Welcome to the field's tour of the IX International Pineapple Symposium

Pineapple (*Ananas comosus* (L.) Merr.) is one of the crops referred to in the strategy of development of fruits in Cuba for the next years. The presence of the fruit in the country dates to before Cuba’s discovery by Christopher Columbus. It was brought by immigrants from the Caribbean and other parts of America, which had settlements in some regions of the country, introducing plants that still remain in uncultivated areas or in producer’s small plantations, especially in the eastern region where they grow as ecotypes adapted to these areas.

The first plantations were established by the end of the 19th century and it was not until the decade of the fifties of the last century when the crop culture boomed, mainly in areas of the Artemisa and Ciego de Avila current provinces. In 1960 Cuba ranked ninth among the world’s producers, with 100 thousand tons of production and was positioned within the three leading exporters of this fresh fruit, mainly to North America.

Several prospections carried out in Cuba referred that 'Red Spanish', which was already present in the country when it was colonized, is one of the most widely grown cultivars despite the difficulty encountered in handling because of its high number of spines. Its rusticity also results in a high degree of plasticity, which is indicated by the fact that it is planted in different conditions of soil, altitude, temperature and humidity.

In breeding programs, it is vital to have a diverse genetic base for the search of improved cultivars that show characteristics of commercial interest. In this regard, Cuba developed a process of introduction of foreign materials. The introduction of the 'Smooth Cayenne' to the fields of Havana dates back to the thirties of the last century. However, it was not distributed throughout the country and almost disappeared. It was not until the decade of the 60’s that a second introduction of diverse materials from Martinique and Guadalupe were introduced by the experimental stations and were planted in the areas of Alquízar and Bauta, current province of Artemisa, although its development was not successful.

A third introduction of this cultivar from Panama occurred in the decade of 1980s, which was established in the Isla de la Juventud. The cultivar was promoted in the province of Ciego de Avila and plantings reached more than 200 ha; while it was planted on a smaller scale in the provinces of Pinar del Río, Matanzas, Granma and Holguín. This cultivar, although is not the most widespread in Cuba, is one of the most commercially important cultivars at the global level. The ‘Smooth Cayenne’ clone Serrana, a national selection, has been well adapted. This, together with the development or a protocol for *in vitro*
propagation, has allowed its introduction in productive areas of some of the provinces of the country. It also has been used successfully as a female parent in the development of hybrids within the scheme of improved crop production in Cuba.

As part of the enrichment of germplasm present in the country with promising materials, in 2009 the hybrid known as 'MD-2' was introduced from Costa Rica and was established in the province of Ciego de Avila. The cultivar has shown good adaptability to the climatic conditions of that region and yields have been comparable with those for this cultivar published by other producer countries.

The cultivar 'White Pineapple' or 'Cuban Pineapple', already described by Py in 1987, has little representativeness in Cuba. It has excellent organoleptic qualities and there are currently few individuals detected.

In Cuba, pineapple production is mainly intended for domestic consumption. According to the statistics of December 2016, the cultivated area is approximately 6,670 ha and a production of 39,981 tons, mainly of the cultivar 'Red Spanish'. The percentage of the total area planted and production of 'MD-2' is currently increasing, attending to its acceptance for export as fresh fruit. These production areas are located mostly in the farmer and cooperative sectors.

A group of scientific institutions in the country have obtained important results with this crop (Research Institute of Tropical Fruit Crops, Center of Bioplants from Ciego de Avila University, Agrarian University of Havana, among others). Within these, it is appropriate to emphasize those which are summarized below:

- Determination of the incidence of the pineapple wilt disease in the main production regions.
- Identification of the presence of the ameloivirus *Pineapple mealybug wilt-associated virus 1 and 3* (PMWaV-1 and PMWaV-3), the badnavirus *Pineapple baciliform CO virus* (PBCOV), and endogenous sequences PBCOV, appointed endogenous Pineapple baciliform CO virus (ePBCOV).
- Establishment of the minimal descriptors, assessing genetic diversity using morph-agronomic and molecular markers and establishment of a core collection.
- Identification of the threats that can cause genetic erosion in the cultivars and possible actions to minimize it.
- Development of successful protocols for cryopreservation of both, apices and callus of in vitro plantlets, with good results of recovery after their conservation.
- Program of hybridization in search of promising genotypes using conventional methods and biotechnological techniques.
- Obtaining haploid plants through the cultivation of anthers, ovule and by out-crossing for future genetic studies of the species and toward the formation of heterotic hybrids.
- Use of somaclonal variation from regenerating callus to generate diversity
- Establishment of a methodology for the genetic transformation of ‘Smooth Cayenne’ clone Serrana using Agrobacterium tumefaciens, with tolerance to the Herbicide FINALE® and resistance to Phytophthora nicotianae var. Parasitica, using temporary immersion bioreactors (BIT).
- Validation of the temporary immersion systems as an alternative tool for the mass production of plants.
- Improvement of the protocols of in vitro propagation, with emphasis on the acclimatization phase, to obtain more vigorous plants and with a reduction in the time spent under these controlled conditions.
- Introduction of in vitro plants of the cultivar ‘MD-2’ into the productive sector, reaching levels of survival of 92% or more.
- Determination of biochemical changes, as well as the levels of expression of the genes DELLA and GA2-Ox, associated with the process of artificial flowering induction mediated by Ethrel.
- Isolation, purification, characterization by various methods, scaling, production and current uses of a stem bromelain biopreparated obtained from crop residues with multiple applications in the area of food and therapeutic.

