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NEWSLETTER
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Agriculture . Innovation . Life
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Faculty of Science is pleased to present the fourth issue of thrice-yearly e-Science Putra Newsletter. This e-newsletter intended to disseminate and highlight the latest research findings, activities, and contribution to the community by the Faculty members. We hope that you enjoy reading this newsletter.

Development of salt and drought tolerant lines of Malaysian Indica Rice

Rice production intimately associated with climate. Therefore, in the long term, climate change in Malaysia is an additional problem that the rice industry must face in meeting national requirements. Climate change like an uneven pattern of rainfall leads to prolonged dry season like El-Nino causes limited fresh water supply and worst salinity problem. Rise in sea water level, in addition, intensive use of fertilizers caused salinity that related with the water scarcity in certain plantation areas. Rice plantation areas in Malaysia especially in Johor, Kelantan, Sabah, Perlis, and Terengganu were reported to be at high risk of water scarcity due to the dry and hot weather caused by El Nino since 2014. In Kelantan, 19,300 rice farmers were affected by the drought and 54.6ha rice damaged in Machang district in April 2019 (Fig. 1).

Meanwhile, 238 rice planters in Tangkak, Johor, were reported seriously affected by drought in early 2020. Rice fields began to dry up and cracked due to lack of water thus unable to start sowing seeds (Fig. 1). The paddy seedlings withered and caused a 'wind paddy' disaster, and this led to the severity of the impact on rice production, loss of farmers' income and threatened the food security.

The Integrated management of soil-water-plant system has been introduced to combat drought and water scarcity in rice plantation areas. It includes taking into consideration rainfall, proper irrigation system and paddy soil. However, selection of rice cultivars that are resistant to climate change (especially drought and salinity) and development of tolerant rice cultivars have not been given full attention yet.

Fig 1. Rise in sea water level and drought in the rice plantation area

Hydrotime analysis found that these cultivars are glycophytes which are drought and salt-sensitive crops. However, until to date, tolerant lines of these cultivars have not been produced so far. In this article, the development, production, and selection of salt tolerant lines of M219 and Mardi Siraj 297 were presented. These tolerant lines were produced from embryogenic calli (undifferentiated cells) treated in high salinity condition *in vitro* (Fig. 2A (1-3)). During treatment, some of the cells were able to survive due to somaclonal variation

FOOD SAFETY AND SECURITY

HIGHLIGHTS

- Malaysian Indica Rice
- Standardized *Paederia foetida*
- Science in Food Safety

which is a type of genetic variation found among *in vitro* cultured cells. These cells responded towards salinity stress by activating certain biochemical and physiological changes that lead to their survival. Therefore, biochemicals and physiological markers such as proline, protein, total soluble sugar, catalase, ascorbate peroxidation, lipid peroxidation and K^+/Na^+ content were found to be reliable parameters for screening and selection of salt tolerant cell lines. All salt tolerant lines demonstrated significant increase in all parameters being assessed (Fig. 2B).

Upon selection, these cells were maintained in a regeneration medium to induce shoot and root formation to produce salt tolerant plantlets. The plantlets were then acclimatized by gradually introducing them to *in vivo* condition. After two weeks, the salt tolerant plants were transferred to the greenhouse and grown until maturity to produce seeds and seeds were collected (Fig. 2A (4-5)).

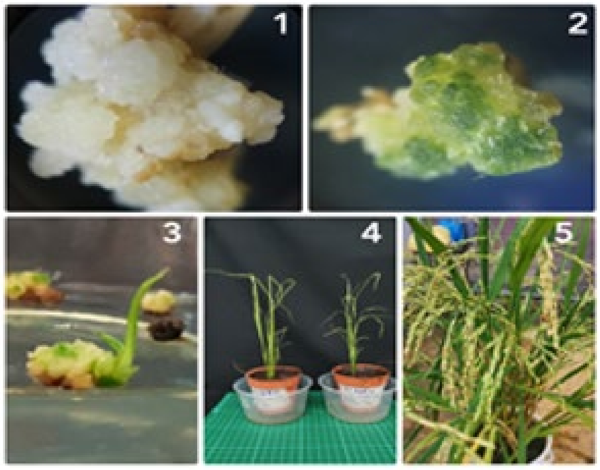

Fig. 2A. Stages in development of salt tolerant Mardi Siraj 297 rice. (1) Embryogenic callus (2) Salt tolerant callus (s) Salt tolerant callus producing shoots (4) Acclimatized salt tolerant plants (5) Salt tolerant line (75 mM NaCl) at harvest stage

Collected salt tolerant seeds which are the first generation of salt tolerant lines (R1) were planted in saline medium to test the capability to grow in saline and drought. Following this, the elite tolerant lines were selected by using morphology, biochemicals, and molecular markers. It is hoped that the selected elite tolerant lines of Malaysian indica rice will be introduced to rice planters.

