Book of Abstracts

5th International Vanilla Congress
Reunion Island, 4-7 June 2024

Compiled by Pascale BESSE, Carine CHARRON & Michel GRISONI
UMR PVBMT, CIRAD-Université de La Réunion
F-97410 Saint-Pierre, La Réunion, France

Scientific Committee

Pascale BESSE - University of La Réunion
Carine CHARRON – CIRAD
Michel DRON - University Paris Sud
Michel GRISONI – CIRAD
Eric JENNINGS - University of Toronto
Michel MANCEAU - DEMETER
Emerson PANSARIN - University of São Paulo
Paulo PARADA MOLINA - University of Veracruz
Araceli PEREZ SILVA - Technological Institute – Tuxtepec
Aro Vonjy RAMAROSANTRATANA- University of Antananarivo

Organizing Committee

Chairs:
Pascale BESSE - University of La Réunion
Michel GRISONI – CIRAD

Cathucia ANDRIAMIHAJA - University of La Réunion
Adrien BRIGO - CIRAD
Carine CHARRON – CIRAD
Virgile CONDINA – CIRAD
Quentin DA SILVA – University of La Réunion Marion
DAILLOUX - CIRAD
Michel DRON - University Paris Sud
Isabelle FOCK-BASTIDE – University of La Réunion
Cyril JOURDA – CIRAD
Thierry PAILLER – University of La Réunion Quentin
PIET - University of La Réunion
Rinah RAVELONANOSY - University of La Réunion
Marc SEGUIN - CIRAD
Chantal TERRENTROY - CIRAD
Aurélie TOCK – CIRAD
Déborah TURPIN – CIRAD

Acknowledgments

Conseil Régional de La Réunion

Conseil Départemental de La Réunion

Union Européenne

Agropolis Fondation

Direction des Relations Internationales,
Université de La Réunion

Fédération BioST,
Université de La Réunion

Toarova Project

Vaniclim, Conahcyt Project

Detailed program

Monday 3rd June, 2024

16:00 – 19:00 Registration of participants and welcoming cocktail

Tuesday 4th June, 2024

08:30 – 09:30 Late registrations and Welcoming coffee

09:30 – 10:10 Welcoming conferences

10:10 – 11:25 **Inaugural conferences,** *Convener: Michel Grisoni*
10:10 Provanille Cooperative, Graziella Catan*
10:30 Eric Jennings*

11:30 – 13:10 Lunch

13:10 – 15:45 **Topic 1 "Vanilla bio-ecology, diversity of resources and uses"**
Convener: Pascale Besse
13:10 Emerson Pansarin*
14:05 Adam Karremans
14:30 Coffee break
14:50 Ken Cameron*

15:45 – 16:45 **Flash presentations of posters**, *Convener: Carine Charron*

Wednesday 5th June, 2024

08:30 – 10:15 **Topic 1 "Vanilla bio-ecology, diversity of resources and uses"**
Convener: Pascale Besse
8:30 Aro Vonjy Ramarosandratana*
9:25 Felambinintsoa Cathucia Andriamihaja
9:50 Alemao Botomanga

10:15 – 10:35 Coffee break

Keynote speaker

10:35 – 16:25 **Topic 2 "New approaches and practices for sustainable vanilla production, particularly in the context of climate change",**
Convener: Michel Grisoni
10:35 Paulo Parada Molina*
11:30 Charlotte Watteyn

12:00 – 13:30 Lunch and Group photography

13:30 Alan Chambers*
14:25 Quentin Piet
14:50 Quentin Da Silva
15:15 Coffee break
15:35 Mauricio Luna Rodriguez
16:00 Guillaume Lalanne-Tisné

19:30 – 23:00 Social Dinner (Zinzin Grand Bois) for registered participants

Thursday 6th June, 2024

08:30 – 10:00 **Vanilla collection visit** D. Turpin, C. Charron, M. Grisoni

10:00 – 11:30 **Posters session** and Coffee break

11:30 – 12:30 **Vanilla Genome Hub** Stéphanie Bocs*

12:30 – 13:50 Lunch

13:50 – 16:55 **Topic 3 "Innovations and trends in vanilla curing and marketing",**
Convener: Michel Dron
13:50 Araceli Pérez-Silva*
14:45 Zeineb Nhouchi
15:10 Keshika Mahadeo
15:35 Michel Dron
16:00 Michel Manceau*

16:55 – 18:25 Best posters awards and Closing cocktail

Friday 7th June, 2024

07:00 – 17:30 Vanilla Tour for registered participants

*Keynote speaker

Table of contents

Table of contents

Inaugural conferences

I-01. Provanille and the Reunion's vanilla sector

Graziella Catan *[1]

[1] Provanille – Réunion

In this presentation, we will first present the vanilla sector of Reunion Island; producers, pod production, local market, consumption and imports. Detail the model of agrotourism (40,000 tourists per year) and preservation of traditional heritage and know-how, notably through the Protected Geographical Indication "Vanilla from Reunion Island" and the organic labels. Then we will focus on the activities of the Provanille Cooperative; History of the creation of the Cooperative (established in Bras Panon since 1950), specificity of the value chain; Advantages and constraints of being a member of the cooperative. Then we will discuss Provanille's 2030 objectives: produce 20 to 30 tons of green vanilla (thanks to technical optimization of cultivation methods, taking into account global warming, and expansion of cultivated areas), increase our pod processing capacity, modernization and upgrading of processes (HACCP), and improve our curing processes with new equipment.

Keywords: Provanille, Coopérative de vanille de La Réunion

*Keynote Speaker

I-02. Vanilla Voyages: The history of vanilla introductions to Bourbon (Réunion), Madagascar and Tahiti in the 19th century

Eric Jennings * [1]

[1] University of Toronto, Department of History – Canada

This presentation focuses on vanilla circulation in the 19th century, in particular on the different waves of diffusion to Bourbon, Madagascar and Tahiti. It traces waves of introductions in each case, including different varietals (*pompona* and *planifolia*). It also provides a new narrative for the first arrival of vanilla in Tahiti, which bypasses the Philippines, thereby debunking a leading origin story. Based on new archival sources conducted on five continents, my presentation begins by reviewing the successive waves of introductions to Bourbon: the epic Perrotet/ Philibert mission of 1819-1820 that began in French Guyana and then extended into Southeast Asia, as well as the Marchant introduction of 1822 from Paris. Next, the paper turns to Madagascar. I demonstrate that vanilla first reached Nosy Be through the efforts of French botanist Louis-Hyacinthe Boivin in the 1840s. Vanilla was later brought to Madagascar's terra firma at Vatomandry in 1873. The third and final part of my paper deals with Polynesia. Standard genealogies have vanilla first arriving in Tahiti from the Philippines in 1848. However, a box in the French colonial archives contains several critical pieces of evidence to the contrary. Thanks to this key source, I will demonstrate that vanilla first reached Tahiti from Mexico in 1846, and not from the Philippines in 1848 as has been commonly held. This has bearing on the thorny question of *Vanilla tahitensis*' origins, to which I hope to contribute in the process.

Keywords: Circulation, Introductions, History

*Keynote Speaker

Topic 1

“Vanilla bio-ecology, diversity of resources and uses”

O-01. The natural history of Neotropical Vanilla

Emerson Pansarin * [1]

[1] University of Sao Paulo – Brazil

With more than 40 species, the Brazil is the center of diversity for *Vanilla*. Currently, many Brazilian species have been described or rediscovered, and taxonomic realignments have been carried out based on integrative taxonomy. The accuracy in species delimitation is important for studies on phylogeny and ecology, and because some Brazilian vanilla seems to be inappropriate to human consumption. *Vanilla* is monophyletic, with three main lineages, two of which occur throughout the Neotropics. The pollination system of Neotropical *Vanilla* is not species-specific, and their flowers are commonly adapted to pollination by euglossine males. The pollination mechanism of euglossinophilous *Vanilla* is based on a combination of perfume collection and nectar seeking. At least one species, *V. palmarum,* is pollinated by hummingbirds representing an evolutionary disruption in the pollination system among *Vanilla*. With regards to seed dispersal, the mesocarp of species with dehiscent fruits are rich in raphid idioblasts that can be harmful to seed dispersers. For this reason, in *Vanilla* with dehiscent fruits, birds and mammals commonly access the sclerotic seeds through fruit valves. Seeds of *Vanilla* with indehiscent fruits are dispersed by terrestrial herbivores. Besides the nutritive rewards, fruits are rich in polyphenols toxic to omnivores. The chemical scarification of seed coat by the digestive acids is crucial for synchronizing the biological processes involved in seed germination.

