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IMPACT OF TUBER MATURITY AND SIZE CHARACTERISTICS ON SENSORY PROFILES OF SYRUP AND POWDER FROM SWALLOW ROOT (*DECALEPIS HAMILTONII* WIGHT & ARN)

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ABSTRACT

An experiment was conducted to determine the optimal maturity stage and tuber size of swallow root (*Decalepis hamiltonii*) for the preparation of value-added products such as sharbat and powder. Four treatment combinations were evaluated *viz*. T_1- three-year-old large sized tuberous roots (>3 cm diameter), T_2- three-year-old small sized tuberous roots (<3 cm diameter), T_3- two-year-old large sized tuberous roots (>3 cm diameter) and T_4- two-year-old small sized tuberous roots (<3 cm diameter). These tuberous roots were processed into sharbat and powder and the resulting products were assessed for organoleptic qualities. Sharbat prepared from T_1- three-year-old, large sized tuberous roots (>3 cm diameter) received the highest sensory scores for appearance (8.55), colour (8.64), aroma (8.73), texture (8.55), taste (8.55), after taste (8.45) overall acceptability (8.73) and a total score of 60.2. Conversely, powder prepared from T_1- three-year-old, large sized tuberous roots (>3 cm diameter) obtained superior scores for appearance (8.45), colour (8.27), aroma (8.00), texture (8.82), taste (7.91), after taste (7.55), overall acceptability (7.91) and a total score of 56.91. These findings indicate that three-year-old, large sized tuberous roots (>3 cm diameter) are preferable for both sharbat and powder formulation.

Introduction

Decalepis hamiltonii Wight & Arn., commonly known as "swallow root," is an endangered, perennial woody climber belonging to the family Asclepiadaceae. It is native to the Indian subcontinent, specifically restricted to the Deccan Plateau and the forest ecosystems of the Western Ghats, regions renowned for their high biodiversity and ecological significance. This species is identified by various vernacular names across South India- "Maredu kommulu," "Nannari kommulu," and "Maredu gaddalu" in Telugu; "Makaliber" in Kannada; "Magalikizhangu" in Tamil; and "swallow root" in English (Vedavathy, 2004). The growing commercial demand for this species has led to its widespread cultivation in selected districts of Andhra Pradesh (Prakasam, YSR, Chittoor, Annamayya, Palnadu, Ananthapur), Karnataka (Tumkuru, Savanadurga) and Tamil Nadu (Chengalpattu, Coimbatore, Dharmapuri, Nilgiri), predominantly at elevations ranging from 300 to 1200 meters above mean sea level (Sharma and Shahzad, 2014).

The economic and ethnopharmacological significance of *Decalepis hamiltonii* primarily lies in its tuberous roots, which develop in compact clusters underground. Morphologically, the roots are elongated,

cylindrical and fleshy, with diameters varying between 2 to 5 cm and lengths reaching up to 150 cm. Each plant typically produces 4 to 10 such tubers. These roots are externally pale brown and consist of a fleshy cortex enclosing a tough, woody inner core. Notably, they exude a characteristic vanilla-like aroma, attributed to their high content of volatile aromatic compounds, particularly 2-hydroxy-4-methoxy benzaldehyde (96% of the total volatile oil content), which constitutes about 0.68 per cent of the dry root biomass (George *et al*., 2004; Nagarajan *et al*., 2001). The roots possess a mild bitterness, adding to their unique sensory profile and enhancing their appeal for both culinary and medicinal uses.

In traditional systems of medicine, particularly Ayurveda and local ethnomedicinal practices, the tuberous roots of *D. hamiltonii* have long been utilized for a wide array of therapeutic purposes. They are regarded as an effective appetite stimulant, carminative and general health tonic (Vedavathy, 2004). The roots are employed in the treatment of numerous ailments including dysentery, cough, bronchitis, leucorrhoea, uterine haemorrhage, skin disorders, fever, vomiting, indigestion, anaemia, chronic rheumatism and other haematological or metabolic conditions (Kumuda *et al*., 2011; Arutla *et al*., 2012. Ethnobotanical research has revealed that the roots possess a diverse range of pharmacological activities such as antifungal, antibacterial, insecticidal, antioxidant, antitumor, hepatoprotective and ulcer-preventive properties (Harish *et al*., 2005; Monika *et al*. 2020; Devi and Latha, 2012). Among the indigenous tribal communities, particularly the Yanadi tribe of Andhra Pradesh, the roots are traditionally consumed either raw, chewed directly or processed into a herbal decoction, often referred to as "swallow root drink or sharbat," which is believed to aid in digestion, boost immunity and improve overall vitality (Reddy and Murthy, 2013; Raju and Ramana, 2011).

