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NATURAL PRESERVATION OF POLLEN IN HONEY AND BEE BREAD: DIVERSITY, VIABILITY, AND *IN VITRO* GERMINATION IN THE INDIAN SUNDARBANS MANGROVE ECOSYSTEM

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Abstract: Pollen preservation is important for understanding plant reproductive biology, pollination ecology and biodiversity, but conventional storage methods often require controlled environmental conditions and specialised infrastructure. The present study investigated the diversity, viability and *in vitro* germination potential of pollen naturally recovered from bee bread (BB) and honey (HN) in the Sundarbans mangrove ecosystem of India. Bee bread and honey samples collected from five bee hives representing four regions of the Sundarbans were subjected to palynological analysis. Pollen viability was assessed using Aniline Blue, Acetocarmine and 2,3,5-triphenyl tetrazolium chloride (TTC), while germination was evaluated under *in vitro* conditions at different sucrose concentrations and incubation periods. A total of 20 pollen taxa representing 12 plant families were identified, comprising mangrove, mangrove-associated and terrestrial taxa and reflecting the diverse floral resources exploited by honey bees. Viability varied among pollen taxa, staining methods and storage matrices, with bee-bread pollen generally showing higher viability than pollen recovered from honey. Significant differences in viability between BB and HN were observed for all three staining methods, whereas the responses among staining methods varied according to the pollen matrix. *In vitro* germination was highest in 20% sucrose and reached a maximum at 72 h of incubation. Germination frequency was consistently higher in BB than in HN pollen, ranging from 70.46–87.64% in BB and 62.32–73.42% in HN. Linear regression indicated strong positive associations between incubation time and germination frequency in both BB ($R^2 = 0.8941$) and HN ($R^2 = 0.9107$). Thus, pollen recovered from bee bread showed greater retention of viability and germination potential than pollen recovered from honey, although responses were species-specific. The findings identify bee bread as a promising natural biological archive for investigating pollen biology, bee–plant interactions, pollination ecology and biodiversity, while providing a basis for future research on natural pollen preservation.

Keywords: Bee bread, Honey; Pollen preservation, pollen viability, Sundarbans, Mangrove ecosystem

MORPHOLOGICAL, PHENOLOGICAL AND MEIOTIC ANALYSIS OF *BUDDLEJA CRISPA* BENTH. FROM JAMMU PROVINCE

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Abstract: *Buddleja crispa* Benth. is an important species growing on high altitudinal sites of Jammu province. Presently, two populations from Pouni and Batote of Jammu province were analysed for morphological, phenological and meiotic aspects. The plants of this species remain in vegetative stage from late September to mid-February, form buds from mid-February to early March, show full blooming from early March to mid-May and fruiting from May to June. Morphological comparison using one way ANOVA reveals Batote population is vigorous in comparison of Pouni population which seems to be an outcome of prevailing climatic conditions. Meiotic studies revealed all PMCs having diploid count of 38. These chromosomes paired as 19 bivalents at diakinesis and metaphase I and separated equally (19:19) at anaphase I. The second meiotic division was also regular. The percentage pollen stainability and viability as determined using 1% acetocarmine, triphenyl tetrazolium chloride (TTC) and fluorescein diacetate (FDA) respectively valued as 88.65%, 53.82% and 62.6% which points towards cytological stability of the species.

Keywords: *Buddleja crispa*, Meiosis, Phenology, Jammu province

EVALUATION OF PHYTOCHEMICAL COMPOSITION AND BIOLOGICAL ACTIVITIES OF LEAF AND ROOT EXTRACTS OF *JUSTICIA SANTAPAU* BENNET

