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Rasanirdharana (Taste Determination) Of Solanum Torvum Sw. — An Unexplored Bruhati Bheda: A Preliminary Study

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ABSTRACT

Background: Solanum torvum Sw. (Solanaceae), known in Ayurveda as Bruhati bheda or Vatvarangi, is a closely related species of Bruhati (Solanum indicum L.). Though widely used in traditional medicine for its anti-inflammatory, analgesic and bronchodilatory properties, its pharmacological properties have not been systematically assessed from an Ayurvedic pharmacological perspective. Rasanirdharana constitutes the foremost step in evaluating the Ayurvedic pharmacological profile of any drug.

Objectives: To assess the Rasa (taste) of fruit and root powder of S. torvum by Nipata method (direct taste by tongue) in healthy volunteers; and to determine the intensity of perceived Rasa through Taste Threshold (dilution) method.

Materials and Methods: Authenticated fruit and root powder of S. torvum were subjected to Rasanirdharana study involving 30 healthy volunteers using a structured proforma based on classical Rasa Lakshanas. Taste threshold was assessed in 10 volunteers using cold and hot infusion through the ascending dilution technique as per SC Dhyani's method with modifications.

Results: Rasanirdharana study revealed Tikta (bitter) and Katu (pungent) as the Pradhana Rasa (primary taste) of both fruit (51.66% and 46.66%) and root (58.33% and 41.10%) powder, with Kashaya (astringent) as Anurasa (secondary taste). Taste threshold study corroborated the above findings; threshold point was 320–360 ml for fruit and 380–420 ml for root, with Tikta-Katu Rasa perceived at higher dilutions confirming their dominance.

Conclusion: The Rasa of S. torvum is Tikta-Katu with Kashaya as Anurasa, which corresponds to the pharmacological property of Bruhati (Solanum indicum) documented in classical Ayurvedic texts. These findings suggest that S. torvum may share similar Dravyaguna properties viz. Kapha-Pitta shamaka, Deepana, and anti-inflammatory activities, and may serve as a functional substitute for Bruhati in formulations.

Keywords: Rasanirdharana, Solanum torvum, Bruhati bheda, Taste threshold, Nipata method, Dravyaguna**.**

INTRODUCTION

Rasa (taste) occupies a primary position in the pharmacological evaluation of drugs in Ayurveda. It is the only attribute that is Pratyaksha gamya (directly perceivable) through the tongue by direct contact (Nipata). The knowledge of Rasa enables a physician to predict the probable pharmacological action of a drug with reasonable accuracy, as each Rasa has a specific Mahabhuta constitution and corresponding biological activities [1,2].

Solanum torvum Sw. (Family: Solanaceae), commonly known as Turkey berry or Devil's fig, is identified as Bruhati bheda or Vatvarangi in Ayurvedic lexicons. It is closely related to Bruhati (Solanum indicum L.), which is a well-documented member of the Dashamula group of herbs, and shares morphological and phytochemical similarities with S. indicum [3]. The plant is widely distributed across tropical India and is used in various traditional formulations for its anti-inflammatory, bronchodilatory, haematinic and antidiabetic properties [4]..

Despite its extensive folk and traditional use, a systematic Ayurvedic pharmacological assessment of *S. torvum* based on *Rasapanchaka* has not been undertaken. The textual reference for *Bruhati* (*S. indicum*) documents its *Rasa* as *Katu-Tikta*, *Guna* as *Laghu, Ruksha, Tikshna*, *Vipaka* as *Katu*, and *Virya* as *Ushna* [5]. Based on the principle of *Samanaprathyayarabdha* (drugs having similar botanical and pharmacological characteristics), it is anticipated that *S. torvum* may exhibit similar *Rasa*. The present study was therefore undertaken to assess the *Rasanirdharana* of *S. torvum* through both the classical *Nipata* method and the taste threshold (dilution) method.

