Trop J Nat Prod Res, August 2021; 5(8):1323-1332

**ISSN 2616-0684 (Print)**
**ISSN 2616-0692 (Electronic)**

# Tropical Journal of Natural Product Research

Available online at https://www.tjnpr.org

*Review Article*

# The Valuable Medicinal Plants of Northeast India: *Illicium griffithii* Hook. f., *Pothos scandens* L. and *Sarcostemma acidum* (Roxb.) Voigt

Deepjyoti Dutta[1,2], Manob Jyoti Bordoloi[1], Nayan Kamal Bhattacharyya[2]*

[1]*Chemical Science and Technology Division, CSIR-North East Institute of Science & Technology, Jorhat 785006, Assam, India*
[2]*Department of Chemistry, Sikkim Manipal University (Sikkim Manipal Institute of Technology), Majitar -737136, Sikkim, India*

ARTICLE INFO

*Article history:*
Received 12 April 2021
Revised 25 July 2021
Accepted 07 August 2021
Published online 02 September 2021



ABSTRACT

*Illicium griffithii* Hook. f., *Pothos scandens* L. and *Sarcostemma acidum* (Roxb.) Voigt are important medicinal plants available in sub-Himalayan region of Northeast India. The study was designed to investigate the plants for their traditional values responsible for the treatment of several diseases along with diverse chemical constituents and biological activities. A bibliographic survey was conducted by exploring recognized books and searching Scientific databases (ScienceDirect, SciFinder, Google Scholar, and PubMed) for the available information on the three species. A total of 80 references were covered with 49 compounds reported from these three plants till date. This review demonstrates the potential of the plants *I. griffithii*, *P. scandens* and *S. acidum* as a source of therapeutic agents.

***Keywords***: *I. griffithii*, *P. scandens*, *S. acidum*, Traditional uses, Chemical constituents, Bioactivity.

## Introduction

Natural products have been utilized as a source of medicine throughout history. Many modern pharmaceuticals are prepared from natural products.[1] In recent years, the trend of using natural products has increased and the active plant extracts and their isolated constituents are frequently screened for new drug discoveries.[2,3] Natural product chemists are impressed by the fact that active biomolecules display an unbelievable range of diversity in terms of their structure as well as their biological and physical characteristics.[4,5] Due to both climatic and geographical variations, the Sub-Himalayan region of Northeast India is endowed with vast flora and fauna.[6] The ethnic people of this region are widely relying on these widely available natural sources for various health remedies. It is estimated that about 50% of the total flora of India is found in this part of the country. Bestowed with a large number of medicinal endemic plant species, this region is marked as one of the thirty-four mega-center of biodiversity. This region is inhabited by a large number of ethnic tribal groups and they depend on local herbs for their primary health care.[7,8] As part of our continuing study of medicinal plants in Northeast India[9-12], it is proposed to review three traditional medicinal plants *Illicium griffithii* Hook. f., *Pothos scandens* L. and *Sarcostemma acidum* (Roxb.) Voigt. *Illicium griffithii* is an important traditional medicinal plant, mainly found in Arunachal Pradesh, a Northeastern state of India.[13-19] Shikimic acid, isolated from the fruits of *I. griffithii* which is a starting material for the production of oseltamivir (Tamiflu) used against Avian Flu.[20] Therefore, it is a growing demand for *I. griffithii* species as a source of shikimic acid for the manufacture of anti-viral drugs. *Pothos scandens* is an epiphyte with climbing and rooting branches.[24-27] The plant is mainly native to the Himalayas as well Indo-Burma region and Madagascar. However, it is commonly found on rocks, walls and tree trunks in moist and wet forests in northeastern India. In other parts of India, it is found in Bihar, Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu, Andaman and Nicobar Islands.[28-33] *Sarcostemma acidum* is a medicinal plant belongs to the family Asclepiadaceae found in India mainly in the areas of Northeast India, Bihar, West Bengal and many places of South India in dry rocky places.[52-55] This comprehensive review covers the traditional uses, chemical constituents and biological activities of *I. griffithii*, *P. scandens* and *S. acidum* species.

## Methodology

The authors collected data from library and digital databases including Science Direct, SciFinder, Google Scholar, PubMed, MDPI, Web of Science, etc. related to *I. griffithii*, *P. scandens* and *S. acidum* species. Authors explored literature survey of recognized books in CSIR-NEIST, Jorhat from year 1936 to till date to collect available information on the plants.

## Results and Discussions

*Traditional uses*

According to Vedic literature, *S. acidum* (local name: Soma) was a sacred plant as the juice (Soma-Rasa) of this plant was offered to Gods as divine drinks. Rig Veda explains the preparation of drinks for several medical purposes. It has been used as a narcotic since the time of India's earliest civilizations. The fruits of *I. griffithii* have a slightly aromatic, bitter and astringent taste and are used to treat several diseases and disorders.[13-17] The dried seedless fruit has been used as incense and for sweet fragrance while preparing butter-salted tea or sugar tea.[18] The traditional uses of the different parts from three species are listed in Table 1.