In addition to its therapeutic significance, *Decalepis hamiltonii* has emerged as a promising for value addition in the natural products industry. Its aromatic root extract, rich in phenolic aldehydes, is being explored as a natural flavouring agent and preservative in beverages and traditional food products. Furthermore, the potential integration of this species into the nutraceutical and pharmaceutical sectors underscores its growing commercial relevance. Despite these developments, critical gaps remain in the scientific understanding of the influence of morphological factors particularly tuber age, size and maturation stage on the phytochemical composition, essential oil yield, bioactive and value addition potential of the roots. The studies investigating the influence of tuber age and size on sensory qualities of value-added products such as sharbat and powder.

The present research aims to investigate the organoleptic qualities of sharbat and powder prepared by using different age and size of swallow root tubers. Specifically, it will access the correct age and size of the root tubers for the preparation of swallow root sharbat and powder.

Materials and Methods

Materials

Tuberous roots of swallow root at two different maturity stages (two-year-old and three-year-old) were collected from the College of Horticulture, Anantharajupeta, Dr. YSR Horticultural University. Following collection, the roots were categorized based on age and further classified by diameter of the root into two groups *viz.* greater than 3 cm and less than 3 cm. These four distinct categories of roots were utilized for the preparation of sharbat and powder. Sharbat and powder were prepared in the department of Post Harvest Technology, College of Horticulture, Anantharajupeta, Dr. YSR Horticultural University with four different treatments.

T_1 - Three-year-old & large sized tuberous roots (>3cm diameter)

T_2 - Three-year-old & small sized tuberous roots (<3cm diameter)

T_3 - Two-year-old & large sized tuberous roots (>3cm diameter)

T_4 - Two-year-old & small sized tuberous roots (<3cm diameter)

Preparation of swallow root sharbat

Ingredients:

Swallow root (dried) – 1Kg

Water – 10 Liters

Sugar – 8 kg (can adjust to taste)

Sharbat was prepared by using following treatments:

T_1 (1 kg) + ingredients
T_2 (1 kg) + ingredients
T_3 (1 kg) + ingredients
T_4 (1 kg) + ingredients

The flow chart for the preparation of sharbat was presented in Figure 1.

Wash the dried roots thoroughly to remove any dirt
↓
Crush the roots lightly with a mortar and pestle to release their essence
↓
Add the crushed roots to 10 Liters of water
↓
Soak overnight (8–10 hours)
↓
Boil the soaked roots for 60–90 minutes on medium heat until the water reduces to about 8 litres
↓
Cool and strain the decoction through a muslin cloth or fine sieve to remove root particles
↓
Add 8 kg sugar to the strained liquid.
↓
Simmer on low heat, stirring continuously until it thickens slightly into a syrup consistency (takes about 30–40 minutes)
↓
Let the syrup cool completely.
↓
Store in a clean and airtight glass bottle

Fig. 1 : Flow chart for the preparation of Sharbat with *Decalepis* roots

Preparation of swallow root powder

Swallow root powder prepared with different treatments was presented in Figure 2.