Keywords: Neotropics, Pollination, Seed dispersal, Reproductive biology, Phylogeny, Systematics

*Keynote Speaker

O-02. The identity crisis of the "Mexican" Vanilla

Adam Karremans * [1]

[1] Centro de Investigación Jardin Botánico Lankester, Universidad de Costa Rica – Costa Rica

Upon publishing the genus name *Vanilla* Mill. in 1754, Philip Miller did not designate a type species. He did mention that it was the fruit of these plants which the "Spaniards in America" called Vanilla and which was "much used by them to scent their Chocolate". In 1768, When Miller updated his definition of *Vanilla*, proposing the name *Vanilla mexicana* Mill. for the species cited above. Naturally, *Vanilla* was typified with the name *V. mexicana*, a species which became associated with vanilla of commerce. However, it later became apparent that early authors had confused different aromatic and non-aromatic *Vanilla* species under the name *V. mexicana* and unfortunately the name actually refers to a species that neither grows in Mexico, nor is aromatic and of commercial interest. The aromatic Mexican *Vanilla* thereafter became known as *V. planifolia*. In Mexico, *Vanilla planifolia* seems rather rare in nature, and the name has been heavily associated with the aromatic vanillas in cultivation. Wild populations in Central America, which have somewhat smaller flowers and fruits, have even been suggested to be a different species. But it is these, and not the commercially grown varieties, which in fact are more similar to the original drawings of the type of this species. We propose recognizing these wild forms of *V. planifolia* as typical for the species and have made a formal proposal for substituting the type of genus *Vanilla*, from the non-Mexican and non-aromatic *V. mexicana* to the well-known and aromatic *V. planifolia*.

Keywords: Taxonomy, *Vanilla mexicana*, *Vanilla planifolia*, *Vanilla sotoarenasii*, Wild relatives

*Speaker

O-03. Population genetics, mycobiome metabarcoding, and fungal endophyte isolation have implications for the conservation of North America’s native Vanilla species

Ken Cameron * [1]

[1] Department of Botany, University of Wisconsin-Madison (WIS) – 430 Lincoln Drive, Madison, WI 53706, United States

Although *Vanilla* is a tropical genus, there are six species indigenous to the continental United States. Four are native: *Vanilla barbellata, V. dilloniana, V. mexicana*, & *V. phaeantha*. Unfortunately, the first two are already considered extinct in North America, whereas *V. barbellata* & *V. phaeantha*’s distribution is limited now only to a few protected areas. Their habitats face numerous environmental threats including loss of pollinators, habitat fragmentation, and rising sea levels due to climate change; conservation efforts are needed immediately. For *V. barbellata*, a total of 115 individuals from two Floridian populations and three Caribbean populations were sampled. The *V. planifolia* draft genome was used to identify a filtered set of 12,825 single nucleotide polymorphism markers generated via Genotyping-By-Sequencing. From these data we calculated current genetic diversity, investigated evidence of gene flow, and documented low heterozygosity among disjunct populations of sampled populations. Additionally, we isolated endophytic fungi to ascertain their diversity and to acquire fungi with the potential to germinate *Vanilla* seeds. Furthermore, we compared and contrasted the mycobiomes of leafless *V. barbellata* and leafy *V. phaeantha* from among their different biological compartments. We argue that future conservation efforts must consider relocation of *Vanilla* species via assisted migration or ex situ cultivation and should consider also these documented fungal communities.

Keywords: Conservation, Fungi, Genetics, Population

*Keynote Speaker

O-05. Divergent perceptions of the worth of leafless Vanilla spp. Exist among various communities in Madagascar

Aro Vonjy Ramarosandratana * [1], Malalatiana Raveloarison [2], Alemao Botomanga [2], Nicola Fuzzati [3], Vololoniaina Hary Jeannoda [2]

[1] University of Antananarivo, Department of Plant Biology and Ecology, 101 Antananarivo – Madagascar;

[2] University of Antananarivo, Department of Plant Biology and Ecology, 101 Antananarivo – Madagascar

[3] Innovation Research Development Laboratories – CHANEL Parfums Beauté – France

Perception plays an important role in conservation, as it influences behavior towards species and their natural habitats. The island of Madagascar is widely recognized as the primary producer of *Vanilla planifolia*, providing a significant means of subsistence for farmers. Despite this, less attention has been accorded to the perceptions of local communities with respect to leafless *Vanilla* species. This research sought to address the following questions: (i) What is the perception of each ethnic group towards the leafless *Vanilla* species (ii) What implications do these perceptions have for future conservation initiatives? In order to address these queries, semi-structured interviews were conducted at four sites in the northern region and three lo- cations in the southern region. Textual analysis revealed variations in the perceptions of wild species between the northern and southern communities. The results indicated that the northern respondents generally perceived the latter as a potential threat to their children and villages, whereas the southern respondents regarded them as sources of fodder, medicine, and food. Differences were observed between the sexes. Men typically concentrated on the value of leafless *Vanilla* species, whereas women frequently associated it with children. These findings will prove valuable in the customization of future conservation strategies for these species.

Keywords: Conservation, Crop wild relatives, Local perception

*Keynote Speaker

O-06. An integrative approach for the conservation of taxonomically complex groups: the case of Madagascar endemic leafless Vanilla species (Orchidaceae)

Felambinintsoa Cathucia Andriamihaja * [1], Aro Vonjy Ramarosandratana[2], Michel Grisoni [3], Vololoniaina Hary Jeannoda [2], Pascale Besse [1]

[1] University of La Réunion, UMR PVBMT, F-97410 St Pierre, Reunion Island - France

[2] University of Antananarivo, Department of Plant Biology and Ecology,101 Antananarivo – Madagascar

[3] CIRAD, UMR PVBMT, 501 Toamasina – Madagascar

Species conservation is a difficult task, especially when it involves taxonomically complex groups, where conventional species identification fails. Such is the case of the *Vanilla* genus, which comprises 18 leafless species spread across the Caribbean, Asia and the south-west Indian Ocean region. In Madagascar, leafless vanillas are under constant threat from deforestation and harvesting for medicinal purposes. They have strong morphological similarities and chloroplast DNA failed to differentiate them. We therefore used an integrative approach to resolve the taxonomy of these species and provided the information needed to plan their conservation. Phylogenetic analyses based on the ITS region combined with microsatellite genetic structuring and morphological comparison confirmed the presence of seven species in Madagascar, two of which are newly described. Genetic analyses and information on reproductive biology suggest that *V. atsinananensis*, *V. allorgeae* and *V. decaryana* are threatened by low population density, loss of interaction with pollinators and high inbreeding, respectively. Based on spatial distribution modeling, *V. bosseri* and *V. perrieri* are of least concern as they are widespread on the west coast. *V. madagascariensis* and *V. humblotii* are vulnerable due to their restricted potential distribution. To protect these wild species, ex situ and in situ conservation with a strong involvement of local communities should be implemented.

