

**PhD student position available at Plant Health Institute (PHIM), Montpellier, France**

<https://umr-phim.cirad.fr/en>

Starting date: 1<sup>st</sup> of December, 2021

**Project: Role of viral and host factors in circulative transmission of tomato begomoviruses by the whitefly *Bemisia tabaci***

Transmission of plant viruses by insect vectors is a complex phenomenon involving viral, plant and insect factors. Begomoviruses (mono or bipartite ssDNA viruses, genus *Begomovirus*, family *Geminiviridae*) are major pathogens of crop plants worldwide. They are exclusively transmitted by the whitefly *Bemisia tabaci* in a persistent-circulative manner, such that once ingested from the plant phloem through the whitefly stylet, virions pass to the midgut, cross to the hemolymph, and move into the primary salivary glands, where they are egested back to plant with salivary secretions. Little is known about components of “virus transmission complex” that besides virions (circular ssDNA encapsidated by viral coat protein) may contain other viral or host proteins and nucleic acids which may play a role in circulation and persistence in the insect vector. The most predominant and invasive whitefly biotypes causing begomoviral epidemics worldwide are Middle East Asia Minor 1 (MEAM1) and Mediterranean (MED). Contrary to previous reports, most recent evidence indicates that the monopartite tomato yellow leaf curl virus replicates in the salivary gland cells of MEAM1 flies and the replication enhances transmission efficiency and persistence of this virus. In plant cells, begomoviruses replicate via rolling circle and recombination-dependent mechanisms generating circular ssDNA genomes and linear concatemeric dsDNA, respectively, and thereby evade small (s)RNA-directed RNA interference (RNAi) and gene silencing-based antiviral defences. Evidence for begomovirus replication in whitefly raises questions on the mechanism(s) of replication and the induction of the insect defences based RNAi and innate immunity and on insect defense evasion and/or suppression by viral proteins. Our main objectives will be to (i) elucidate a composition of “virus transmission complex” present in plant phloem and ingested by MEAM1 and MED whiteflies fed on tomato plants infected with monopartite and bipartite begomoviruses, (ii) validate the function of insect proteins implicated in virus circulation and transmission, (iii) investigate viral replication in whitefly and its impact on virus persistence and transmission efficiency, and (iv) explore the role of sRNAs and RNAi in plant-virus-whitefly interactions and virus transmission. Phloem-mobile viral and virus-induced plant sRNAs are implicated in trans-kingdom RNAi and silencing of the insect defence genes. Based on this phenomenon, a virus-induced gene silencing (VIGS) approach generating artificial phloem-mobile siRNAs was successful in knocking down target genes in whitefly. We will employ a VIGS approach based on a disarmed begomoviral satellite to validate the roles of viral and host factors in virus circulation and persistence in whitefly and transmission to new plant, with an ultimate goal to develop new strategies for control of viral disease spread at the transmission step.

Financed by the Indo-French fund CEFIPRA (<http://www.cefipra.org/>) and the French Occitanie region fund RIVOC (<https://rivoc.edu.umontpellier.fr/>)

We are looking for **candidates with skills in plant molecular virology**

Contact:

**Mikhail Pooggin** (Email: [mikhail.pooggin@inrae.fr](mailto:mikhail.pooggin@inrae.fr)), team DefensiRNA:

<https://umr-phim.cirad.fr/en/research/virus-vector-plant-interactions-virom/defensirna-group>