*Chemical constituents*

Diverse chemical compounds, including alkaloids, diterpenoids, flavones, lignans, phytosterols, triterpenoids and steroids have been isolated from the three species. A total 49 different types of compounds have been isolated from these three species (Figures 2-4 and Table 2).

*Corresponding author. E mail: nkamalbhatt@gmail.com
Tel: +91-9382371372

Citation: Dutta D, Bordoloi M, Bhattacharyya NK. The Valuable Medicinal Plants of Northeast India: *Illicium griffithii* Hook. f., *Pothos scandens* L. and *Sarcostemma acidum* (Roxb.) Voigt. Trop J Nat Prod Res. 2021; 5(8):1323-1332. doi.org/10.26538/tjnpr/v5i8.1

Official Journal of Natural Product Research Group, Faculty of Pharmacy, University of Benin, Benin City, Nigeria.

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)


**Figure 1:** Pictures of the three plants

**Table 1:** Traditional uses of *I. griffithii*, *P. scandens* and *S. acidum*

| Plant | Part | Condition | Ref. |
|---|---|---|---|
| *I. griffithii* | Fruit | To treat avian flu (commonly bird flu), cough, sinusitis, toothache, regurgitating, dyspepsia, abdominal pain, food poisoning, vomiting, carminative, stimulant, stomachic, galactagogic and incense. | [16-20] |
| *P. scandens* | Leaves | Heal wounds, swelling, drinks as tea, small pox, snake bites | [29, 31, 43] |
| | Stem | Asthma | [32] |
| | Root | Abscesses | [34, 38] |
| | Whole plant | Bone fracture | [33] |
| *S. acidum* | Leaves | Ear ache and dog bite<br>Snakebite, mental diseases, allergic rhinitis and sinusitis | [52-54] |
| | Latex | Chronic ulcer, lotion, wounds and cuts | [52-55] |
| | Stem | Rheumatism, arthritis and joints pain, mad dog bite, Vasodilator, diaphoretic, bronchodilator, antifertility | [56] [80] |
| | Bark | Galactagogue | [58] |
| | Root | Snake bite | [52] |
| | Pulpy mesocarp | Epilepsy | [57] |
| | Fruits, Seeds | Anti-rabies | [59] |
| | Whole plant | Rheumatic pain, anti-inflammatory narcotic, emetic, pitta, rejuvenating, antiviral, dipsia, hydrophobia, diabetes, antimicrobial, lactation, antidote and edema. | 60-69] [74] |