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Abstract: The present study evaluated the phytochemical composition and pharmacological potential of leaf and root extracts of *Justicia santapau* Bennet, an endemic medicinal plant of the Western Ghats, Kerala. Plant materials were sequentially extracted using petroleum ether, chloroform, ethyl acetate, methanol, and distilled water. Qualitative and quantitative phytochemical analyses were performed using standard protocols. Antioxidant activity was evaluated through DPPH and FRAP assays; anti-inflammatory potential via protein denaturation, LOX, and COX inhibition assays; antidiabetic activity using α -amylase inhibition assay; and cytotoxicity against SH-SY5Y human neuroblastoma cells using SRB assay. Methanol exhibited the highest extraction yield for both leaves (15.83%) and roots (48%). Leaves demonstrated greater phytochemical diversity (10 classes) compared to roots (6 classes), with alkaloids as the most abundant constituent (65.03 mg/g) in the methanolic leaf extract. The leaf extract exhibited superior antioxidant activity (DPPH IC₅₀ = 381.84 μ g/mL; FRAP IC₅₀ = 482.84 mg/mL), potent anti-inflammatory activity (LOX IC₅₀ = 85.34 μ g/mL; COX IC₅₀ = 92.67 μ g/mL), significant α -amylase inhibition (IC₅₀ = 137.20 μ g/mL), and moderate cytotoxicity against SH-SY5Y cells (LC₅₀ = 127.69 μ g/mL). The superior bioactivity of leaves correlated with their richer phytochemical composition, including higher alkaloid, phenolic, and flavonoid contents, along with the exclusive presence of cardiac glycosides and steroids. This study provides the first scientific validation of *J. santapau* and establishes the methanolic leaf extract as a promising source of bioactive compounds with multi-target therapeutic potential for further bioactivity-guided fractionation and mechanistic studies.

Keywords: *Justicia santapau*, Phytochemical screening, Antioxidant, Anti-inflammatory, Antidiabetic

DIVERSITY, DISTRIBUTION AND CONSERVATION PERSPECTIVES OF PTERIDOPHYTES IN KORBA DISTRICT, CHHATTISGARH, INDIA

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Abstract: Pteridophytes are important components of forest ecosystems, contributing significantly to biodiversity and ecological stability. Despite its extensive forest cover and favourable climatic conditions, the pteridophytic flora of the Korba district, Chhattisgarh, Central India, remains unexplored. The present study aimed to document the pteridophyte diversity of the district, provide taxonomic descriptions, assess population status and highlight conservation needs. Extensive field surveys were conducted across the Korba district from 2024 to 2026. Specimens were collected in both vegetative and reproductive stages and processed using standard herbarium techniques. Taxonomic identification was carried out using regional floras and relevant taxonomic literature. A comprehensive review of available literature revealed no previous systematic account of the pteridophytes of the Korba district. The study recorded 30 species belonging to 21 genera and 13 families, all representing new distributional records for the district. These findings provide a baseline for future taxonomic, ecological, and conservation research on pteridophytes in Central India.

Keywords: Chhattisgarh, Conservation, Korba district, New record, Pteridophytes

EFFECT OF STORAGE CONDITIONS AND PACKAGING MATERIALS IN MAINTAINING QUALITY OF *CENTELLA ASIATICA* (L.) URB. RAW DRUG

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Abstract: *Centella asiatica* (L.) Urb. is an important medicinal herb valued for its pentacyclic triterpenoid constituents, particularly asiaticoside, madecassoside, asiatic acid and madecassic acid. However, the raw drug remains vulnerable to quality deterioration during storage. The present study evaluated the influence of storage temperature and packaging material on the retention of important marker compounds and the physical and microbiological quality of *C. asiatica* raw drug over six months. The raw drug was stored under refrigerated (4 °C; M1) and ambient (M2) conditions using six packaging systems: glass jar (S1), plastic jar (S2), vacuum pack (S3), low-density polyethylene (LDPE) bag (S4), aluminium pouch (S5) and cloth bag (S6). Samples were assessed after three and six months for asiaticoside and asiatic acid contents. After three months, refrigerated vacuum packaging (M1S3) retained the highest asiaticoside (0.978%) and asiatic acid (0.097%) contents, while LDPE and cloth-bag samples under ambient storage had spoiled. After six months, the refrigerated vacuum-packed treatment retained 0.86% asiaticoside, equivalent to 88% of the initial value (0.98%), and had the lowest reported total viable count among the surviving treatments (10×10^7 CFU/g compared with 16×10^7 CFU/g initially). Refrigerated aluminium-pouch and cloth-bag samples retained 70% and 74% of the initial asiaticoside content, respectively, whereas the ambient vacuum-packed sample retained 62%. Most other treatments were recorded as spoiled by six months. Overall, the results indicated that combining refrigeration with vacuum packaging was the most effective of the tested storage strategies for maintaining the chemical and sensory quality of *C. asiatica* raw drug for upto six months. The study provides practical information for post-harvest handling and storage of *C. asiatica* intended for medicinal and value-added applications.

Keywords: *Centella asiatica*, Raw drug, Storage stability, Vacuum packaging, Asiatic acid