Keywords: Integrative taxonomy, Genetic diversity, Reproductive biology, Species distribution modelling

O-07. The Malagasy leafless vanillas face limitations in recruitment of young seedlings due to drought conditions

Botomanga Alemao * [1], Vololoniaina H. Jeannoda [1], Nomenjanahary N. Hoby [1], Andrianantenaina Gabriel J. [1], Nicola Fuzzati [2], Ramarosandratana Aro Vonjy [1]

[1] University of Antananarivo, Department of Plant Biology and Ecology, 101 Antananarivo - Madagascar

[2] Chanel Parfums Beauté – Innovation Research Development Laboratories – France

The survival of young seedlings is intricately tied to the environmental conditions. In the present study, we investigated seedling recruitment across 13 ecologically diverse sites and con- ducted in situ experiments to elucidate the key factors influencing germination and seedling survival in leafless vanilla species. Subsequently, we conducted in vitro seed germination trials and evaluated tolerance to water stress at various stages of seedling development. Among the studied sites, three showed non-zero recruitment rates, with two sites presenting rates exceeding 50%. Our findings revealed that the recruitment rates were influenced by the fruiting success, acidic nature of the soil, thinness of the litter, and soil clay composition. Surprisingly, the seed-baiting experiments yielded no germinated plantlets after one year. A 12-months in situ monitoring period showed 90% seedling loss after prolonged drought. In vitro germination assays revealed two distinct peaks corresponding to the germination of immature white seeds after four months, and the germination of mature black seeds eight months later. Water stress induced by the addition of a high concentration of gelling agents leads to either mortality or stunted growth depending on the seedling developmental stage.

Keywords: Orchids, Regeneration, Seeds

*Speaker

Topic 2

“New approaches and practices for sustainable vanilla production, particularly in the context of climate change”

O-08. How climate change is addressing tropical agriculture? Loss of suitable vanilla area

Paulo César Parada * [1]

[1] Facultad de Ciencias Agricolas, Universidad Veracruzana – Mexico

Agricultural production is affected by climate change as it depends on different atmospheric conditions, particularly in tropical regions. Spatial and temporal changes in climatic conditions and an increase in extreme weather events are projected which, together with climate variability, would reduce the suitability of climate in different areas for different crops. This generates various impacts on agricultural activities such as the reduction of production and yield, alterations in the duration of the development phases of crops, prolonging or shortening, increase in the right conditions for the proliferation of pests, and with it also the increase of agricultural inputs. However, when the spatial scale of the study is reduced, it is identified that climate changes are not uniform in different regions. There are particular local changes whose impacts will depend on local characteristics, production systems, and the type of producer, as crop resilience depends on them. A particular case is that of vanilla (Vanilla planifolia), a tropical crop classified as having a high degree of genetic erosion because its worldwide distribution for cultivation is mainly carried out by clones, which makes it susceptible to climate change and its effects, being evident in various regions. In addition, the number of areas suitable for its cultivation is expected to decrease. However, it must also be considered that it is grown under shade, in conditions that differ from the environment, making it more complex to study.

Keywords: Climatic suitability, Climatic seasons, Water stress

*Keynote Speaker

O-09. On a spicy journey: In search of climate resilient vanilla production systems

Charlotte Watteyn * [1], Adam Karremans [2], Steven Janssens [3], Bart Muys[1]

[1] KULeuven – Belgium

[2] Lankester Botanical Garden – Costa Rica

[3] Meise Botanical Garden – Belgium

Both staple food and cash crops provide livelihoods to millions of smallholder farmers in the tropics, with cash crops offering great opportunities for rural development. Vanilla is a high value tropical cash crop and a globally important spice used in a broad spectrum of food products. Future vanilla bean supply is, however, at risk due to the combined effect of a genetically eroded crop species with an over-intensified farming system. The negative effects associated with low genetic diversity are expected to exacerbate under climate change, and there is an urgent need to enhance vanilla production resilience through diversification at both crop and system level. Despite the promising role of the wild relatives of the crop species *Vanilla planifolia*, an in-depth evaluation to integrate these so-called crop wild relatives into breeding programs with improved plant performance under climate change, is currently lacking. Our study seeks to guide the development of a climate-smart vanilla production strategy that involves novel *Vanilla* genetics. We apply an innovative approach that combines state-of-the-art techniques within the field of species distribution modelling and population genetics, to (i) formulate a conservation scheme for priority conservation areas (i.e. areas holding populations with great climate adaptive capacity), and (ii) outline a *Vanilla* provenancing strategy by labelling populations or genetic variants that may serve as donors for crop improvement and breeding.

Keywords: Agroecosystems: Climate change resilience, Crop wild relatives, Diversification, Population genetics, Socio, ecological systems

O-10. Improving the future of vanilla for growers, buyers, and consumers through plant breeding, genetics and genomics

Alan Chambers * [1]

[1] KeyGene USA – United States

Vanilla is among the most expensive and cherished spices globally, but has not generally benefited from modern plant improvement. Legal definitions have restricted commercial vanilla extract to the properly cured beans of either *Vanilla planifolia* or *V.* × *tahitensis*. Interestingly, many of these legal frameworks were created before the true nature of this species and hybrid, respectively, were resolved. There are significant risks to the vanilla industry due to the massive clonal propagation of a few foundational clones. Similar risks exist for the citrus and banana industries that are currently threatened with devastating diseases. Plant breeding is one powerful solution to the lack of genetic diversity and the risks associated with vanilla monoculture. While most of the world's vanilla is sourced from Madagascar, there are interesting and genetically diverse types of vanilla found at the center of cultivation from North to South America. These types could be used in a plant breeding program to generate new cultivars with increased yield, disease resistance, and even flavor. This presentation will demonstrate how plant breeding, genomics, and gene editing are being used to create the next generation of elite vanilla cultivars.

Keywords: Plant breeding, Gene editing, Genomics

*Keynote Speaker

O-11. Advances in reconstructing the genome of *Vanilla planifolia*: addressing partial endoreplication challenges

Quentin Piet * [1], Gaëtan Droc [2], William Marande [3], Gautier Sarah [2], Stéphanie Bocs [2], Christophe Klopp [4], Mickael Bourge [5], Sonja Siljak-Yakovlev [6], Olivier Bouchez [7], Céline Lopez-Roques [7], Sandra Lepers-Andrzejewski [8], Amaury Dedours [9], Fanny Lambert [10], Michel Dron [11], Pascale Besse [1], Michel Grisoni [12], Cyril Jourda [13], Carine Charron [13]

[1] University of La Réunion, UMR PVBMT, F-97410 St Pierre, Reunion Island – France; [2] UMR AGAP Institut, Univ Montpellier, CIRAD, INRAE, Institut Agro, 34398 Montpellier – France; [3] INRAE, CNRGV, Genotoul, 31326 Castanet-Tolosan – France; [4] Plateforme Bioinformatique, Genotoul, BioinfoMics, UR875 Biométrie et Intelligence Artificielle, INRAE, Castanet-Tolosan – France; [5] Cytometry Facility, Imagerie-Gif, Université Paris-Saclay, CEA, CNRS, Institute for Integrative Biology of the Cell (I2BC), 91198 Gif-sur-Yvette – France; [6] Université Paris-Saclay, CNRS, AgroParisTech, Ecologie Systématique Evolution (ESE), 91190 Gif-sur-Yvette – France; [7] INRAE, GeT-PlaGe, Genotoul, 31326 Castanet-Tolosan – France; [8] Etablissement Vanille de Tahiti, Uturoa - French Polynesia; [9] Eurovanille, Rue de Maresquel, 62870 Gouy Saint André – France; [10] Département Biotechnologie, V. Mane Fils, 06620 Le Bar Sur Loup – France ; [11] University Paris-Saclay, CNRS, INRAE, Univ. Evry, Institute of Plant Sciences Paris-Saclay (IPS2), 91405 Orsay – France; [12] CIRAD, UMR PVBMT, 501 Toamasina – Madagascar; [13] CIRAD, UMR PVBMT, F-97410 St Pierre, Reunion Island – France

Despite *Vanilla planifolia*'s economic importance, genomic resources decisive in modern diversity studies and breeding programs have been lacking. Recent attempts to reconstruct this 4.09 Gb diploid genome (16 pairs of chromosomes) revealed insights into gene (~59,000) and repeat content (72% of the genomic sequence). However, none fully succeeded in reconstructing the entire sequence, with the most complete assembly reaching 82% of the expected size and anchoring only one-third of its sequence on a total of 14 pairs of chromosomes, meaning that two pairs are still missing. In addition to frequent aneuploidy and a high rate of repeats, the main cause of the difficulties encountered seems to be partial endoreplication (PE), an orchid specific phenomenon involving several replication rounds of a fraction of the genome without cell division. PE varies in genome proportion and amplification intensity depending on the species and the tissues observed. Latest efforts from the Vaniseq consortium, leveraging tissue selection and technological advancements, are finally leading to a complete and more contiguous assembly, focusing on a better understanding of PE. All in all, this assembly and its refined annotation, along with the recent increase of *Vanilla* related omics data, should open up new possibilities in several fields, including vanilla varietal improvement and diversity studies.