Rinse the fresh swallow root roots thoroughly under running water to remove dirt and impurities
↓
Cut the fresh tuberous roots into small pieces (3-5 cm)
↓
Allow the roots to air dry completely under sun light (7-10days)
↓
Lightly crush them using a mortar and pestle to make grinding easier
↓
Use a high-powered blender or a traditional grinder to grind the pieces into a fine powder
↓
Sieve the powder to remove any coarse particles
↓
Store the fine swallow root powder in an airtight container
↓
Keep it in a cool and dry place

Fig. 2 : Flow chart for the preparation of powder from *Decalepis* roots

Procedure followed for organoleptic evaluation of sharbat and powder

An organoleptic evaluation was conducted under laboratory conditions using a semi-trained panel consisting of fifteen judges, aged between 21 and 60 years. The sensory assessment was based on seven key quality attributes *viz.* appearance, colour, flavour, texture, taste, after taste and overall acceptability. A nine-point hedonic scale was employed for the evaluation of each attribute.

Statistical analysis

Organoleptic evaluation of sharbat and powder were performed following Kendall's W test using SPSS software.

Result and Discussion

Organoleptic qualities of sharbat prepared using different treatments

The mean rank score and mean score computed for quality parameters for sharbat and powder prepared using different treatments is presented in Table 1 and Table 2, respectively.

The sensory evaluation of sharbat prepared using different treatments (T_1 to T_4) revealed significant variations in all assessed attributes, including appearance, colour, aroma, texture, taste, after taste and overall acceptability. Among all treatments, T_1 consistently recorded the highest sensory scores across most parameters. The mean score for appearance ranged from 7.64 (T_4) to 8.55 (T_1), with corresponding mean rank scores from 1.64 (T_4) to 3.23 (T_1). Colour scores followed a similar trend, with T_1 attaining the highest mean score of 8.64 and mean rank score of 3.00, while T_4 recorded the lowest values (8.09 and 1.91, respectively). In terms of aroma, T_1 again scored highest (8.73) with a mean rank score of 3.50, compared to T_4 which scored the lowest (7.55 and 1.50, respectively). Texture evaluation also favoured T_1 with a mean score of 8.55 and a rank score of 3.14, followed by T_3, T_2, and T_4 in descending order. Taste scores ranged from 7.64 (T_4) to 8.55 (T_1), with mean rank scores mirroring this trend (1.64 to 3.14). Aftertaste scores were highest in T_1 (8.45 and 3.00), followed by T_2, T_3, and T_4. Overall acceptability of the sharbat was most prominent in T_1, which achieved the highest mean score (8.73) and mean rank score (3.36), while T_4 scored the lowest in both respects (7.73 and 1.50). These findings indicate that the formulation in T_1 was most preferred by the sensory panel across all evaluated parameters, suggesting its potential for superior consumer acceptability and marketability.

The sensory evaluation of swallow root powder prepared under different treatments (T_1 to T_4) demonstrated notable differences across all quality attributes, including appearance, colour, aroma, texture, taste, after taste and overall acceptability. For appearance, the mean sensory score ranged from 7.45 (T_4) to 8.45 (T_1), with corresponding mean rank scores from 1.55 to 3.00, indicating that T_1 was most preferred. Similarly, T_1 exhibited the highest mean score for colour (8.27) and mean rank score (2.95), followed closely by T_3 and T_2, with T_4 recording the lowest values (7.82 and 2.05, respectively). Aroma scores were also superior in T_1 (8.00 and 3.09), followed by T_2 (7.73 and 2.77), while T_4 had the lowest scores (7.27 and 2.00). In terms of texture, T_1 (8.82 and 3.32) again outperformed the other treatments, with decreasing preference observed in the order $T_3 > T_2 > T_4$. Taste evaluation reflected a similar trend, with T_1 achieving the highest scores (7.91 and 3.73), followed by T_2 (7.27 and 2.77), while T_4 scored the lowest (6.27 and 1.41). Aftertaste scores ranged from 6.09 (T_4) to 7.55 (T_1) in mean score and from 1.50 to 3.68 in mean rank score. Finally, overall acceptability was rated highest for T_1, which recorded a mean score of 7.91 and mean rank score of 3.36, followed by T_2, T_3, and T_4 in descending order. These results clearly indicate that the powder prepared under T_1 treatment was most preferred by the sensory panel across all evaluated attributes, signifying its potential for higher consumer acceptability and commercial application.