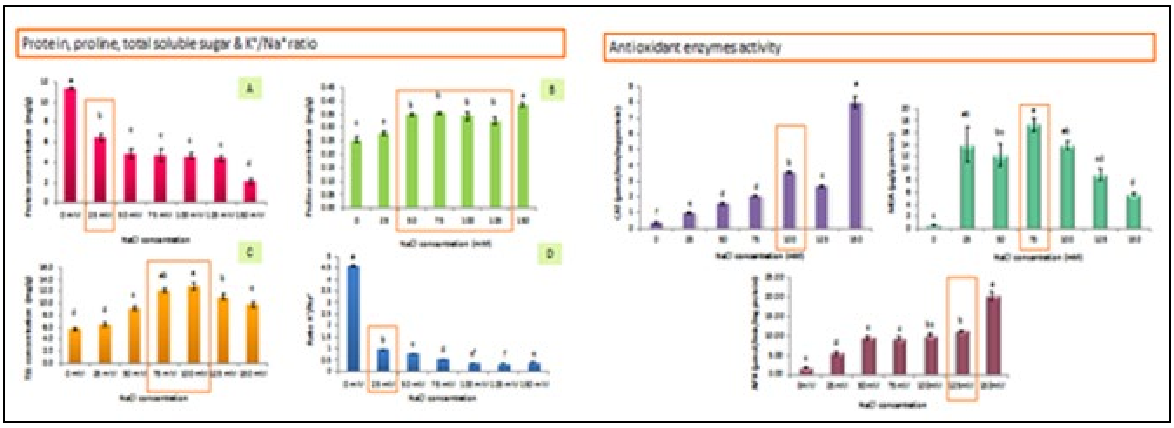

Fig. 2B. Biochemical and physiological parameter used for screening of MARDI Siraj 297 salt tolerant lines.

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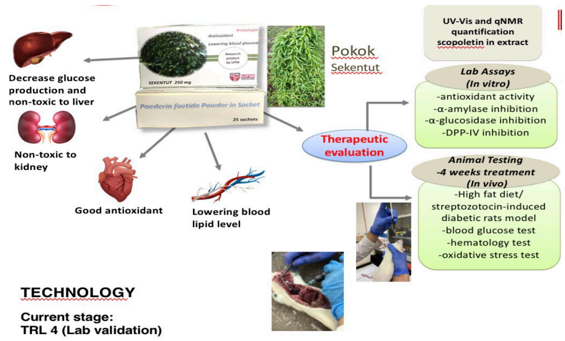
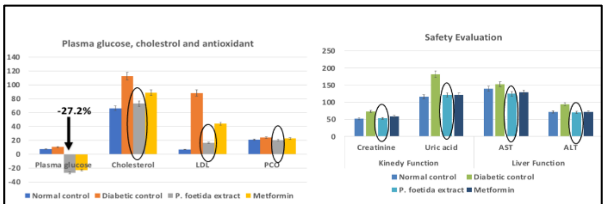
Standardized *Paederia foetida* (Pokok Sekentut) Extract Natural Remedy for Type 2 diabetes
PATENT NO. PI2020000673

Diabetes mellitus is one of the major degenerative diseases that haunt world population today. A total of 463 million people has diabetes mellitus in 2019 and it was predicted to raise up to 578 million by 2030 and 700 million by 2045. In Malaysia, according to the National Health and Morbidity Survey (NHMS) 2019 by the Ministry of Health, the prevalence rate of diabetes in adults has increased from 13.4 per cent in 2015 to 18.3 per cent in 2019, with diabetes defined as having sugar levels 7.0 mmol/L or above. Many synthetic drugs are developed, but still cure is not provided by any of the molecules up to this date. Apart from the high cost of synthetic drugs, continuous and prolonged use of some synthetic agents caused many severe side effects, and thus the demand for non-toxic, affordable drugs are still awaited. Medicinal plants have a vast potential in the treatment of various ailments due to the presence of phytochemicals with therapeutic potential. *Paederia foetida* L. or locally known as Pokok Sekentut is a plant widely distributed in Asian countries including Malaysia.



The plant has been used as a traditional remedy to diabetes, rheumatism, digestive problem among others. Despite its traditional use against diabetes, there is no standardized dosage or method of the extract in producing *Paederia foetida* extract suitable for effective antidiabetic remedy. Our invention provides a standardized *Paederia foetida* extract intentionally as a dietary supplement and/or adjuvant to the pharmaceutical products which can be used to treat diabetes particularly Type 2 diabetes mellitus (T2DM). Research has discovered that Coumarin compound from the plant has antidiabetic function which may enhance the action of the other phytocompounds. The quantification of this bio-active marker was done by quantitative nuclear magnetic resonance (qNMR) and ultraviolet (UV) spectroscopy. In *vivo* treatment of 50mg/kg *Paederia foetida* standardized extract on diabetic rats for four weeks showed the bio-efficacy of the invention as a potential antidiabetic agent by lowering the blood glucose (27.2%) which is comparable to metformin (23.1%). The results also showed a good lipid, renal, and liver functions and close to normal range of control in rats, indicative for non-toxic effects.