The field trip organized within the framework of the IX International Pineapple Symposium aims to show the main areas of development of the hybrid 'MD-2'. Also, to promote exchange between specialists, technicians, producers and participants of the Symposium on the main challenges and solutions imposed by the development of this cultivar. The field trip guides have extensive experience both in research for the development of this crop, as well as in its handling and processing or fresh marketing. All are natives of the province of Ciego de Ávila and hope to make this visit a great experience for participants throughout a theoretical and practical exchange.

The field trip will begin starting from Havana on the 18 October and travel towards the province of Ciego de Ávila, a central region of the country and an approximate distance of 500 km from the capital of Cuba. The trip will cover two days (18 and 19 October), and will complete the following itinerary:
18/10/2017 6:00 am  Departure from Hotel Nacional de Cuba in Havana to Ciego de Ávila.
12:30 - 1:30 pm. Arrival in Ciego de Ávila, lunch in a rural ranch in the city of Ciego de Ávila
1:30 pm  Visit to the Bioplants Center from the Ciego de Ávila University. Tour to the scientific laboratories specialized in the culture in vitro pineapple plants. We will visit the facilities and discuss the major research carried out with researchers and specialists (duration: 2:00-3:30 pm).
3:30 pm  Departure to accommodations at Hotel Cayo Coco Iberostar Mojito, Ciego de Ávila province: will proceed to the registration of the field trip participants at the hotel to enjoy its facilities and the beach.

19/03/2017 8:00 am  Departure for Base Enterprise Unit (BEU) for Pineapple Production from the Agro-industrial Ceballos Enterprise. Tour to the conditioning and packing center and the mini-industry of the BEU. It will visit the facilities and provide an opportunity for exchanges with specialists and technicians on major productions that are developed today. A light snack will be provided. The visit will last for one hour (duration: 9:30 am-10:30 am).
10:30 am  Tour to the pineapple hybrid 'MD-2' commercial plantations from the BEU for Pineapple Production from the Agro-industrial Ceballos Enterprise. It will visit the plantations and will provide an opportunity for exchanges with leading producers, specialists and technicians in crop management (duration: 11:00 am - 12:30 m).
12:30 pm  Closing activity and lunch at the BEU for pineapple production from the Agro-industrial Ceballos Enterprise (duration: 12: 30 - 2:00 pm-m).
2:30 pm  Return to Havana.
8:00 pm  Arrival at the Hotel Nacional de Cuba

Ciego de Avila

The Ciego de Ávila province is located in the central part of the island, bordered to the west by Sancti Spiritus, to the north by the Strait of Florida, to the east with Camagüey and south with the Caribbean Sea. Its capital is the city of Ciego de Ávila, founded in 1840. With an area close to seven thousand square kilometers, including the small islands that make up the adjacent keys, the predominant territory is its plain relief and the fertile lands, of vital importance to agriculture. In this region will be developed the activities related with the field tour of the IX International Pineapple Symposium.
General information about the visits

Visit to the Bioplants Center, Ciego de Avila University

The visit will be guided by Dr. Janet Quiñonez Gálvez, General Director of the Bioplants Center, Ciego de Avila University. She is a researcher at the Metabolic Engineering Laboratory of the Bioplants Center. Also, is graduated as an Agricultural Engineer in 2002, Master in Plant Biotechnology in 2006 and a Doctorate in Agricultural Sciences in 2016 on the ecophysiology theme. She has participated in various researches related to the study of the primary and secondary metabolism of plants, with emphasis on the metabolic routes of secondary metabolites synthesis and management of in vitro culture.
for its production; development of technologies applied in the production of bioactive natural products for the control of pests and diseases of agriculture for human health; genomic study of maturation functional processes and nitrogen assimilation; control of flowering and cryopreservation of plants.

Bioplants is a center which develops, implements and provides technologies, products, technical assistance and services of academic excellence in the context of plant biotechnology. It was originated in 1987 as a laboratory of research and micro-propagation of fruit plants. At present it is a scientific institution, attached to the Ciego de Avila University.

Within its objectives are the research in plant biotechnology, the transfer of scientific and technological results, mass production of plants by in vitro culture for international trade and postgraduate education and training. Bioplants has specialized laboratories for cells cultivation and plant tissue, plant-pathogen interactions, metabolic engineering, genetic improvement of plants and applied computing.

It has capabilities for the in vitro production of four million plants per year for national and international trade. In its production area are scaling technologies generated by research for the mass production of elite crops of commercial and economic interest.