2. Materials and Methods

2.1. Collection and authentication of plant material

Matured fruits (*Phala*) and roots (*Mula*) of *Solanum torvum* Sw. were collected from the peripheral area of shivpuri, godhra, Gujarat. The plant material was cleaned, shade dried at room temperature (25–30°C), coarsely powdered and sieved through mesh no. 80 to obtain uniform fine powder for experimental use.

2.2. *Rasanirdharana* Study (*Nipata* Method)

2.2.1. Study design and volunteers

Thirty healthy volunteers of either gender (Age-21-50 years) well-acquainted with the six classical tastes (*Shadarasa*), were enrolled from among ayurveda faculties (assistant, associate and professor) of Jay jalaram Ayurvedic Medical College, Godhra, Gujarat. Volunteers with oral pathology (stomatitis, glossitis), acute rhinitis, impaired taste perception, or habitual dependence on tobacco/pan masala were excluded.

2.2.2. Proforma design

A structured bilingual proforma was designed based on the *Rasa Lakshanas* described in *Charaka Samhita*, *Sushruta Samhita*, *Ashtangahridaya* and *Ashtangasangraha*. The proforma comprised two parts: Part I recorded the subjective characteristics of each of the six *Rasa* experienced on placing the drug on the tongue (17 sensory parameters — 2 for *Madhura*, 5 for *Amla*, 2 for *Lavana*, 3 for *Katu*, 2 for *Tikta*, 3 for *Kashaya*). Part II enabled volunteers to directly identify the perceived *Rasa* and *Anurasa*.

2.2.3. Procedure

Volunteers were instructed to abstain from food for at least 2–3 hours prior to the experiment and to rinse their mouth thoroughly with water immediately before sampling. Half a gram (0.5 g) of each test powder was placed on the protruded tongue of each volunteer using a blind method. Volunteers were requested to identify and record their taste perceptions in the proforma. Percentage of absolute *Rasa* perception was calculated using the formula [6]:

% Absolute *Rasa* Perception = (Sum of % perception of symptoms attributed to individual *Rasa*) / (No. of characters in proforma for individual *Rasa*)

Rasa perceived by >30% volunteers was considered as *Pradhana Rasa* and that perceived by 15–30% volunteers as *Anurasa*.

2.3. Taste Threshold Study (Dilution Method)

Ten healthy volunteers meeting the above inclusion criteria were selected for taste threshold assessment. Both cold and hot infusions of fruit and root of *S. torvum* were prepared as follows:

Cold Infusion: Five grams of sample powder was suspended in 100 ml of distilled water, stirred for 30 minutes, and allowed to stand for another 30 minutes, then filtered through Whatman No. 1 filter paper.

Hot Infusion: Five grams of sample powder was added to 100 ml of freshly boiled distilled water, stirred for 30 minutes, allowed to cool, and filtered similarly.

Stock solution dilutions were prepared using the ascending series method as per SC Dhyani's technique with modifications [7]. Starting from 1 ml of stock solution added to 10 ml of distilled water (1:10), subsequent dilutions were prepared in increments of 10–20 ml until the volunteers could no longer perceive any taste (threshold point). Each dilution was scored on a 7-point scale (1 = same as water; 7 = clear taste). Statistical analysis was performed using mean ± SEM.

3. Results

3.1. *Rasanirdharana* by Nipata Method

The characteristics of the six *Rasa* perceived by 30 volunteers on tasting fruit powder and root powder of *S. torvum* are presented in Tables 1 and 3 respectively.

Table 1: Number and percentage of *Rasa* characteristics perceived by the volunteers for *Phala* (Fruit) powder of *S. torvum* (n=30)