Keywords: *Vanilla planifolia*, Genomics, Partial endoreplication

*Speaker

O-12. Genetic basis of vanilla plant resistance to *Fusarium oxysporum* f. sp. *radicis-vanillae*, the causative agent of root and stem rot disease

Quentin Da Silva * [1], Félicien Favre [1], Katia Jade[2], Pascale Besse [1], Carine Charron [2]

[1] University of la Réunion, UMR PVBMT, F-97410 St Pierre, La Réunion – France

[2] CIRAD, UMR PVBMT, F-97410 St Pierre, La Réunion – France

Fusarium oxysporum f. sp. *radicis-vanillae* (Forv) is a soil-borne fungus responsible for the fusariosis, a major disease affecting cultivated vanilla plants, causing root and stem rot. Harnessing resistance sources within the natural diversity of the *Vanilla* genus is currently the most effective strategy for sustainable disease management. Deciphering the molecular factors involved in this resistance is essential for further marker assisted breeding of resistant plants. The recent availability of a population of 126 progenies (AF CR40) resulting from self-pollination of the susceptible *Vanilla planifolia* cultivar CR0040, exhibiting a distribution of resistant and susceptible profiles, has enabled the construction of a first genetic map of resistance to a highly pathogenic strain of Forv. Twenty quantitative trait loci (QTLs) associated with this resistance, explaining a significant portion of the phenotypic variance, have been identified and localized in gene-rich regions. Using the complete genome sequencing of CR0040, genes potentially involved in biotic resistance mechanisms have been pinpointed at the QTL level, including genes encoding Leucine-Rich Repeat (LRR) motif proteins, kinases or pentatricopeptide repeat (PPR) proteins. These recent studies have opened new opportunities for characterizing the resistance of vanilla plants to fusariosis.

Keywords: *Fusarium oxysporum* f. sp. *radicis vanillae*, Genetic resistance, QTL

*Speaker

O-13. Metabolomics of the interaction *Vanilla planifolia – Fusarium oxysporum*

Mauricio Luna Rodríguez *[1], Sacsi Xhanat Cervantes-Herrera[1], José Antonio Guerrero Analco[1], Juan Luis Monribot Villanueva [1], Lourdes Georgina Iglesias-Andreu[1] , Nadia Guadalupe Sánchez-Coello[1]

[1] Universidad Veracruzana – Mexico

Exploring the metabolic pathways and natural defense induction mechanisms of the plant in interaction with the pathogen will allow understanding how the plant responds during the infection process. The objective of this research was to evaluate the distinctive metabolic differences of *V. planifolia* in its interaction with pathogenic (M21C5) and non-pathogenic (BC1) strains of *F. oxysporum*. The metabolic response was determined in root, stem, and leaf, at three exposure times. Samples were analyzed by RP-UPLC coupled to Q-TOF-MS. The results reveal that the most significant differences in the chemical profiles were identified 5 days after inoculation. The biosynthesis of phenylpropanoids, flavonoids and the metabolism of one-carbon units were the distinctive pathways of the interaction with M21C5. Meanwhile, for the interaction with BC1, the biosynthesis of secondary metabolites, phenylpropanoids and the metabolism of starch and sugar, seem to strengthen the defense in *V. planifolia*. The mycotoxins nivalenol and deoxynivalenol 3-glucoside were found in a differentiated manner at 36 h in roots and stems of vanilla inoculated with BC1, and ergothioneine and deoxynivalenol in roots and stems of vanilla cuttings inoculated with M21C5 at 36 h and 5 days after inoculation.

Keywords: Defense pathways in vanilla, Distinctive metabolic, Deoxynivalenol, Nivalenol

*Speaker

O-15. Diversity of cultivable endophytic bacteria in *Vanilla planifolia* across organs and influencial factors and their potential phytobeneficial impact

Guillaume Lalanne-Tisné * [1,2], Jean-Christophe Meile [2], Ahmed Taïbi [3], Suzanne Petit [1,2], Natoavina Faliarizao [1,2], Hasna Boubakri [4], Hippolyte Kodja [1,2]

[1] Université de La Réunion – France

[2] Qualisud - Pôle de La Réunion – France

[3] GreenCell SA – GreenCell SA – France

[4] Université Claude Bernard Lyon 1 - Faculté des sciences – France

Our study focuses on the diversity of cultivable endophytic bacteria present in this plant. By closely examining the spatial distribution of these bacterial communities within vanilla organs (green pods, aerial, and terrestrial roots) and considering different cultivation practices, along with pod development stages, we aimed to decipher their influence on these microbiomes. Taxonomic identification of isolates reveals an astonishing wealth of microbial diversity within vanilla. The distribution of genera shows a lower presence in terrestrial roots compared to aerial organs. The abundance of bacteria in aerial roots underscores their crucial role in the exchange between the plant and its environment. By evaluating the effect of pod maturity stages, we observed a correlation between the predominant presence of specific bacterial genera, such as *Bacillus* or *Lysinibacillus*, at mid-pod maturity, and an increased presence of *Pseudomonas* at full maturity. This observation suggests a specific recruitment of beneficial bacteria for plant growth, particularly from the *Pseudomonas* genus. This hypothesis is supported by the competencies of *Pseudomonas* strains in various beneficial functions for plants. This study highlights the potential of vanilla as a promising source of beneficial bacteria for the development of new biofertilizers suited to agriculture in La Réunion.

Keywords: Endophytic Bacteria, Cultivation practice, Microbial ecology, Plant Growth, Promoting Bacteria

*Speaker

O-VGH. Exploring the *Vanilla planifolia* genome using bioinformatics tools such as the Vanilla Genome Hub

Gaëtan Droc [1, 2, 3], Quentin Piet [4] , Gautier Sarah [2, 3] , Stéphanie Bocs [1, 2, 3]*

[1] CIRAD, UMR AGAP Institut, 34398 Montpellier - France

[2] French Institute of Bioinformatics (IFB) - South Green Bioinformatics Platform, Bioversity, CIRAD, INRAE, IRD, 34398 Montpellier - France

[3] UMR AGAP Institut, Univ Montpellier, CIRAD, INRAE, Institut Agro, 34398 Montpellier - France

[4] University of la Réunion, UMR PVBMT, F-97410 St Pierre, Reunion Island - France

Among tropical crops, the tricky *Vanilla planifolia* genome has been sequenced. Two haplotype-level genomes were produced: Daphna cultivar in 2020 and CR0040 cv in 2022. To explore CR0040, we developed a genomic portal https://vanilla-genome-hub.cirad.fr. First, we will present the Genome Hubs, knowledge systems based on generic and modular web applications such as those of the GMOD project or the South Green bioinformatics platform. We will then examine this genome version in relation to the 16-chromosome structure, the process of partial endoreplication (PE) and the orchid ancestral whole genome duplication (*alpha*-o WGD). Using advanced-search and browsing tools, we will identify candidate genes relevant to the vanilla value chain. For instance, we will look for protein genes involved in the biosynthesis of shikimate derivatives (phenylpropanoid metabolism), such as methyltransferases. aldehyde lyases (*e.g.* 4HBS, VAN), also part of the vanillin pathway, contribute to the aromatic bouquet of vanilla. Additionally, we will search for transcription factors involved in regulating flowering and fruit development (e.g. MADS-box in pod dehiscence). Building on this experience, we are considering developing a new version of the Vanilla Genome Hub to explore genetic diversity within the *Vanilla* genus as part of ongoing omics projects. These tools will contribute to a shared understanding of the evolution of this genus within orchids and to vanilla improvement.

