0
Total AZE	43	38 AB (88.4 %)	37 B (86.0 %)	20 B (46.5 %)	43 B (100 %)	0	0	0
Akhtala	16	14 a	10 a	11 a	16 a	0	0	0
Getahovit	8	7 a	6 a	4 a	7 a	0	0	0
Total ARM	24	21 A (87.5 %)	16 B (66.7 %)	15 B (62.5 %)	23 B (95.8 %)	0	0	0
Total all	129	102 (79.1 %)	65 (50.4 %)	48 (37.2 %)	105 (81.4 %)	0	0	0

Note: Small letters (a, b, c) show differences between country regions. Capital letters (A, B) show differences between countries. When $p < 0.05$ interaction was considered as statistically significant.

Statistical analyses: Chi-square test was used to compare the categorical data within and between groups in order to discern effects of pathogen infection and between populations inside the countries or average for the countries studied. Fisher's exact test was applied where the expected values were less than 5 in a 2 x 2 table.

Results and Discussion

No symptoms caused by phylloxera, root-knot nematodes and fungi were found on roots (Tab. 2). It has to be remarked that Eurasian wild grape has no tolerance to the root phase of this homopteran under artificial infestation in the laboratory tests. So, the absence of the insect in these habitats sampled seems due to the flooding of the soils several months each year (Ocete *et al*., 2011). This edaphic condition could also be responsible for the absence of damages caused by nematode species of *Meloidogyne* and root rot fungal species of *Armillaria.*

The presence of the erineum strain of the mite *Colomerus vitis* (Pagenstecher) (Acari, Eryophidae) is evident on the majority of all the populations observed (Tab. 2), as it was related before on another Georgian population

(Ocete *et al*. 2012). In the case of the present study, the occurrence of this mite was registered in 79.1 % of the vines. Its level of infestation shows small differences along the different South Caucasian countries. Infestation caused by *Calepitrimerus vitis* (Nalepa) (Acari, Eryophidae) affected half the number of observed wild vines (50,4 %). Its percentages of infestation varied from 19,4 % in Georgia, 66,7 % in Armenia to 86 % in Azerbaijan. Powdery mildew, *Erysiphe necator* (Schweinitz), and downy mildew, *Plasmopara viticola* (Berkely & Curtis) Berlease & de Toni were observed in 37,1 % and 81,4 % of the vines, respectively – so this study demonstrated that downy mildew is more frequently found than powdery mildew on South Caucasian wild grape. *P. viticola* is more widespread for Armenia and Azerbaijan, and *E. necator* for Azerbaijan. However, the presence of both monophagous eryophid mites could indicate that they were transferred to cultivars along the domestication process. On the contrary, mildews were imported from North American grapevine species and were transferred from vineyards to the wild habitats.

Conclusions

A prospecting on the sanitary status of the aerial organs and roots of the Eurasian wild grape, *Vitis vinifera* s*ylvestris*, was carried out on 14 natural populations situated along river bank forests, floodplains and colluvial positions in Georgia, Armenia and Azerbaijan. The results indicate that roots are free of symptoms caused by phylloxera, rot fungi and root-knot nematodes. Symptoms caused by the erineum strain of *Colomerus vitis* (Pagenstecher) and *Calepitrimerus vitis* (Nalepa) (Acari, Eriophyidae) are frequent. On the other hand, damages caused by powdery and downy mildews, *Erysiphe necator* (Schweinitz) Burrill and *Plasmopara viticola* (Berkeley and Curtis) Berlease and de Toni), respectively, show an irregular intensity on leaves belonging to different vines from each location. In case of fungal diseases favorable climatic conditions (in majority) plus some interaction of genotypes (for single genotypes) can be considered due to low general resistance of *V. vinifera* towards the fungal deceases. However, the absence of symptoms caused by Phylloxera, nematodes and root-rot fungi could be due to edaphic conditions, not to a real tolerance/resitance of the vines. This fact is important to take into account for the *ex situ* conservation of this taxon.

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