The superior sensory performance of both sharbat and powder in treatment T_1 can be attributed to the higher concentration of 2-hydroxy-4-methoxy benzaldehyde (2H4MB), the principal aromatic compound in *Decalepis hamiltonii*. This natural isomer of vanillin imparts the characteristic vanilla-like aroma and mild bitterness, which significantly enhanced the flavour, aroma and overall acceptability of the products. T_1 consistently recorded the highest scores across all sensory parameters *viz.* appearance, colour, aroma, texture, taste, after taste and overall acceptability in both formulations. The strong aromatic profile and palatable flavour associated with 2H4MB likely contributed to the enhanced consumer preference. These findings highlight the importance of 2H4MB in determining product quality and suggest its potential as a key indicator for value addition and commercial development of *D. hamiltonii*-based functional products.

Conclusion

The present study demonstrated that three-year-old, large sized tubers (T_1) of *Decalepis hamiltonii* consistently exhibited superior sensory qualities in both sharbat and powder formulations, as indicated by higher mean and mean rank scores across all evaluated attributes. This enhanced organoleptic performance is largely attributed to the higher concentration of 2-hydroxy-4-methoxy benzaldehyde, the key aromatic compound responsible for the tuber's characteristic flavour and aroma. These findings underscore the suitability of mature, large-sized tubers for developing value-added products with greater consumer acceptability. Considering the established health benefits of swallow root including its antioxidant, digestive and blood-purifying properties there is considerable potential for its incorporation into functional beverages, powders and other nutraceutical products.

Table 1 : Organoleptic qualities of various types of sharbat

Treatments	Appearance	Colour	Aroma	Texture	Taste	After taste	Overall acceptability	Total score
T_1	8.55 (3.23)	8.64 (3.00)	8.73 (3.50)	8.55 (3.14)	8.55 (3.14)	8.45 (3.00)	8.73 (3.36)	60.2
T_2	8.00 (2.23)	8.27 (2.27)	8.27 (2.82)	8.09 (2.27)	8.36 (2.86)	8.27 (2.73)	8.45 (2.86)	57.71
T_3	8.36 (2.91)	8.55 (2.82)	7.91 (2.18)	8.36 (2.77)	8.00 (2.36)	8.09 (2.45)	8.09 (2.27)	57.36
T_4	7.64 (1.64)	8.09 (1.91)	7.55 (1.50)	7.82 (1.82)	7.64 (1.64)	7.73 (1.82)	7.73 (1.50)	54.20
Kendall' W	0.556**	0.394**	0.664**	0.447**	0.387**	0.232**	0.606**	

Values in parentheses are mean rank score based on Kendall's W

**-Significant at 1% level

T_1 – Sharbat prepared using three-year-old & large sized tuberous roots (>3cm diameter)

T_2 - Sharbat prepared using three-year-old & small sized tuberous roots (<3cm diameter)

T_3 - Sharbat prepared using two-year-old & large sized tuberous roots (>3cm diameter)

T_4 - Sharbat prepared using two-year-old & small sizde tuberous roots (<3cm diameter)

Table 2 : Organoleptic qualities of various types of powder

Treatments	Appearance	Colour	Aroma	Texture	Taste	After taste	Overall acceptability	Total score
T_1	8.45 (3.00)	8.27 (2.95)	8.00 (3.09)	8.82 (3.32)	7.91 (3.73)	7.55 (3.68)	7.91 (3.36)	56.91
T_2	8.09 (2.55)	8.00 (2.45)	7.73 (2.77)	8.18 (2.18)	7.27 (2.77)	6.91 (2.59)	7.55 (2.82)	53.73
T_3	8.36 (2.91)	8.00 (2.55)	7.36 (2.14)	8.55 (2.91)	6.82 (2.09)	6.64 (2.23)	7.09 (2.09)	52.82
T_4	7.45 (1.55)	7.82 (2.05)	7.27 (2.00)	7.82 (1.59)	6.27 (1.41)	6.09 (1.50)	6.82 (1.73)	49.54
Kendall' W	0.407**	0.158**	0.224**	0.597**	0.769**	0.690**	0.545**	

Values in parentheses are mean rank score based on Kendall's W

** -Significant at 1% level

T_1 – Powder prepared using three-year-old & large sized tuberous roots (>3cm diameter)

