

Arecanut and human health*

Arecanut consumption and its effect on human health is of much concern in recent times in India. Even though there were limitations in the epidemiological studies and lack of evidence-based research, voluminous reports were prepared alleging arecanut as a cancer-causing agent based on information available on the internet and submitted before the Supreme Court of India. This has caused much anxiety in the arecanut community, including growers, scientists, policymakers, traders and officials of the developmental agencies. A two-day interactive workshop was conducted recently with regard to research on arecanut and human health, and to identify the shortcomings and prioritize future research.

All the organizations involved in research or continuing research on arecanut and human health aspects, including cancer research institutes, medical colleges and institutes, ayurveda colleges and centres, traditional and agricultural universities, Health Secretaries of all the States and Union Territories, State Directors of the National Health Mission (NHM), and all other concerned were informed about the workshop. In response to our invitation, 25 medical practitioners, 30 scientists associated with arecanut production and value addition, 150 traders and growers, administrators, advocates and officials of developmental agencies attended the workshop.

During the inauguration, P. Chowdappa (Director, ICAR-CPCRI, Kasaragod) enlisted many positive effects of arecanut and unequivocally urged all those concerned to dispel the prevailing negative notions on the crop through evidence-based research. Satheesh Kumar Bhandary (NITTE University, Mangaluru) suggested identification and study of areca-only chewers for epidemiological research and emphasized on the need to explore the potential of arecanut in treating Alzheimer's disease, schizophrenia and other neuroprotective effects. Man-

junatha Naik (University of Agricultural and Horticultural Sciences, Shivamogga) considered that it is important to dispel some preconceived notions about arecanut, e.g. is not good for health. V. V. Bhat (former Secretary to the Government of India) called for need-based research on arecanut with the collaboration of multiple research institutions breaking their respective academic barriers.

Presentations in the workshop were made under five technical sessions, namely (i) phytochemistry, (ii) arecanut in ayurvedic medicine and value addition, (iii) pharmacology I: neuro-protective, hyperglycaemic, wound-healing effects etc., (iv) pharmacology-II: anti-microbial properties, and (v) epidemiological studies.

In the technical session on phytochemistry, papers were presented regarding the chemical constituents of arecanut, their variability with maturity, structural significance, etc. J. Ishwar Bhat (Mangalore University) observed increased chemical components of nuts, including tannins and alkaloids with maturity. X-ray crystallography showed distinct differences in the chemical structure of arecanut and gutkha with low N content in the dried nut compared to the tender nut and gutkha. M. P. Sadashiva (University of Mysore) described how a small change in structural moiety of alkaloids could result in some valuable compounds of medicinal/therapeutic/industrial use (e.g. tannins from arecanut can be converted to ink). Further, antioxidant property of arecanut is found to be significantly influenced by genotype \times environment as observed by Laxminarayan Hegde (University of Horticultural Sciences, Bagalkot).

In the session on arecanut in ayurvedic medicine and value addition, there were seven presentations. Sathyannarayana Bhat (Ayurvedic practitioner and Sahitya Academy awardee) enlisted the traditional uses of arecanut for treating various ailments. Jayarama Bhat (Formerly with Goa University) highlighted the demerits of some of studies, such as improper dosage of arecanut, sample size and absence of clarity in the methodologies followed. V. V. Bhat suggested that

in ayurveda there is a need for systematic research and the findings should be published in high impact factor journals to popularize it as medicine. A product, areca tea, which elicited anti-diabetic activity in Wistar albino rats, was presented by Naveen Chandra (SDM College of Ayurveda and Hospital, Udupi) who requested to revisit the methodologies followed. The mechanism of disease control in ayurveda, i.e. how arecanut chemical constituents are best suited in ayurvedic medicines to ward off doshas vata, pitta and kapha was narrated by M. D. Giridhar Kaje (Prashanti Ayurvedic Center, Bengaluru) and Jeddu Ganapathi Bhat (Jeddu Ayurveda Specialty Hospital, Bengaluru). Arecanut and its importance in traditional and folk medicines was highlighted by Hemand Aravind (Santhigiri Research Foundation, Thiruvananthapuram), Subrahmanya Prasad (Nehru Arts & Science College, Kanhangad) and Shankar Bhat Badanaje (Traditional Practitioner, Vittala).

In the pharmacology session, findings from experiments conducted *in vitro* and animal studies were presented. All parts of the arecanut inflorescence, including flower, seed nut and husk are found to have medicinal properties. In alloxan-induced diabetic rats, Virupanagouda Patil (Bijapur Lingayat District Education Association (BLDEA) College of Pharmacy, Bijapur) observed anti-hyperglycaemic activity of *Areca catechu* flowers. On the other hand, arecanut husk reduced the tobacco-induced cytotoxic and genotoxic effects as well as oxidative stress in cultured human oral mucosal cells (Manjula Shantaram, Mangalore University) and wound-healing properties (Sukesh Bhat, Kodagu Institute of Medical Sciences, Madikeri). Wound-healing property was further elaborated by Sachidananda Adiga (K. S. Hegde Medical Academy (KSHEMA), Mangaluru) who showed that extracts of arecanut increased the wound contraction and period of epithelization. From the study he inferred that alkaloid and polyphenols of areca could be used to enhance the healing of burn wounds, leg ulcers and donor skin graft surgery. Anti-ulcerogenic activity of aqueous extract of

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A. catechu in ethanol was confirmed by Reena R. Nelson (P.S.G. College of Arts and Science, Coimbatore). Further, the positive effect of arecanut extract on learning and memory in rats using eight-arm radial maze led M. P. Joshi (Goa College of Pharmacy) to hypothesize that arecanut extracts could control schizophrenia symptoms and also have a positive effect on Alzheimer's disease.