Keywords: Vanilla planifolia, Bioinformatics, Comparative genomics, Metabolic pathway, Regulatory network

---

*Speaker

Topic 3

"Innovations and trends in vanilla curing and marketing"

O-16. New vanilla species in trade

Araceli Pérez-Silva * [1]

[1] Tecnológico Nacional de Mexico campus Tuxtepec – Mexico

Global climate change has impacted vanilla production across various regions. One strategy to address the challenge of increasing vanilla production affected by this phenomenon is the domestication, study, and utilization of wild species with commercial potential due to their aromatic attributes. Mexico, Guatemala, Colombia, Costa Rica, Ecuador, Peru, and Brazil are among the American countries rich in *Vanilla* genus germplasm. Aromatic species include *V. cribbiana*, *V. odorata*, *V. sotoarenasii*, *V. bahiana*, and *V. chamissoni*. This presentation discusses research results on *V. cribbiana* and *V. odorata*, revealing vanillin contents surpassing those in *V. planifolia*, along with the presence of anisic compounds that give them a distinctive aromatic profile and a chemically different composition compared to well-known species. Both species have recently been proposed as new commercial alternatives in the draft standard for vanilla during the fifth session of the Codex Committee on Spices and Culinary Herbs.

Keywords: Aroma vanilla, Climate change, Wild species

*Keynote Speaker

O-17. Impact of post-harvested period on chemical and sensorial properties of *Vanilla planifolia* and *Vanilla pompona* vanillas

Zeineb Nhouchi * [1], Anaick Ravier *[1], Cyrille Santerre *[1], Nadine Vallet *[1]

[1] Institut Supérieur International du Parfum, de la Cosmétique et de l'Aromatique alimentaire (ISIPCA), 34-36 rue du parc de Clagny, F-78000 Versailles – ISIPCA – France

Vanilla holds a preeminent position in global flavorings and ranks as the second most costly spice worldwide following Saffron. From a botanical view, vanilla is a tropical perennial plant from the *Orchidaceae* family, with 18,500 species across 788 genera. Three of them are cultivated: *Vanilla planifolia, Vanilla pompona,* and *Vanilla tahitensis*. The aromatic complexity of vanillas is continuously interesting scientific committee. To upgrade the litterature, this study was performed to evaluate the chemical and sensory specificities of *V. planifolia* and *V. pompona* originate from Caribbean Island through the scald and scarification transformation processes, as well as two different refining times (T1 and T2). Chemical characterization using GC-MS, showed a significant difference between the two species, where vanillin was mostly present in *V. planifolia*, unlike *V. pompona*, where mainly rich in 4-methoxybenzyl alcohol. In the other hand, sensory analysis was carried out through sessions of terms generation for both olfaction and gustation after infusing vanilla beans in milk at a temperature of 95 °C. Regardless the heat treatment and the vanilla specie, all samples were described as sweet, gourmand and milky. The application of the agglomerative hierarchical clustering showed a significant difference between vanillas. Indeed, the dendrogram was composed of three groups, where *V. planifolia* scalded and *V. pompona* scarified belongs to the same groups for T1.

Keywords: *Vanilla planifolia*, *Vanilla pompona*, Sensory analysis, GC, MS, Correlation, Aromatic profile

O-18. Exploring bacterial endophyte communities and the chemical profile of *Vanilla planifolia* according to the substrate nature

Keshika Mahadeo * [1], Ahmed Taïbi [2], Jean-Christophe Meile [2], Bertrand Côme [3], Hasna Boubakri [4], Aude Herrera-Belaroussi [4], Anne Gauvin-Bialecki [1], Hippolyte Kodja [2]

[1] Laboratoire de Chimie et Biotechnologie des Produits Naturels, Faculté des Sciences et Technologies, Université de la Réunion, 15 Avenue René Cassin, CS 92 003, 97 744 St Denis Cedex 9, La Réunion – France ; [2] QualiSud, Université de La Réunion, Univ Montpellier, Avignon Université, CIRAD, Institut Agro,Montpellier – France ; [3] La Vanilleraie, 2 ter Domaine du Grand Hazier, allée Chassagne, 97441, La Réunion – France ; [4] Université Claude Bernard Lyon 1, UMR Ecologie Microbienne, UMR CNRS 5557, UMR INRAE 1418, VetAgro Sup, 69622 Villeurbanne– France

Different cultural techniques are used to cultivate Vanilla. On Reunion Island, *V. planifolia* is widely cultivated in forest-type land (95% of the production) and a few cultivators have chosen to grow vanilla in shade houses. Two types of substrates are mainly used for the cultivation in shade houses: leaf litter and compost. The diversity of Vanilla rhizosphere bacterial community and endophytes are now known to influence plant health and response to environmental stress. And some bacteria might play an important role in the formation of aroma. The aim of this study was to explore the chemical profile of vanilla beans according to the type of substrate. The composition and diversity of the Vanilla rhizosphere bacterial community were explored by analyzing rhizosphere soil and root tissue samples as well as green pods of three accessions of *Vanilla planifolia* grown on different types of substrates. The chemical profiles of *Vanilla planifolia* beans were analyzed and the bacterial composition of the soil, roots, green pods, and cured pods were explored using a metabarcoding approach. The results showed that the non- volatile composition and the vanillin content differed according to the type of substrate. Besides, the bacterial species richness and diversity were higher in the compost substrate. The genera *Halomonas, Pseudoalteromonas, Bacillus, and Carboxydocella* were found in the beans after scalding and sweating and might contribute directly or indirectly to the formation of aromatic compounds.

Keywords: Endophytes, Substrate, Microbial transmission, Chemical profile

O-19. New 2D 1H-detected NMR experiments to detect Nicotine in natural extracts of *Vanilla planifolia*, issued from islands of the Indian Ocean

Michel Dron * [1], Caroline Mauve [1], Benoit Kuate Wafo [1], Boris Goullieux[2], François-Marie Moussalieh [2], Bertrand Gakiere [1], Françoise Gilard [1]

[1] Institut des Sciences des Plantes de Paris-Saclay – Université d'Évry-Val-d'Essonne, Université Paris-Saclay, Centre National de la Recherche Scientifique, Université Paris Cité, Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement – France

[2] Institut de Chimie Moléculaire et des Matériaux d'Orsay – Institut de Chimie - CNRS Chimie, Université Paris-Saclay, Centre National de la Recherche Scientifique – France

Nicotine is a chemical barrier against herbivores. Is nicotine accumulated in vanilla pods? Preliminary tests have been carried out on *Vanilla planifolia* beans from islands of the Indian Ocean to identify metabolites that can be observed by GC/MS. This technique revealed the presence of nicotinic acid, which is an intermediate of the production of nicotine in the tobacco biosynthesis pathway. Because GC/MS analysis appears insufficiently sensitive in the detection of various molecules, we decided to focus on the identification and quantification of nicotinic compounds in vanilla beans using Nuclear Magnetic Resonance (NMR) spectroscopy. Most of the recent methods in the field of 1D/2D NMR have been implemented for that purpose. In this context, new 2D 1H-detection experiments have been developed, such as the QUantItative Perfected and pUre-shifted 1H-13C HSQC or QUIPU HSQC. This method, developed by us at University Paris-Saclay, allows to detect metabolites up to 100 μM for acids embedded in extracts of *Arabidopsis thaliana* leaves. This work will allow to check for the presence of putative endogenous nicotine production using isotope labelling. We are using NMR techniques and 13C labelling since these are powerful tools for the elucidation of biosynthesis pathway. This principle of carbon-13 enrichment, combined with follow-up NMR labeling, has previously been used by our MetaboActions team to highlight the biosynthetic pathway of a specialized metabolite in clary sage.

Keywords: Nicotine, 2D1H NMR, Vanilla

*Speaker

O-20. Vanilla market volatility and speculation: Market trends and price scenarios. How can farmers cope while maintaining decent incomes?