50 mg/kg *P. foetida* extract lower the blood glucose by 27.2%, cholesterol, LDL, and oxidative stress of protein carbonyl content.

50 mg/kg *P. foetida* extract lower the creatinine and uric acid. Lower AST and ALT in *P. foetida* extract showed the lower inflammation and damaged cells compared to diabetic control.

Treatment with 50 mg/kg *Paederia foetida* extract also displayed significant antioxidant properties that reduce oxidative stress in protein carbonyl content. For the safety evaluation, treatment with 50 mg/kg *Paederia foetida* extract decrease the creatinine and uric acid of diabetic rats as compared to non-treated diabetic control group. *Paederia foetida* supplementation or metformin reversed the clinical manifestation of T2DM but Paederia foetida alleviated biochemical alteration of T2DM better than metformin. The research work was done by a PhD student, Mr Tan Dai Chuan from Chemistry Department, Faculty of Science and supervision from UPM committee incuding Dr Nur Kartinee Kassim, Assoc. Prof Dr Intan Safinar Ismail, Assoc.Prof Dr Muhajir and Dr Suhana from Physiology Departent, USM, Kubang Kerian. The research been displayed during the International Greentech and Eco Products Exhibition and Conference Malaysia (IGEM 2020), organised by Ministry of Environment and Water.

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Science in Food Safety

Science has always made the front pages of local news because of its innate capacity to analyse contaminants in food samples.[1] The findings in this article determines the level of food quality and food safety. There is an array of scientific methods that allow monitoring, screening, detection and identification of biological and non-biological in food samples. These methods provide qualitative and quantitative information of the food samples. For example, food nutrients, contaminants and food adulterants found in the food matric.

Methods such as separation science (physical and chemical separation), mass spectrometry and spectroscopy (vibrational, electronic and rotational) require an understanding of the fundamental scientific theories in addition to the modern application. Without the science the analytical method would be impossible.

Public with access to these scientific instruments can analyse food samples, however, their results require validation against established methods. Researchers are always exploring ways to deconvolute the complexity of the food matric; this allows rapid identification of analytes.

Figure 1. The isolated crystals from street food samples. Food samples were donated by MOH.

In the past, our research team have studied several street food samples donated by the local authority in Malaysia, as shown in Figure 1. This process involved the separation and identification of the solid particles from the samples. Using a light microscope, we assessed the physical properties of the separated particles, such as the shape and the size. We were able to identify the particles with a benchtop ATR-FTIR and transportable Raman spectrometers non-invasive methods. In the presence of spectral libraries, the identification process is so rapid meaning that we can identify and validate up to 10 spectra in less than 5 minutes (Fig. 2). Our finding shows the impact of science in food safety and subsequently helps other agencies to make rapid food safety decisions.

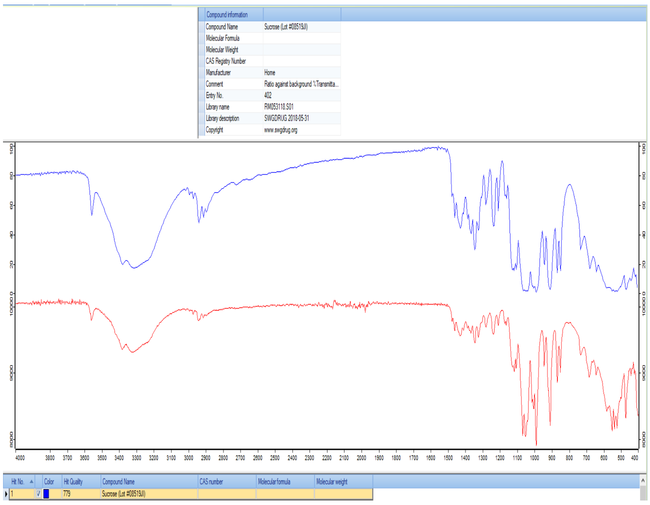

Figure 2. A fast method (ca 4 seconds) identifying crystals using a search and identify vibrational spectrum.

In conclusion, science is very useful in all aspects of food safety and it requires integration of data processing and modern instruments to obtain meaningful data. Further studies at molecular level is a must and it requires huge effort as well as passion.

References:

https://www.moh.gov.my/moh/resources/Keratan%20Akhbar/2020/Dis/Keratan_Akhbar_8_Disember_2020.pdf

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Science is much more than just a body of KNOWLEDGE.
It is a way of THINKING.