S.No	Characteristics of *Rasa*	Attributable *Rasa*	No. of volunteers (n=30)	% of perception
1	*Vaktram Anulimpati* (besmears the mouth)	*Madhura*	3	10.00
2	Indriya prasadayati (soothing to sense organs)	*Madhura*	2	6.66
3	Asyama aasravayati (abundant saliva secretion)	*Amla*	4	13.33
4	*Danta hrisyati* (tingling sensation of teeth)	*Amla*	0	0.00
5	*Roma hrisyati* (piloerection)	*Amla*	1	3.33
6	*Jihva udvejayati* (stimulates the tongue)	*Katu*	18	60.00
7	*Akshi bhruvam samkochyati* (shrinking of eyebrows and eyelids)	*Amla*	0	0.00
8	*Kshalayati mukham* (cleansing the mouth)	*Amla*	3	10.00
9	*Kapha prashekama janayati* (produces salivation)	*Lavana*	5	16.66
10	Kantha- Kapolam vidahati (burning sensation in buccal cavity and throat)	*Lavana*	3	10.00
11	*Mukha-akshi-Nasa stravyati* (watering from mouth, eyes and nose)	*Katu*	9	30.00
12	Jihvagra kurvat chimchimayan (burning sensation over the tongue)	*Katu*	15	50.00
13	*Arochishnu* (distasteful)	*Tikta*	17	56.66
14	*Rasanam pratihanti* (feeling of temporary loss of taste perception)	*Tikta*	14	46.66
15	*Jihva stambhayati* (feeling of stiffness in tongue)	*Kashaya*	4	13.33
16	*Vaktram parishoshyati* (dryness of mouth)	*Kashaya*	6	20.00
17	*Kantha vibandhakruta* (choking feeling in throat)	*Kashaya*	5	16.66

In the fruit powder, 60% of volunteers experienced stimulation of the tongue (*Jihvā udvejayati*), 50% experienced burning sensation over the tongue (*Jihvāgra chimachimaṁ*), and 30% reported watering from mouth, eyes and nose — all characteristic features of *Katu Rasa*. For *Tikta Rasa*, 56.66% reported distasteful perception (*Arociṣṇu*) and 46.66% experienced temporary loss of taste perception (*Rasanam pratihanti*). Features of *Kashaya Rasa* were also perceived — 20% experienced dryness of mouth and 16.66% reported a choking feeling in the throat.

Table 2: Number and percentage of *Rasa* characteristics perceived by the volunteers for *Mula* (Root) powder of *Solanum torvum* (n=30)

S.No	Characteristics of *Rasa*	Attributable *Rasa*	No. of volunteers (n=30)	% of perception
1	*Vaktram Anulimpati* (besmears the mouth)	*Madhura*	2	6.66
2	Indriya prasadayati (soothing to sense organs)	*Madhura*	1	3.33
3	Asyama aasravayati (abundant saliva secretion)	*Amla*	3	10.00
4	*Danta hrisyati* (tingling sensation of teeth)	*Amla*	0	0.00
5	*Roma hrisyati* (piloerection)	*Amla*	1	3.33
6	*Jihva udvejayati* (stimulates the tongue)	*Katu*	16	53.33
7	*Akshi bhruvam samkochyati* (shrinking of eyebrows and eyelids)	*Amla*	0	0.00
8	*Kshalayati mukham* (cleansing the mouth)	*Amla*	4	13.33
9	*Kapha prashekama janayati* (produces salivation)	*Lavana*	6	20.00
10	Kantha- Kapolam vidahati (burning sensation in buccal cavity and throat)	*Lavana*	2	6.66
11	*Mukha-akshi-Nasa stravyati* (watering from mouth, eyes and nose)	*Katu*	8	26.66
12	Jihvagra kurvat chimchimayan (burning sensation over the tongue)	*Katu*	13	43.33
13	*Arochishnu* (distasteful)	*Tikta*	19	63.33
14	*Rasanam pratihanti* (feeling of temporary loss of taste perception)	*Tikta*	16	53.33
15	*Jihva stambhayati* (feeling of stiffness in tongue)	*Kashaya*	5	16.66
16	*Vaktram parishoshyati* (dryness of mouth)	*Kashaya*	7	23.33
17	*Kantha vibandhakruta* (choking feeling in throat)	*Kashaya*	6	20.00

In root powder, *Tikta Rasa* features were more prominent — 63.33% reported distasteful perception and 53.33% noted temporary loss of taste perception. *Katu Rasa* features included tongue stimulation (53.33%), burning sensation (43.33%) and nasal/ocular secretion (26.66%). *Kashaya Rasa* features were observed in 23.33% (dryness of mouth) and 20% (choking feeling) of volunteers.