The production area consists of two laboratories. The first is specialized in the introduction and development of new technologies of in vitro propagation, which includes temporary immersion systems techniques. The second in the accelerated multiplication of crops.
It also has greenhouses for the acclimatization of plants produced \textit{in vitro} and mini-sticks through the use of conventional methods, a Department of quality control and certification of their products, as well as the Department of marketing. Different species of fruit, forest and ornamental plants are multiplied.

**Visit to the Base Enterprise Unit (BEU) for Pineapple Production from the Agro-industrial Ceballos Enterprise, Ciego de Avila**

The Base Enterprise Unit (BEU) for Pineapple Production from the Agro-industrial Ceballos Enterprise, Ciego de Avila, is specializes in fruit production. Specifically, in the areas of this unit are the hybrid 'MD-2' pineapple plantations, which were developed from the year 2009 and since then have reached productions that ranged from 70 to 115 t/ha. This variability in the yielding is due to several factors, between them are the control of soil fungi, mainly \textit{Phytophthora parasitica}, the management of the intense solar radiation and drains planning. Therefore, these are the main challenges in the production of pineapple 'MD-2' in Ciego de Avila in the future. It is currently one of the fruits marketed for fresh fruit export in the country. Associated with the areas of production, the BEU account with the conditioning and packing center specialized in the pineapple and mini-industry "Ernesto Che Guevara".

Visitors will be accompanied by the specialist **Reinaldo de Avila Guerra**, Director of the BEU for Pineapple Production from the Agro-industrial Ceballos Enterprise. He has served in this position for the last five years. As director of this unit, he has managed exports of pineapple cv. 'MD-2' to Europe and obtained important awards for the quality of the fruit at international fairs. He has promoted, in addition, the exchange with researchers and specialists of research centers and universities.
Center for conditioning and packing of the pineapple 'MD-2' and mini-industry

There will be a visit to the facilities where the fruits of pineapple 'MD-2' are processed for fresh export and for the elaboration of commercial byproducts. During the programmed visits, the participants will have the opportunity to discuss with researchers and producers the experiences of the country in the cultivation of this fruit.

Plantation of the Base Enterprise Unit (BEU) for pineapple production from the Agro-industrial Ceballos Enterprise

The BEU for Pineapple Production from the Agro-industrial Ceballos Enterprise of the Ciego de Avila province, has about 150 hectares of the hybrid 'MD-2' destined mainly for export to Europe, in addition to sales to tourism and other industries. This is the first territory in the country that has commercial areas of this cultivar. Yields similar to those of other producer countries have been obtained and up to the present have exported 3200 tons of fruit with a good acceptance in the European market.

The fresh fruit of 'MD-2' has received quality awards ("Gold of Cuba") in the International Fair of Havana. In addition, with the certification of the Protocol GLOBALGAP, and this unit where its produced has its Quality Management System certified by the NC ISO 9001-2008 and is currently making progress towards certification by the NC ISO 9001-2015. The technology applied in these areas include programs of soil improvement, biological beds for the degradation of chemicals wastes, application of biological products and other agro-ecological strategies that guarantee the safety of the retrieved fruit.
For the next five years, the country has planned a development program for the cultivation of pineapple that aims to increase the production areas of the cultivar 'MD-2' to export fresh fruits, as well as to revitalize the line of production of by-products for export. Of equal importance in the objectives is a plan to increase the areas of the cultivar 'Smooth Cayenne', with views to both types of marketing.

In this regard, the enterprise is receiving proposals of investment from different countries, taking into account the acceptance that has been realized by the Cuban commercial cultivar 'MD-2' in the European market, which will contribute largely to the financing of this program and to the compliance of the goals. Similarly, the increase in areas and productions will allow insertion into new markets in the region of the Caribbean and North America (Canada and United States).

**Regulations to prevent the entry of quarantine diseases of high economic importance for pineapple during the field tour.**

The Organizing Committee of the IX International Pineapple Symposium, in conjunction with the entities to be visited, will implement bio-security regulations established at the international level related to controlled movement of the visitors, disinfection of hands and footwear, as well as use of means of disposable protection for the visit to the pineapple plantations during the field tour. For more detailed information on these regulations, visit the web pages where the event is going to be promoted ([www.fruticulturacubana.co.cu](http://www.fruticulturacubana.co.cu); [www.riacnet.net](http://www.riacnet.net)).
Touristic package for the field tour. Hotel Iberostar Mojito, Cayo Coco, Ciego de Avila

This hotel is located in Cayo Coco, at the north of the Ciego de Avila province, and classifies with four stars. It has 352 comfortable rooms: 286 standard rooms, 30 family rooms and 36 superior standard rooms. Also have two specialized restaurants and one main buffet restaurant with show cooking, a main swimming pool for adults, one for children and one for adults only. In addition, the hotel has a new solarium, a mini-club for children aged 4-12 years with extensive entertainment program and night live shows.