

Population genetics of the global grapevine pest *Colomerus vitis* (Pagenstecher) (Acari: Cecidophyinae: Colomerini)

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Abstract: *Colomerus vitis* (Pagenstecher) is the economically most important pest within the genus *Colomerus*. In addition to direct damage feeding, it also transmits virus diseases in grapevine. Depending on the type of injury, three morphologically identical strains can be distinguished: erineum, bud, and leaf curl strain. Over the last two decades, the use of molecular genetic tools, has contributed significantly to our understanding of natural genetic variation and speciation within different strain of *C. vitis*. Several studies suggest that erineum and bud strain are distinct, closely related species, and indicate that *C. vitis* is a complex of cryptic species. The main objective of our research was to estimate the genetic divergence among the specimens of the erineum strain of *C. vitis* collected in the Balkans (Serbia, Greece, and Croatia) based on the *COI* gene and to combine it with all available data. The analysis of *COI* sequences in the 12 eriophyid populations obtained in this study showed high genetic variability. The presence of two groups corresponding to G1 and G5 was identified by the ML topologies of the phylogenetic tree.

Key words: Eriophyidae, grapevine, genetic divergence, economically important pest

Summary: *Colomerus vitis* (Pagenstecher) is a widespread and economically important eriophyid species infesting grapevine (Duso and de Lillo, 1996). Three morphologically identical strains can be identified based on the type of injury: leaf erineum, bud and leaf curl (Smith & Stafford, 1948). In addition to direct feeding damage, *C. vitis* can also transmit the Grapevine inner necrosis virus – GINV (Kunugi et al., 2000) and the Grapevine pinot gris virus – GPGV (Malagnini et al., 2016). The adult female of the erineum strain overwinters at the bud base or under the bud's scales. Spring activity begins at mean daily temperature of 15.5 °C (Jeppson et al., 1975). The females continue their activity and colonise the opening leaves when the buds enlarge. They form the first erineum on young leaves and begin to reproduce rapidly (Duso and de Lillo, 1996). Embryonic development takes 5-9 days, while the one generation development takes 10-14 days (Jeppson et al., 1975). Leaf damage caused by *C. vitis* feeding includes recognizable white felt-like erineum on the lower leaf surface and swellings on the upper leaf surface.

The taxonomic status of *C. vitis* has been questioned due to the interpopulation morphological homogeneity of different strains (Carew et al., 2004; Valenzano et al., 2020; Saccaggi et al., 2022). In a study based on PCR-RFLP analysis of the *ITS1* region and microsatellite markers, Carew et al. (2004) showed that bud strain and erineum strain of *C. vitis* actually represent two distinct species. Afterwards, in a comparable study, Valenzano et al. (2020), analyzed the protogyne and deutogyne (winter form) of the erineum strain mite using the *ITS1* gene and morphometric data. The study showed that the analyzed specimens belong

to the same species as the bud and erineum derived populations share the same *ITS1* sequence. In a recent study, based on the cytochrome oxidase subunit I gene (*COI*), Saccaggi et al. (2022) showed that the distance between some *C. vitis* populations significantly exceeded the typical intraspecific variation. They concluded that *C. vitis* is a complex of at least five distinct cryptic species. Therefore, the objective of this study was to estimate the genetic divergence between populations of the erineum strain of *C. vitis*, collected in the Balkans (Serbia, Greece, and Croatia), using the *COI* gene and combining it with all available data. The presence of two groups corresponding to G1 and G5 (see Saccaggi et al., 2022), was ascertained by the ML phylogenetic analysis. Moreover, seven populations belonged to the G1 cluster, while five belonged to the G5 cluster. The economic importance and established presence of two cryptic species of *C. vitis* in the Balkans highlight the need for further studies to determine taxonomic status as well as the differences in invasiveness and vector potential.

References

- Carew, M. E., Goodisman, M. A. D. and Hoffmann, A. A. 2004. Species status and population genetic structure of grapevine eriophyoid mites. *Entomol. Exp. Appl.* 111: 87-96.
- Duso, C. and de Lillo, E. 1996. Grape. In: Lindquist, E. E., Sabelis, M. W. and Bruin, J. (eds.): *Eriophyoid mites – their biology, natural enemies and control*, World Crop Pests, Vol. VI, pp. 571-582. Elsevier, Amsterdam, The Netherlands.
- Jeppson, L. R., Keifer, H. H. and Baker, E. W. 1975. *Mites injurious to economic plants*. Univ. of California Press.
- Kunugi, Y., Asari, S., Terai, Y. and Shinkai, A. 2000. Studies on the grapevine berry inner necrosis virus disease. 2. Transmission of grapevine berry inner necrosis virus by the grape erineum mite *Colomerus vitis* in Yamanashi. *Bull. Yamanashi Fruit Tree Exp. Stn.* 10: 57-63.
- Malagnini, V., de Lillo, E., Saldarelli, P., Beber, R., Duso, C., Raiola, A., ...and Gualandri, V. 2016. Transmission of grapevine Pinot gris virus by *Colomerus vitis* (Acari: Eriophyidae) to grapevine. *Arch. Virol.* 161: 2595-2599.
- Saccaggi, D. L., Maboei, P., Powell, C., Ngubane-Ndhlovu, N. P., Allsopp, E., Wesley-Smith, J. and van Asch, B. 2022. Towards solving the “*Colomerus vitis* Conundrum”: Genetic evidence reveals a complex of highly diverged groups with little morphological differentiation. *Diversity* 14(5): 342.
- Smith, L. M. and Stafford, E. M. 1948. The bud mite and the erineum mite of grapes. *Hilgardia* 18(7): 317-334.
- Valenzano, D., Tumminello, M. T., Gualandri, V. and de Lillo, E. 2020. Morphological and molecular characterization of the *Colomerus vitis* erineum strain (Trombidiformes: Eriophyidae) from grapevine erineum and buds. *Exp. Appl. Acarol.* 80: 183-201.