Table 3: Calculation of Absolute *Rasa* Perception for *Phala* (Fruit) and *Mula* (Root) powder of *Solanum torvum*

Rasa	**No. of chars in proforma**	**Sum of % perception (Fruit Powder)**	**% Absolute *Rasa* (Fruit Powder)**	**Sum of % perception (Root Powder)**	**% Absolute *Rasa* (Root Powder)**
Madhura	2	16.66	8.33	9.99	4.99
Amla	5	26.66	5.33	26.66	5.33
Lavana	2	26.66	13.33	26.66	13.33
Katu	3	140.00	**46.66**	**123.32**	**41.10**
Tikta	2	103.32	**51.66**	**116.66**	**58.33**
Kashaya	3	49.99	16.66	**59.99**	19.99

Values in bold represent *Pradhana Rasa* (>30%); *Rasa* between 15-30% *considered as Anurasa*

Based on the absolute *Rasa* perception calculation (Table 2), the fruit powder showed *Tikta* (51.66%) and *Katu* (46.66%) as *Pradhana Rasa* (>30%), and *Kashaya* (16.66%) and *Lavana* (13.33%) as *Anurasa* (15–30%). The root powder showed *Tikta* (58.33%) and *Katu* (41.10%) as *Pradhana Rasa*, and *Kashaya* (19.99%) and *Lavana* (13.33%) as *Anurasa*.

Table 4: Direct perception of *Rasa* and *Anurasa* for *Phala* (Fruit) and *Mula* (Root) powder of *Solanum torvum* [n=30]

Name of *Rasa*	**Fruit Powder *Rasa* [%]**	**Fruit Powder Anu*Rasa* [%]**	**Root Powder *Rasa* [%]**	**Root Powder Anu*Rasa* [%]**
Madhura (sweet)	1 [3.33]	3 [10.00]	1 [3.33]	3 [10.00]
Amla (sour)	0 [0.00]	0 [0.00]	0 [0.00]	0 [0.00]
Lavana (salty)	0 [0.00]	0 [0.00]	0 [0.00]	0 [0.00]
Katu (pungent)	14 [46.66]	5 [16.66]	12 [40.00]	8 [26.66]
Tikta (bitter)	13 [43.33]	7 [23.33]	15 [50.00]	5 [16.66]
Kashaya (astringent)	2 [6.66]	8 [26.66]	2 [6.66]	7 [23.33]

In the direct perception study (Table 3), 46.66% and 43.33% of volunteers identified *Katu* and *Tikta* respectively as the primary taste of fruit powder. For root powder, 50% identified *Tikta* and 40% identified *Katu* as the primary taste. *Kashaya* was reported as *Anurasa* by 26.66% (fruit) and 23.33% (root) of volunteers.

Table 5: *Rasa* ascertained to the samples as per the proforma

Sample	***Pradhana Rasa* (Proforma 1)**	***Anurasa* (Proforma 1)**	***Rasa* (Direct Perception)**
Fruit (*Phala*) powder	*Tikta, Katu*	*Kashaya*	*Katu, Tikta*
Root *(Mula)* powder	*Tikta, Katu*	*Kashaya*	*Tikta, Katu*

3.2. Taste Threshold Study

The taste threshold data for both fruit and root samples in cold and hot infusion are presented in Table 5.