T_2 - Powder prepared using three-year-old & small sized tuberous roots (<3cm diameter)

T_3 - Powder prepared using two-year-old & large sized tuberous roots (>3cm diameter)

T_4 - Powder prepared using two-year-old & small sized tuberous roots (<3cm diameter)

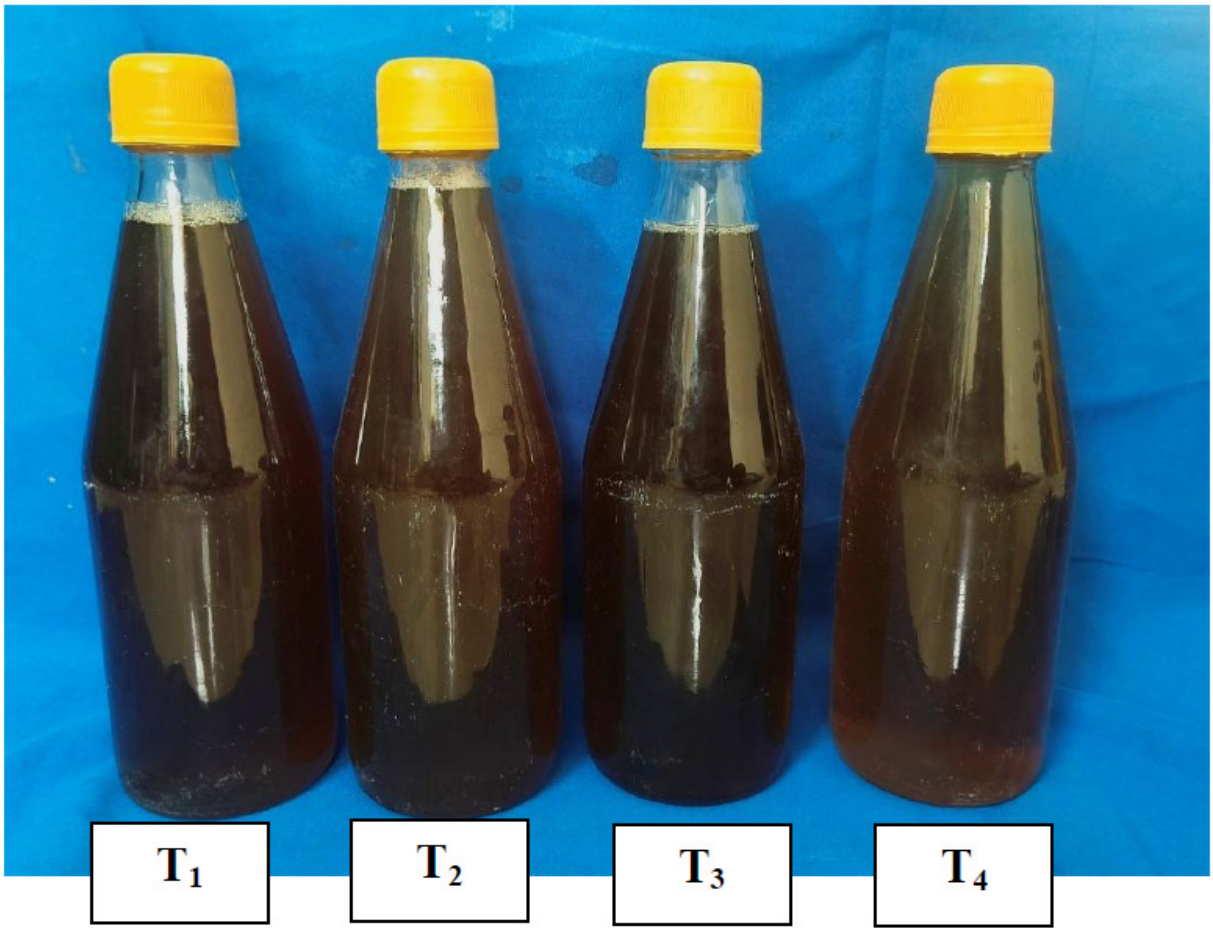

Fig. 1: Sharbat prepared using different age and size of tuberous roots.