Michel Manceau * [1]

[1] Demeter – The VanillaReport – France

The global vanilla market presents glaring contradictions: while demand is growing slowly and steadily with the entry of new markets (new countries and products), supply is undergoing episodes of intense rise in prices following episodes of profound decline. This brings producing countries apart of Madagascar to develop or leave production depending on its profitability for producers (India, Uganda, etc.) adding instability to this market. The climate and particularly the cyclones which affect Madagascar have been accused of being responsible for these ups and downs but a deeper analysis of the data shows quite clearly that this market undergoes significant cycles of speculation, buyers taking advantage of periods of depressed price levels to buy large quantities of pods which are then stored away from markets before being released at a much better price. Vanilla producers around the world benefit from periods of rising prices to develop their production and improve their lifestyles (solar panels, housing, etc.) but cannot save their profits and find themselves in periods of crushed prices having to face lean periods where rice is scarce and they face famine. Attempts to rebalance farms through crop diversification are underway and seem to be satisfactory: they concern fish farming, poultry farming and market gardening, for which there is significant domestic demand on the one hand, and other cash crops on the other (cloves, pepper, turmeric, ginger, aromatic essential oils, etc.).

Keywords: Vanilla Market

*Keynote Speaker

Posters

P-01. Advances on physicochemical characteristics of Aguajales peatlands and their relationship with *Vanilla pompona* from the Peruvian Amazon

Silvia Aguero -Aguilar * [1,2], Raúl Blas * [1]

[1] Universidad Nacional Agraria La Molina, Facultad de Agronomia, Instituto de Biotecnologia (IBT) – Peru

[2] Instituto de Biologia del Suelo – Peru

The flooded forests of the Peruvian Amazon are carbon sinks, as are the peat bogs, habitat of *Mauritia flexuosa* "aguaje", a trellis species of *Vanilla pompona* For this reason, the objective was to relate the physicochemical properties of Aguajales peatlands with nutrition of *V. pompona.* Three locations were chosen: Yantaló (5o58'9.4"S,77o1'24.9"E) and Tingana (5o53' 52"S,77 o7' 39"E) and Bello Horizonte (12o28'39" S, 69o 5'20.6"E). In July and September 2023, five points were sampled per location and at two levels: a) organic matter (mainly decomposition of bark from the aguaje stem and understory vegetation) of 0-20 cm and b) hydromorphic soil (organic and fine sediments) "mud" of 20 cm until the presence of water. Analysis of organic matter, macro and micronutrients, C/N and physicochemical characterization of soils were carried out: texture, pH, %organic matter, P ppm, K ppm, CEC, % gravimetric humidity and microbial population (CFU/g soil). The results: pH 5.6, 4.8, 5.7 for Yantaló, Tingana and Bello Horizonte respectively, %Humidity 254 – 662, sandy clay loam - silty clay texture, > 20% organic matter, 20 – 40 P ppm, > 20 C/N. Total bacteria and fungi 107 and 105 CFU/soil respectively. This information is the first advances which shows the high activity of microbial decomposition present mainly in peatlands given their optimal C/N ratio, explaining the cycling of nutrients and their nutrition availability for the *V. pompona*.

Keywords: Organic matter, Vanilla nutrition, Soils Amazon

*Speaker

P-02. The potential roles of warty structures on the stem of leafless vanillas

Andrianantenaina Johnson Gabriel * [1], Alemao Botomanga [1], Hoby Nomenjanahary [1], Nicola Fuzzati [2], Aro Vonjy Ramarosandratana [1]

[1] University of Antananarivo, Department of Plant Biology and Ecology, 101 Antananarivo – Madagascar

[2] Chanel parfums beauté – Innovation Research, Innovation Research Development Laboratories – France

The leafless vanilla stem possesses unique structures known as warts, which are displayed in either a rounded or elongated configuration and are subsequently classified into three categories: isolated, grouped, and mixed. Therefore, we investigated the potential ecological significance of these structures. An anatomical study of the warts showed that the origin was located at the four outermost cortical layers of the stem. A comparison of stomatal density between the warty and smooth parts showed twice as many stomata in the smooth parts ($P < 0.0001$). This suggests a possible role for reducing the number of stomata in mitigating evapotranspiration. The analysis of distribution along the stems revealed a low density of warts in the youngest parts compared to the old branches located at the base of the vine ($P < 0.008$). This could be seen as a defense mechanism to ward off terrestrial herbivores by mimicking the appearance of the skin of certain reptiles. However, there are no living reptiles on the island with a skin texture resembling the warty appearance of leafless vanilla stems. Morphological comparison of the stems showed that wart density is a distinctive characteristic of leafless *Vanilla* species.

Keywords: Batesian mimicry, Orchids, Plasticity

*Speaker

P-03. Towards understanding the genetic basis of pollinator-relevant floral traits in Orchids

Philipp Schlüter * [1]

[1] University of Hohenheim – Germany

Most orchids cannot self-pollinate and - unlike commercially grown vanilla with its human helpers - orchids mostly rely on insect pollinators for pollen transfer. Floral traits are crucial to mediate both long-distance attraction and close-range interactions with pollinators. Under- standing how these traits, including scent, colour and texture and geometry, affect pollinator behaviour is therefore of key interest to address questions about plant ecology and evolution, and may perhaps one day enable the rational re-design of crop flowers for improved pollination. Currently, however, the genetic, developmental and genomic bases of pollination-relevant floral traits are only poorly understood in orchids. Our research program therefore aims to establish the function and molecular basis of such traits in *Ophrys* orchids, which feature highly specific pollination. We have assembled the chromosome-level genome of *Ophrys* to identify candidate genes underlying important floral traits and we have begun investigations into the developmental genetics of labellum features. We hope that results from this research will ultimately benefit researchers interested the biology of orchid flowers and pollination more broadly, including *Vanilla*.

Keywords: Pollination, Floral traits, Genomics

*Speaker

P-04. Biological Resource Center Vatel: to safeguard and promote access to genetic diversity within the *Vanilla* genus

Déborah Turpin * [1], Virgile Condina [1], Katia Jade [1], Michel Grisoni [2], Marc Seguin [1], Carine Charron * [1]

[1] CIRAD, UMR PVBMT, F-97410 St Pierre, La Réunion – France

[2] CIRAD, UMR PVBMT, 501 Toamasina – Madagascar

The conservation of biodiversity, whether wild or cultivated, is crucial in this context of global climate change. Biological Resource Centers (BRC) are dedicated to the preservation, characterization, and distribution of biological samples representative of this biodiversity. The BRC Vatel, located in Reunion Island and managed by CIRAD, has the mission of safeguarding and promoting access to the diversity of plant varieties traditionally cultivated in Reunion Island. Five collections are maintained: Vanilla, tropical garlic, root and tuber vegetables, seed vegetables, and maize. The CRB Vatel has been ISO 9001 certified since 2021. The vanilla collection includes accessions of the three cultivated species (*Vanilla planifolia*, *V. pompona* and *V.* × *tahitensis*) as well as 25 wild relatives and interspecific hybrids. Vanilla genetic resources are preserved as vines in shadehouses, on field plots, or as *in vitro* in the Plant Protection Platform facilities. Over the past ten years, BRC Vatel has provided vanilla material to one hundred clients in fourteen countries. It has contributed to major work on the genetic diversity and evolution of cultivated and wild vanillas, on the mechanisms of biosynthesis and storage of aromatic compounds in the fruit, and on resistance to fusariosis. The BRC Vatel is involved in the VaniSeq consortium Research project which aims to decipher the complex genome of *V. planifolia*, and is also running breeding programs to produce new vanilla varieties.

Keywords: Genetic diversity, Plant collection, *Vanilla* genus

*Speaker

P-06. Impact of apex pinching on *Vanilla planifolia* flowering

Charlotte Daguenet * [1,2], Frédéric Chiroleu [1], Michel Grisoni [3], Alizée Guimbeau [4], Amaury Dedours [2], Isabelle Fock-Bastide [1]

[1] Université de La Réunion, UMR PVBMT, 97410 St Pierre, La Réunion – France

[2] Eurovanille, Rue de Maresquel, 62870 Gouy Saint André – France

[3] CIRAD, UMR PVBMT, 501 Toamasina – Madagascar

[4] Saint Aubin Limitée – Mauritius

Vanilla planifolia vines typically start flowering three years after planting. It is accepted that flowering is triggered by stresses i.e. low temperatures, drought, light, physiological disturbances such as the pinching of hanging stems apices (decapitation). However, the determinism of flowering remains little studied and cultural practices aimed at promoting flowering are mainly based on empirical observations. The objective of this work was to study the effectiveness of decapitation to promote flowering. A trial was conducted on 180 *V. planifolia* plants grown under shade house in Mauritius for three productions cycles. Decapitation was performed on 120 plants (on 1 to 7 hanging stems per plants). The rest were kept as controls. 84% of the inflorescences occurred on hanging stems. In cycles 2 and 3 the probability of flowering was five and three times higher, respectively, for decapitated stems compared to undecapitated ones. Additionally, decapitated stems tend to produce a slightly higher number of inflorescences than non-decapitated stems: 2.5 versus 2 inflorescences/stem. We also showed a delayed effect of apex pinching on flowering: the rate of decapitated stems setting flowers was 3.7 times higher after two years than after one year. Therefore, in our conditions, decapitation significantly promotes the flowering of *V. planifolia*. However, further work should clarify the best date for pinching and its transferability to other conditions.