Table 6: Data of Taste Threshold Study of *Phala* (Fruit) and *Mula* (Root) of *Solanum torvum*

Sample	Dosage Form	Start Point (Clear taste) ml	Threshold Point (Same as water) ml	Taste Perceived
Phala (Fruit)	Cold infusion	4.5 ± 0.527	320 ± 28.456	*Katu, Tikta*
	Hot infusion	5.5 ± 0.674	360 ± 31.234	*Katu, Tikta*
Mula (Root)	Cold infusion	6.2 ± 0.814	380 ± 35.120	*Tikta, Katu*
	Hot infusion	7.0 ± 0.943	420 ± 29.670	*Tikta, Katu*

Values expressed as Mean ± SEM (Standard Error of Mean); n=10 volunteers

The cold infusion of fruit powder showed a start point (clear taste) at 4.5 ± 0.527 ml and a threshold point (same as water) at 320 ± 28.456 ml, with *Katu-Tikta Rasa* perceived. The hot infusion of fruit showed a threshold point at 360 ± 31.234 ml with similar taste perception. For root powder, the threshold point was higher — 380 ± 35.120 ml (cold infusion) and 420 ± 29.670 ml (hot infusion), indicating higher intensity of *Tikta-Katu Rasa* in root than in fruit. *Tikta* was perceived at higher dilutions in root samples, confirming its dominance as *Pradhana Rasa* in root powder.

4. Discussion

The present study systematically assessed the *Rasa* of *Solanum torvum* using both the classical *Nipata* method and the modern taste threshold dilution technique, which provided complementary and mutually corroborative findings.

The prominent *Rasa* identified for both parts of *S. torvum* is *Tikta-Katu*, which is in close agreement with the *Rasa* documented for *Bruhati* (*Solanum indicum*) in Ayurvedic classics — *Katu Tikta Rasa*. This corroborates the principle of *Samanaprathyayarabdha*, which states that botanically related drugs tend to share similar pharmacological attributes [8]. The phytochemical similarity between the two species — with both containing alkaloids (solamargine, solasonine), saponins, and flavonoids — further supports this observation [9].

Tikta Rasa, composed of *Akasha* and *Vayu Mahabhuta*, is known to be *Kapha-Pitta shamaka*, *Ama pachana*, and *Jvaraghna*. *Katu Rasa*, composed of *Agni* and *Vayu*, is characterized by *Deepana*, *Pachana*, *Srotoshodhana* and anti-*Kapha* activity [1]. Thus, the *Tikta-Katu* character of *S. torvum* explains its traditional use in the management of respiratory conditions (*Shwasa, Kasa*), fever, and inflammatory conditions.

The *Kashaya Anurasa* identified in both parts (16–20%) aligns with the presence of tannins and saponins documented in phytochemical studies. The taste threshold study further substantiated the findings — the root powder showed a higher threshold point than fruit (380–420 ml vs. 320–360 ml), indicating a stronger intensity of *Tikta Rasa* in root, consistent with classical texts which cite the root as the most therapeutically potent part (*Mula*) of the *Bruhati* species.

The proforma-based approach offers several advantages over simple direct tasting: it provides a structured, systematic recording of sensory characteristics that reduces inter-individual bias, and the calculation of absolute *Rasa* percentage using number of characteristics per *Rasa* as the denominator helps to normalise the asymmetrical distribution of characteristics across *Rasa* types [6]. As noted in previous studies, the temporary loss of taste perception caused by *Tikta Rasa* and the stiffness of tongue from *Kashaya Rasa* may mask or dampen the perception of other concurrent *Rasa*, which explains minor discrepancies between the two parts of the proforma.

5. Conclusion

The present preliminary study establishes that *Solanum torvum* possesses *Tikta-Katu Rasa* as *Pradhana Rasa* and *Kashaya* as *AnuRasa* in both fruit and root parts. These findings are consistent with classical Ayurvedic documentation of the parent species *Bruhati* (*S. indicum*), thereby providing the first empirical pharmacological validation from an Ayurvedic perspective for this unexplored species. Based on the principle of *Samanaprathyayarabdha*, *S. torvum* may be considered as a potential substitute for *Bruhati* in classical formulations. However, comprehensive assessment of *Guna, Vipaka, Virya* and *Prabhava*, along with bioavailability and safety studies, is recommended before clinical application.

Conflict of Interest

The authors declare no conflict of interest.

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Nil

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