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Introduction

Hawaii's coffee industry, produced commercially on six islands by over 1,470 growers on ~10,000 acres, is conservatively valued at \$100M per year. Until late October 2020, Hawaii was the only major coffee producing region of the world that was free of Coffee Leaf Rust (CLR). Since its introduction (Keith et al. 2022), CLR has rapidly spread throughout the state and can be found on coffee farms and feral coffee. More than 55 different rust races from coffee growing countries worldwide have been identified (Silva et al. 2022).

Materials/Methods

In June 2021, nine spore samples from symptomatic cultivated and feral plants 'Typica' growing on three islands (Hawaii Island: 3, Maui: 5, Molokai: 1) were collected in gelatin capsules using a G-R Electric Manufacturing portable vacuum pump with a mini cyclone spore adapter. The samples were sent to the Coffee Rust Research Center (CIFC) in Portugal. At CIFC, the urediniospores were bulked on susceptible genotype 849/1 Matari and inoculated on a set of coffee differentials following a standard race-typing procedure (Várzea and Marques 2005). The genotype of virulence of rust samples was inferred according to Flor's gene-for-gene theory (Silva et al. 2022).

References:

Keith, L. M., Sugiyama, L. S., Brill, E., Adams, B. L., Fukada, M., Hoffman, K. M., Ocenar, J., Kawabata, A., Kong, A. T., McKemy, J. M., Olmedo-Velarde, A., and Melzer, M. J. 2022. First report of coffee leaf rust caused by *Hemileia vastatrix* on coffee (*Coffea arabica*) in Hawaii. *Plant Disease* Published Online: 16 Jan 20 2. Figueiredo, P., Arruda, H. V. 1974. DE Estudo da biologia de algumas raças de *Hemileia vastatrix* Berk. & Br. *Arquivos do Instituto Biológico* 41(1): 47 – 51.. Silva, M.d.C.; Guerra-Guimarães, L.; Diniz, I.; Loureiro, A.; Azinheira, H.; Pereira, A.P.; Tavares, S.; Batista, D.; Várzea, V. 2022. An Overview of the Mechanisms Involved in Coffee-*Hemileia vastatrix* Interactions: Plant and Pathogen Perspectives. *Agronomy*, 12: 326. Várzea, V. M. P., Marques, D. V. 2005. Population variability of *Hemileia vastatrix* vs. coffee durable resistance. In, 'Durable Resistance to Coffee Leaf Rust' (Eds L. Zambolim, E. M. Zambolim, V. M. P. Várzea). pp. 53–74. (Vicosa: Universidade Federal de Viçosa).

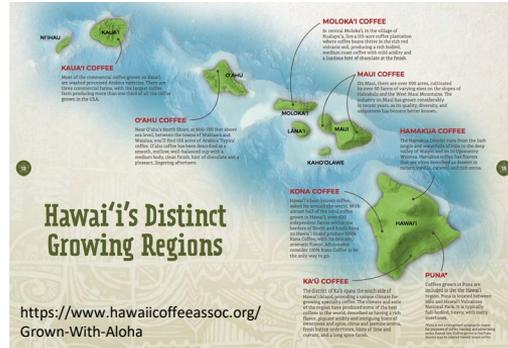


Figure 1: Coffee production on the islands of Hawaii



Figure 2: Coffee Leaf Rust on 'Typica' plants

Results/Discussion

The genes of virulence v2, v4, and v5 (Race XXIV) were identified in all rust samples from all islands in Hawaii, supporting the theory of a single introduction to the state, which subsequently spread. Race XXIV was previously characterized at CIFC and is commonly found in the majority of coffee-growing countries in South and Central America, Africa and Asia (CIFC's data base). According to Figueiredo & Arruda (1974), race XXIV is considered highly aggressive with a high spore germination rate, medium germ tube length, and short incubation period required for infection. Race XXIV is pathogenic to all coffee Arabica genotypes with the resistance genes SH5 or SH2,5 like varieties Blue Mountain, Bourbon, Catuai, Caturra, Kent's, Kona, K7, Mundo Novo, SL 28, SL 39, as well as Accession "Agaro" with resistance genes SH4,5 (CIFC's records). On the other hand, this race is not virulent to some other Arabica genotypes, such as Geisha (SH1,5), S.288 (SH3,5), and Dilla & Alge (SH1). Race XXIV is unable to infect derivatives of interspecific tetraploid hybrids like the groups Catimor and Sarchimor (Bettencourt and Rodrigues 1988).

Conclusion/Perspectives

This is the first report of race XXIV on *Coffea arabica* in Hawaii. This finding is essential to evaluate the potential resistance of coffee germplasm existing in Hawaii or to be introduced in this region to develop new varieties.