Keywords: Orchidaceae, Flowering induction, Shoot apex decapitation

*Speaker

P-08. Invasion and spread of the mealybug *Conchaspis angraeci* (Hemiptera: Conchaspididae), a major obstacle for the Comorian vanilla plantation development

Issa Mze Hassani * [1], Salima Nouhou *[1], Hamza Abdou Azali [1], George Goergen [2]

[1] Institut National de Recherche pour l'Agriculture, la Pêche et l'Environnement (INRAPE), Md´e Ex-CEFADER B.P : 289 Moroni – Comoros

[2] International Institute of Tropical Agriculture (IITA), 08 BP 0932 Tri Postal, Cotonou – Benin

Comorian economy is dominated by cash crops which provide up to 90% of exports and of which vanilla (*Vanilla planifolia*) has taken an important place given its yields and its value. However, from 2003, a drop in its price led to some farmers abandoning the crop. Since 2017, initiatives have been taken to revive cultivation and increase its production. However, as early as September 2017, the vanilla mealybug *Conchaspis angraeci* (Hemiptera: Conchaspididae) was detected, causing a major impact on production. A study of its dispersion was carried out between October 2017 and February 2019 on 24, 17 and 13 sites, respectively in Grande-Comore, Anjouan and Mohéli. It was based on surveys and observations in order to identify its presence, infestation rate and host plants. The results showed a wide dispersion on Grande-Comore causing significant damage to lianas up to 90% of which 19 sites were infested with more than half being severely affected by this mealybug. While in Moheli as in Anjouan, it was only observed on one site. Four severely infested ornamental species were identified as host plants. These are *Acalypha wilkesiana*, *Codiaeum variegatum* (Euphorbiaceae), *Hibiscus rosa-sinensis* (Malvaceae) and *Polyscias guilfoylei* (Araliaceae). Severe attacks by *C. angraeci* were observed in Grande-Comore with the widely distributed host plants constituting important reservoirs. These plants could be the source of Comoros vanilla infestation, hence the importance of their management in the fight against this pest.

Keywords: Invasion, *Conchaspis angraeci*, Host plant

*Speaker

P-09. Preservation of the genetic diversity of Madagascar vanilla: Towards sustainable vanilla crops adapted to climate change

Rafanoharana Tojomanana * [1], Ma-Hong Faratiana Lysia [1], Aro Vonjy Ramarosandratana [2], Nicola Fuzzati [3], Michel Grisoni *[4]

[1] Centre National de Recherche Appliquée au Développement Rural – Madagascar

[2] Department of Plant Biology and Ecology, University of Antananarivo – Madagascar

[3] Ingredients Innovation and Development Department – CHANEL Parfums Beauté – France

[4] CIRAD, UMR PVBMT, 501 Toamasina – Madagascar

Vanilla crops in Madagascar are essential for the country's economy and the global production of natural vanilla flavor. Despite clonal propagation by cuttings, vanilla vines grown on the island have diversified under the effect of spontaneous genetic rearrangements and the spread of hybrid varieties produced in the mid-twentieth century breeding program. Genetic diversity is an invaluable asset when it comes to responding to environmental changes, particularly the rise in temperatures and longer dry periods, which are expected in Madagascar. A collection of cultivated vanilla plants was built between 2019 and 2022, bringing together 227 vanilla accessions collected from the country's main production areas. Currently, the majority of accessions in the collection are ordinary *V. planifolia* vines (158), but the collection also includes various unidentified interspecific hybrids (43), as well as a few atypical *V. planifolia* clones (26). The plant material is preserved *ex situ* by the FOFIFA in a field plot (Ivoloina, Toamasina), and duplicates will be planted at three other sites in the country. Genetic characterization (Whole Genome Sequencing), followed by phenotypic characterization of the collection, will aim to select a panel of varieties potentially adapted to the country's diverse and changing agroclimatic conditions. In the medium term, this collection will provide the basic material to supply all of the country's economic operators with vanilla vines of optimum sanitary and genetic quality.

Keywords: Genetic resources, Plant breeding, *Vanilla planifolia*

*Speaker

P-10. *Vanilla perrieri* and *Vanilla bosseri*: potential model species for studying the bioclimatic adaptation of vanilla plants

Ravelonanosy Harinomena Rinah *[1], Felambinintsoa Cathucia Andriamihaja [1], Carine Charron [2], Michel Grisoni [3], Aro Vonjy Ramarosandratana [4], Nicola Fuzzati [5], Pascale Besse [1]

[1] University of La Réunion, UMR PVBMT, F-97410 St Pierre, La Réunion – France ; [2] CIRAD, UMR PVBMT, F-97410 St Pierre, La Réunion – France ; [3] CIRAD, UMR PVBMT, Toamasina 501 – Madagascar ; [4] Department of Plant Biology and Ecology, University of Antananarivo, 101 Antananarivo – Madagascar; [5] Ingredients Innovation and Development Department, 93500 Pantin, France – CHANEL Parfums Beauté – France

Genome–environment associations (GEA) in crop wild relatives that exhibit natural adaptation enable the identification of adaptive loci, which may be important in crop breeding for abiotic stress tolerance. Leafless *Vanilla* species in Madagascar have developed such adaptation and their speciation was shown to involve ecological selection by bioclimatic factors. In this study, the feasibility of a GEA approach was assessed using accessions of *V. perrieri* and *V. bosseri*, which are widely distributed in Madagascar. Genetic differentiation has been observed across diverse habitat types, using data from seven microsatellites. Principal component analyses of 19 environmental variables revealed a bioclimatic structure based on sample collection sites. For each species, redundancy analyses demonstrated that geographic distance (Isolation By Distance) and environmental variations (Isolation By Environment) (temperatures and precipitations) contributed to the genetic structure of the populations. These results indicate the presence of local adaptation in populations of these two species and suggest that they represent appropriate model species for studying the climatic adaptation of vanilla plants. Therefore, Genotyping-By-Sequencing (GBS) markers were developed for *V. perrieri* to identify candidate markers through a preliminary GEA analysis. Ultimately, the candidate loci identified will be useful for the selection of heat and drought-tolerant vanilla cultivars.

Keywords: Genome-environment associations, Landscape genomics, Local adaptation

*Speaker

P-11. Characterization study of the Brazilian vanilla production chain and its perspective of its insertion and development in the gastronomic circuit in the Federal District region, Brazil

Tainá Bacellar Zaneti* [1], Lucas Coradini [2], Cláudia Angélica Nasser Brumano [3]

[1] Universidade de Brasilia – Brazil

[2] Instituto Federal de Educação, Ciencia e Tecnologia do Rio Grande do Sul – Brazil

[3] Fundação de Apoio à Pesquisa do Distrito Federal – Brazil

In Brazil, an ingredient has aroused the interest of researchers, gastronomists and rural producers. This is the Cerrado Vanilla (popularly known as this, which corresponds to the species *V. pompona*, *V. bahiana* and *V. chamissonis*). In this study, we aimed to characterize the Brazilian Cerrado Vanilla production and consumption chain, identifying its strengths and weaknesses, presenting important elements of the social, cultural and economic arrangements of this segment. We also analyze the most diverse agricultural technologies for the production and commercialization of vanilla in Brazil and around the world, for their possible application in commercial production and qualification of the national chain. Among the partial results, a heterogeneous scenario of production and commercialization can be observed, ranging from extractivism practiced in traditional communities to more sophisticated experimental cultivations, still punctually located. Production for industrial purposes is incipient, noting the need for technical advice and government support for the activity. The processing of vanilla-based products is one of the dimensions that requires attention and improvement of the techniques used. Barriers to entry of products into the market are also identified, due to competition with artificial vanilla. Despite this, the market is promising and can be a relevant income alternative for family farming and small agribusiness.