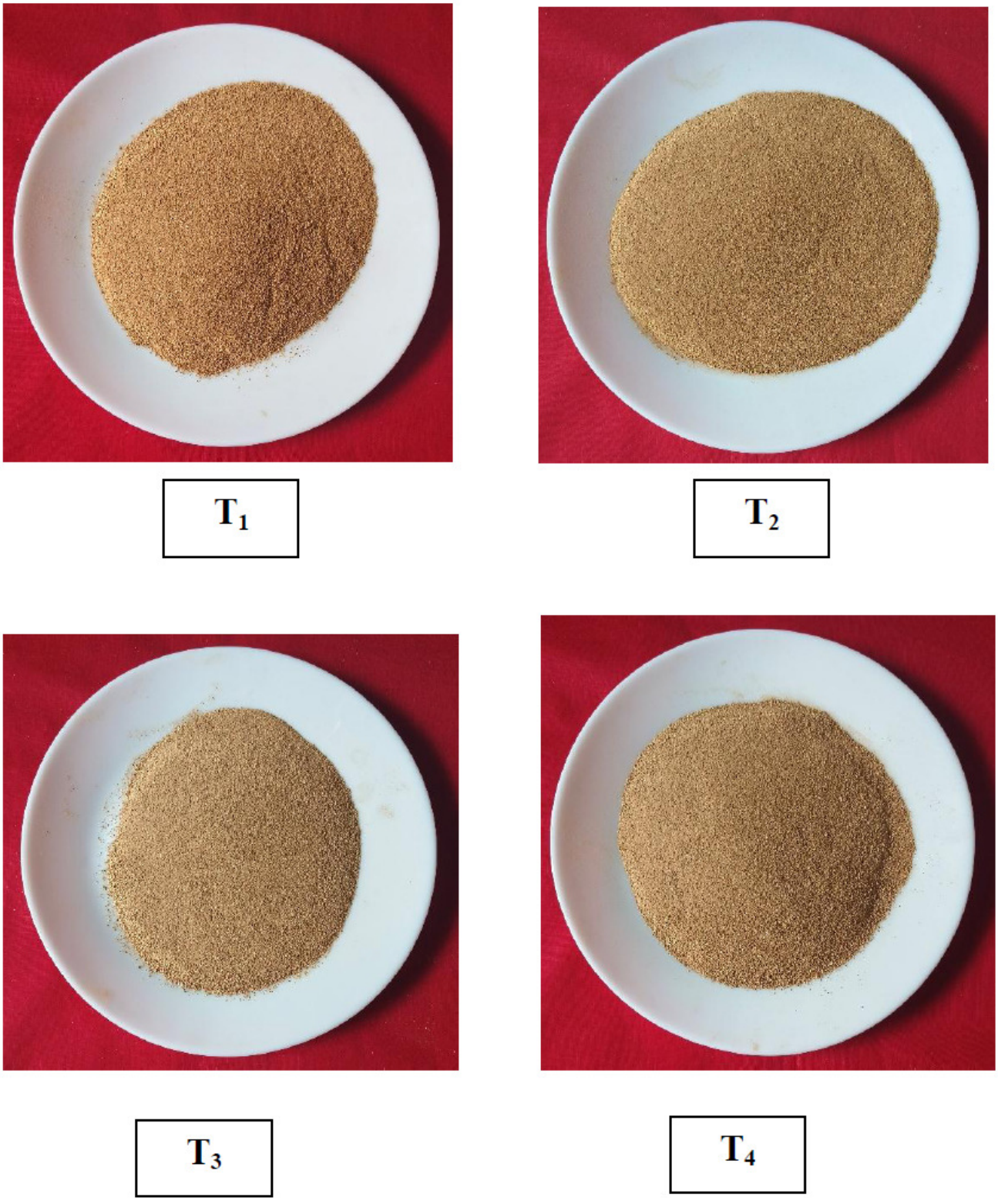

Fig. 2: Powder prepared using different age and size of tuberous roots.

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