UNIVERZITET U BEOGRADU

BIOLOŠKI FAKULTET

mr Biljana Atanasova

# FAUNA CIKADA (HEMIPTERA: AUCHENORRHYNCHA) U VINOGRADIMA MAKEDONIJE I NJIHOVA ULOGA U EPIDEMIOLOGIJI '*CANDIDATUS* PHYTOPLASMA SOLANI'

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MSci Biljana Atanasova

# FAUNA OF CICADAS (HEMIPTERA: AUCHENORRHYNCHA) IN THE VINEYARDS OF MACEDONIA AND THEIR ROLE IN THE EPIDEMIOLOGY OF '*CANDIDATUS* PHYTOPLASMA SOLANI'

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UNIVERZITET U BEOGRADU

BIOLOŠKI FAKULTET

MENTORI:

_____

dr Željko Tomanović
redovni profesor Biološkog fakulteta u Beogradu

_____

dr Tatjana Cvrković
naučni saradnik Instituta za zaštitu bilja i životnu sredinu u Beogradu

ČLAN KOMISIJE:

_____

dr Ivo Toševski
naučni savetnik Instituta za zaštitu bilja i životnu sredinu u Beogradu

Datum odbrane:

_____

# FAUNA CIKADA (HEMIPTERA: AUCHENORRHYNCHA) U VINOGRADIMA MAKEDONIJE I NJIHOVA ULOGA U EPIDEMIOLOGIJI '*CANDIDATUS* PHYTOPLASMA SOLANI'


## Rezime

Bois noir (BN), oboljenje koje izaziva stolbur fitoplazma, nanosi velike štete u vinogradarskim regionima širom Evro-mediteranskog basena. Tokom 2012. i 2013. godine preduzeta su epidemiološka istraživanja za određivanje potencijalnih insekata vektora i najvažnijih biljaka rezervoara BN fitoplazme u makedonskim vinogradima, u jugoistočnom delu zemlje. Istraživanjem diverziteta vrsta iz podreda Auchenorrhyncha utvrđeno je prisustvo 27 vrsta cikada u okviru 6 familija. Ukupno je registrovana 21 vrsta familije Cicadellidae, 2 vrste familije Cixiidae i po jedan predstavnik familija Aphrophoridae, Delphacidae, Dyctiopharidae i Issidae. Tokom istraživanja utvrđena je izrazita učestalost glavnog vektora stolbur fitoplazme, cikade *Hyalesthes obsoletus*, dok drugi dokumentovani vektor BN, *Reptalus panzeri*, nije zabeležen u makedonskim vinogradima. Molekularna karakterizacija '*Candidatus* Phytoplasma solani' u analiziranom materijalu vršena je analizom genskih regiona *tuf, stamp* i *vmp1* gena, RFLP metodom i sekvenciranjem. Cilj karakterizacije je da se stekne detaljan uvid u molekularnu raznolikost izolata stolbur fitoplazme povezanih sa vinovom lozom, potencijalnim biljkama rezervoarima (*Urtica dioica* i *Convolvolus arvensis*) i jedinkama *H. obsoletus* sakupljenim na ovim biljkama. Ukupno je analizirano 91 izolat stolbur fitoplazme među kojima je identifikovano 3 *tuf*, 5 *vmp1* i 11 različitih *stamp* genotipova. Na osnovu sveobuhvatne *tuf/vmp1/stamp* genotipizacije utvrđeno je ukupno 12 genotipova stolbur fitoplazme. Najveći diverzitet genotipova je identifikovan među izolatima iz *H. obsoletus* sakupljenim na *U. dioica*, od kojih je najčešće bio prisutan genotip tuf-ab/V18/M1 (43%). Tuf-b/V2-TA/STOL genotip je utvrđen u 33% prirodno inficiranih biljaka vinove loze. Dva genotipa stolbur fitoplazme povezana su sa *U. dioica*: tuf-ab/V18/M1 (60%) i tuf-a/V3/M4 (40%), dok je samo jedan genotip (tuf-b/V2-TA/Rqg50) povezan sa *C. arvensis*.



**Ključne reči**: žutila vinove loze, Bois noir, molekularna epidemiologija, *Hyalesthes obsoletus*, varijabilnost *stamp* gena, stolbur fitoplazma.

# FAUNA OF CICADAS (HEMIPTERA: AUCHENORRHYNCHA) IN THE VINEYARDS OF MACEDONIA AND THEIR ROLE IN THE EPIDEMIOLOGY OF '*CANDIDATUS* PHYTOPLASMA SOLANI'


## Abstract

*Bois noir* (BN), induced by stolbur phytoplasma, is an important grapevine yellows disease that causes severe damage in viticultural regions throughout the Euro-Mediterranean basin. Epidemiological survey to determine potential insect vectors and the main reservoir plants of BN phytoplasma in Macedonian vineyards was undertaken between 2012 and 2013 in southeastern part of the country. The study of the species diversity from the suborder Auchenorrhycha revealed the presence of 27 species, belonging to 6 families. The most numerous was family Cicadellidae with 21 species, followed by family Cixiidae with 2 species, Aphrophoridae, Delphacidae, Dyctiopharidae and Issidae with only one species recorded. Our study revealed the high abundance of the principal vector of stolbur phytoplasma, the planthopper *Hyalesthes obsoletus*, while the second documented vector of BN, *Reptalus panzeri*, was not recorded in Macedonian vineyards. A molecular characterization performed by sequence and/or RFLP typing of *tuf*, *vmp1* and *stamp* genes, was used to gain detailed insight into the molecular diversity of the stolbur phytoplasma isolates associated with grapevine, tentative reservoir plants (*Urtica dioica* and *Convolvulus arvensis*) and *H. obsoletus* associated with them. Among 91 stolbur isolates detected in diverse plant and insect hosts 3 *tuf*, 5 *vmp1* and 11 distinct *stamp* genotypes were identified. Overall, twelve comprehensive genotypes of stolbur phytoplasma were detected according to *tuf*/*vmp1*/*stamp* genotyping. The highest diversity of genotypes was detected among the isolates from *H. obsoletus* associated with *U. dioica*, of which the most frequent genotype was tuf-ab/V18/M1 (43%). Tuf-b/V2-TA/STOL comprehensive genotype was found in 33% of naturally infected grapevines. Two stolbur phytoplasma genotypes were associated with *U. dioica*: (i) tuf-ab/V18/M1 (60%) and tuf-a/V3/M4 (40%), while only one genotype (tuf-b/V2-TA/Rqg50) was associated with *C. arvensis*.



**Keywords**: grapevine yellows, Bois noir, molecular epidemiology, *Hyalesthes obsoletus*, *stamp* variability, stolbur phytoplasma.

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