Keywords: Gastronomy, Cerrado Vanilla, Sociobiodiversity

*Speaker

P-12. Demonstrating the impact of geographical origin of eastern Indian Ocean *Vanilla planifolia* mature pods on its aromatic profile, using chemical fingerprinting with SPME-GC-MS and metabolomics analysis

Nakid-Dine Djamili * [1], Yannick Eveno[1], Slimane Chaib [2], Cédric Bertrand [2]

[1] Pôle d'innovation intégrée de Mayotte (PER-PI2M), Coconi, Mayotte - France

[2] CRIOBE USR3278 – Université de Perpignan Via Domitia – France

Cultivated on many islands in the eastern Indian Ocean, the mature *Vanilia planifolia* pods express different fragrances for experienced specialists, and we intend through this study to assess this variability by establishing the aromatic profile of pods from various origins. To do so, we collected mature pods from four countries, Reunion Island, Madagascar, Comoros and Mayotte, and establish their corresponding aromatic profiles by SPME-GC-MS analysis, identifying molecules on the basis of calibrated linear retention indices and the comparison of deconvoluted mass spectra with the NIST spectra database. Finally, we statistically analysed the data using MZ-mine and R softwares to evaluate the impact of geographical origin. Our results demonstrate a significant effect of the origin on the aromatic profile, allowing us to identify four sample groups reflecting the various sources. These data allowed us to tentatively identify several biomarkers, typical of each origin. The upcoming projects will aim to confirm the first results, while comparing producers throughout Mayotte to highlight a potential terroir effect, ultimately allowing the local farmers to produce a vanilla that is specific to and representative of Mayotte.

Keywords: *Vanilla planifolia*, Geographical origin, Metabolomic

P-13. Evaluation of the texture profile and physicochemical analysis of cures vanilla beans samples of different species

Abimael Ortega Galeana [1], Araceli Pérez Silva * [1], Ernestina Paz Gamboa [1], Maribel Montero Lagunes [2]

[1] Instituto Tecnológico de Tuxtepec – Mexico

[2] CIR-Golfo Centro. INIFAP – Mexico

The objective was to evaluate the texture profile and evaluate the physical-chemical characteristics of our cured Vanilla beans from different species. Eight lots of V. planifolia, two of *V. pompona* and one of *V. cribbiana* were analyzed, the texture profile was evaluated using a TAXTplusC texturometer (Stable Mycro Systems) and the proximate chemical analysis was performed according to AOAC-2012. The physical differences were significant among the different lots evaluated (n=11), the longest pods were of V. planifolia, while the pods of *V. pompona* were wider, thicker and heavier. Texture results were: modulus of elasticity ranging from 0.3 to 35.8 MPa, shear test 7.2 - 24.5 N, puncture test (breaking strength 1.4 - 6.8 N and elasticity 1-3.6 mm), toughness 24.3 to 72.7 N and extensibility 1.7 to 68.8 mm. Moisture content ranged from 11.48 to 33.46%; ethereal extract values 8.88-15.25 g/100 g m.s., ash 6.66-15.82 g/100 g m.s., protein 4.77-9.8 g/100 g m.s., and fiber 31.89-50.08 g/100 g m.s. Pearson's correlation for the analyzed data shows that moisture content has a significant effect ($p < 0.05$) on texture variables (elastic modulus, firmness and breaking strength) and fiber content on fracturability. This study made it possible to apply a protocol to determine the texture profile by establishing the relationships of aspect with the composition of the pods.

Keywords: Cured vanilla beans, Texture profile, Physicochemical characterization

P-14. Morphological and aromatic characterization of species related to *Vanilla odorata* C.Presl from Mexico

Eduardo Peña-Mojica [1], Araceli Pérez-Silva * [2], Madeleine Hidalgo-Morales [1], Michel Grisoni [3], Carine Charron [4]

[1] Tecnológico Nacional de Mexico/Instituto Tecnológico de Veracruz – Mexico

[2] Tecnológico Nacional de Mexico/Instituto Tecnológico de Tuxtepec – Mexico

[3] CIRAD, UMR PVBMT, 501 Toamasina, Madagascar – Réunion

[4] CIRAD, UMR PVBMT, F-97410 St Pierre, La Réunion - France

The objective of the study was to evaluate the morphological and aromatic characteristics of *Vanilla odorata* and related species from Mexico. For this purpose, morphological characterization was carried out on plants and fruits of populations related to *V. odorata* from three localities in Oaxaca, Mexico: 1) Naranjal, 2) Santiago Tlatepusco and 3) Rancho Gavilán, based on the parameters established by the International Union for the Protection of New Varieties of Plants (UPOV, 2014). Moisture content by gravimetry and aromatic potential and profile by HPLC-DAD were evaluated in ripe fruits and cured beans. Morphological descriptions of three populations related to *V. odorata* from the state of Oaxaca were generated. Fruits moisture ranged between 80 – 85 g H2O/100 g. Fruits from location 2 showed the highest glucovainillin content (28.86 g/100g b. s) and the lowest value was determined in fruits from location 3 (0.59 g/100g b. s). In cured beans, the highest concentration of vanillin was for beans from location 2 (5.12 g/100g b. s), while beans from location 3 were characterized by a high content of anisyl alcohol (2.16 g/100g b. s). The analyses carried out on morphology, potential and aromatic profile showed differences between the vanilla samples studied.

Keywords: *Vanilla odorata*, Morphological characterization, Volatile compounds

Author index

emails of presenting and corresponding authors

Communication*	Email address
I-01	graziella.catan@provanille.fr
I-02	eric.jennings@utoronto.ca
O-01	epansarin@ffclrp.usp.br
O-02	akarremans@gmail.com
O-03	kmcameron@wisc.edu
O-05	arovonjy@yahoo.fr
O-06	felambinintsoa-cathucia.ravelomanantsoa@univ-reunion.fr
O-07	alemaostars@outlook.fr / arovonjy@yahoo.fr
O-08	pparada@uv.mx
O-09	charlotte.watteyn@kuleuven.be
O-10	alan.chambers@keygene.com
O-11	quentin.piet@cirad.fr / cyril.jourda@cirad.fr
O-12	quentin.da_silva@cirad.fr/carine.charron@cirad.fr
O-13	mluna@uv.mx
O-15	guillaume.lalanne-tisne@univ-reunion.fr
O-16	araceli.ps@tuxtepec.tecnm.mx
O-17	znhouchi@isipca-lafabrique.fr
O-18	keshika.mahadeo@univ-reunion.fr
O-19	michel.dron@universite-paris-saclay.fr
O-20	michelmanceau@hotmail.com
P-01	agueroaguilarsilvia@gmail.com
P-02	johnsongabriel05@yahoo.com
P-03	philipp.schlueter@uni-hohenheim.de
P-04	deborah.turpin@cirad.fr / carine.charron@cirad.fr
P-06	cdaguenet@eurovanille.com / isabelle.fock-bastide@univ-reunion.fr
P-08	issa.mzehassani@gmail.com
P-09	tojomananew@gmail.com / michel.grisoni@cirad.fr
P-10	rinahravelonanosy@gmail.com / pascale.besse@univ-reunion.fr
P-11	claudiabrumanonasser@gmail.com
P-11	lucas.coradini@ifrs.edu.br
P-12	ndjamili@gmail.com / yannick.eveno@univ-perp.fr
P-13	araceli.ps@tuxtepec.tecnm.mx
P-14	araceli.ps@tuxtepec.tecnm.mx

** Presentations of the underlined communications are available upon request to the authors.*

Reunion Island
5th
VIVC
2024