Another feature of arecanut is its antimicrobial properties. When arecanut extract was used as root-canal irrigant, it significantly brought down the population of *Enterococcus faecalis* and suppressed oral bacteria such as *Streptococcus mutans*, *S. salivarius*, *Candida albicans* and *Fusiform nucleatum*. This encouraged N. Malathi (Sri Ramachandra Medical College, Chennai) to recommend arecanut extract to be a component of toothpaste for preventing oral diseases. Similar observations were made by Rekha Rai (KSHEMA, Mangaluru) who reported suppression of *Pseudomonas aeruginosa*, *Candida albicans* and *Enterococcus faecalis*. She suggested the extract spray can be used as hand disinfectant or hospital sanitizer.

In the epidemiology session, A. Ruckmani (Chettinad Hospital and Research

Institute, Chennai) reviewed the last 10 years' publications and found some limitations regarding the research projects conducted so far – most of them were *in vitro* on cultured cell lines or animal studies. The methodical and technical gaps in such publications were highlighted by S. Keshava Bhat (Arecanut Research and Development Foundation, Mangaluru) and Ravichandra (KSHEMA). A recent pilot survey conducted in Karnataka did not show any harmful effects of arecanut chewing on human health (C. T. Jose, CPCRI, Vittal).

Speaking at the valedictory session, K. Satyamorthy (Manipal University) and Vijayalakshmi Deshmane (formerly with Kidwai Memorial Institute of Oncology, Bengaluru) mentioned that arecanut is a good source of phytochemicals and can be a treasure trove for substances of pharmacological interest. They opined that further research is needed on the biomedical and psycho-social consequences of areca usage.

K. N. Bhat (Advocate, Supreme Court of India) who delivered the valedictory address, was convinced that arecanut does not have negative effects and urged all those concerned to compile evidence-based research reports and file an affida-

vit with the Central Government at the earliest.

The majority of medical practitioners were of the opinion that reports on the effects of arecanut consumption on human health are only observational and not based on any systematic scientific studies. Arecanut was also described to possess antimicrobial properties and reduce digestive disorders, diabetes, and depression. Most of the findings were *in vitro* or animal studies. However, it was recognized that all the health benefits listed require systematic research and clinical trials and need to be published in reputed journals. A multi-institutional project involving basic and strategic, biochemical, cell line and clinical research was suggested to understand the effects of arecanut consumption in various forms on human health. Preclinical and clinical trials for the development and discovery of new drugs, possible therapeutic effects and toxicity were also discussed.

P. Chowdappa, K. B. Hebbar* and **S. V. Ramesh**, ICAR-Central Plantation Crops Research Institute, Kasaragod 671 124, India.

*e-mail: balakbh64@gmail.com

MEETING REPORT

Modern techniques for molecular and morphological characterization of crustaceans*

Taxonomy is one of the oldest branches of science, dating as far back as the human language itself. It has significantly advanced from Aristotle to Linnaeus, and since the modern Linnaean system, many taxonomists have emerged. Molecular techniques have been added to modern taxonomy in recent times. However, at

present, the number of taxonomists has dwindled, and this has resulted in a greater number of unknown, undescribed organisms. To address this taxonomic impediment, a two-week long international workshop on modern techniques for molecular and morphological characterization of crustaceans was recently organized. The primary aim of the workshop was to train researchers in modern taxonomic techniques and create a network of crustacean taxonomy experts in India, which is a small group at present. It encompassed talks, practical sessions as well as field trips regarding various aspects of crustaceans. Experts from Germany, Japan, Malaysia and India

trained a group of 25 students with varying degrees of knowledge on crustaceans and taxonomy. Subject experts addressed important crustacean taxonomy topics during the workshop.

Morphological characterization is the first step towards identifying a species, and the oldest way of taxonomy. Identification by morphology of prawns, crabs, lobsters, isopods and copepods was taught with great fervour, and pictorial representations as well as handling of the specimens. K. Valarmathi (Zoological Survey of India, Kolkata) and B. Vaseeharan (Alagappa University, Karaikudi) conducted lecture sessions on the identification of freshwater prawns and

*A report on the International Workshop on 'Modern techniques for molecular and morphological characterization of crustaceans', held during 25 June to 6 July 2018. The workshop was organized by the Centre of Advanced Studies in Marine Biology, Annamalai University and sponsored by the Ministry of Earth Sciences, New Delhi.