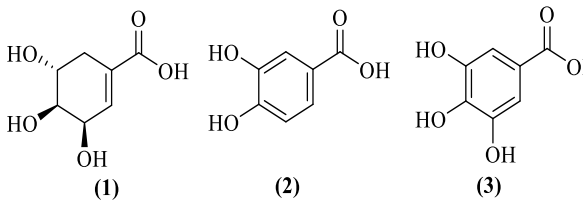


**Figure 2:** Compounds isolated from *I. griffithii*

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

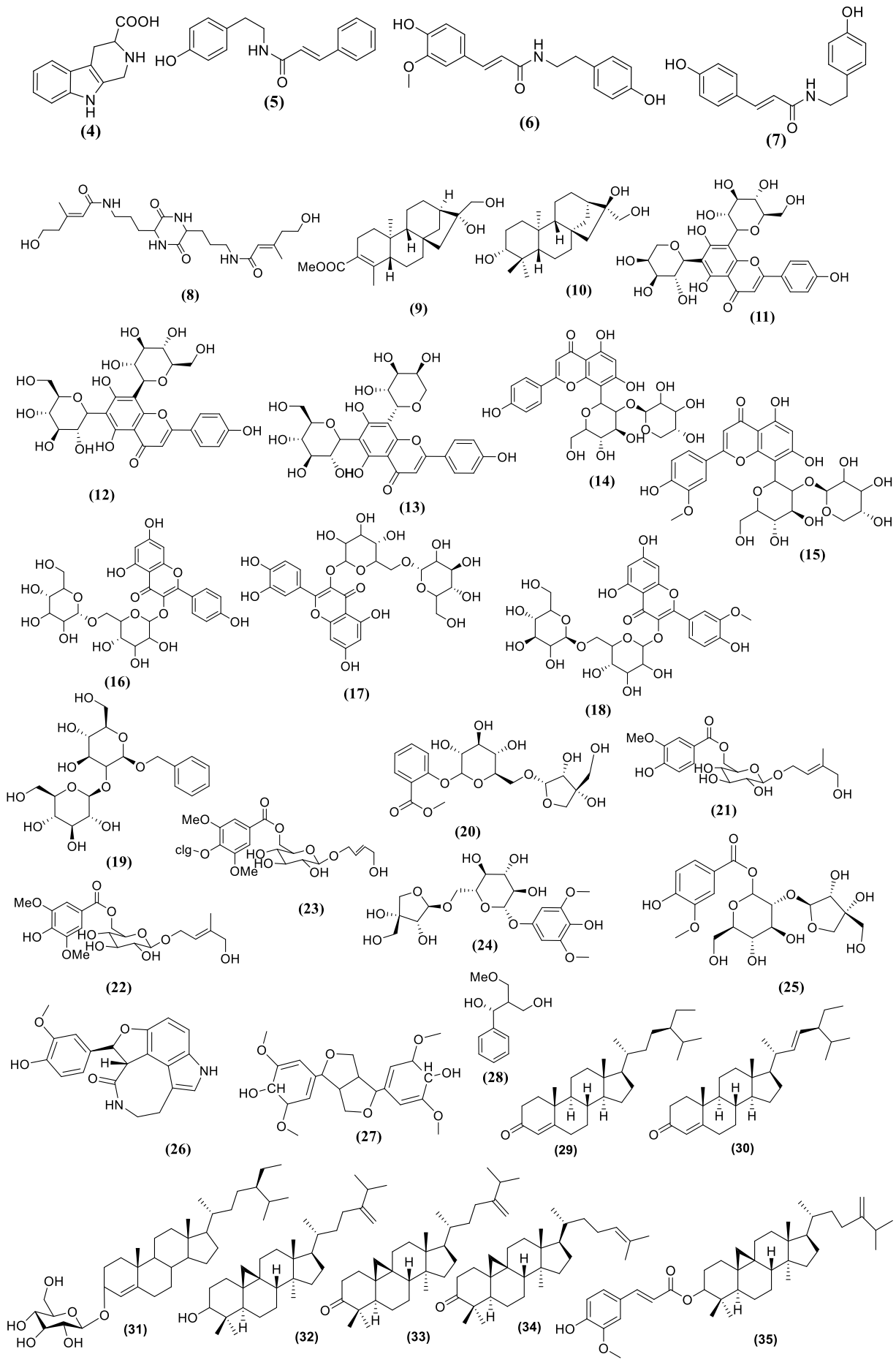


**Figure 3:** Compounds isolated from *P. scandens*

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

**Table 2**: Chemical constituents isolated from *I. griffithii*, *P. scandens* and *S. Acidum*

| Plants | Part | Classification of compounds | Compound names | Ref |
|---|---|---|---|---|
| *I. griffithii* | Fruit | | Shikimic acid (**1**) | [20] |
| | Fruit | | 3,4-dihydroxybenzoic acid (**2**) | [16] |
| | Fruit | | 3,4,5-trihydroxy benzoic acid (**3**) | [16] |
| *P. scandens* | Stem | Alkaloid | 1,2,3,4-tetrahydro-3-carboxy-2 carboline (**4**) | [34] |
| | Whole plant | Alkaloid | N-trans-cinnamoyltyramine (**5**), N-trans-feruloyltyramine (**6**), N-trans-p-cumaroyltyramine (**7**) | [31] |
| | | Diketopiperazine | Eleutherazine B (**8**) | [34] |
| | Stem | Diterpenoid | Methyl Pothoscandensate (**9**), (3β)-ent-kaurane-3,16,17-triol (**10**) | [31] |
| | Whole plant | Flavone | Isoschaftoside (**11**), Vicenin-2 (**12**), Neoschaftoside (**13**), Vitexin 2-O-xyloside (**14**), Scoparin 2-O-xyloside (**15**) | [34] |
| | Stem | Flavonol | Kaempferol 3-O-gentiobioside (**16**), Quercetin 3-O-gentiobioside (**17**), Isorhamnetin 3-Ogentiobioside (**18**) | [34] |
| | Stem | Glycoside | Zizybeoside I (**19**), Canthoside A (**20**) | [34] |
| | Stem | Hemiterpene glucoside | Pothobanoside A (**21**), Pothobanoside B (**22**), Pothobanoside C (**23**), Canthoside B (**24**) | [34] |
| | Stem | Hydroquinone | Markhamioside F (**25**) | [34] |
| | Whole plant | Indole | (–)-serotobenine (**26**) | [31] |
| | Whole plant | Lignan | (+)-syringaresinol (**27**) | [31] |
| | Stem part | Phenyl isobutanol | Pothobanol (**28**) | [34] |
| | Whole plant | Steroid | stigmast-4-en-3-one (**29**), stigmast-4,22-diene-3-one (**30**), β-sitosterolglucoside (**31**) | [35] |
| | Whole plant | Triterpenoid | 24-methylenecycloartanol (**32**), 24-methylenecycloartenone (**33**), 24-en-cycloartenone (**34**), 24-methylenecycloartanylferulate (**35**) | [35] |
| *S. acidum* | Twigs | Disaccharide | Brevobiose (**36**) | [70] |
| | Whole plant | Disaccharide | Sarcidumitol (**37**) | [60] |
| | Whole plant | Lignan | sacidumlignans A–D (**38-41**) | [71] |
| | Whole plant | Lignan | sacidumols A-B (**42-43**) | [71] |
| | Whole plant | | perforatic acid (**44**) | [71] |
| | Whole plant | | peucenine-7-O-methyl ether (**45**) | [71] |
| | Whole plant | Lignan | (+)-pinoresinol (**46**) | [71] |
| | Whole plant | Lignan | 9α-hydroxypinoresinol (**47**) | [71] |
| | Whole plant | Triterpene | α-amyrin (**48**) | [71] |
| | Whole plant | Triterpene | β-amyrin (**49**) | [72] |

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

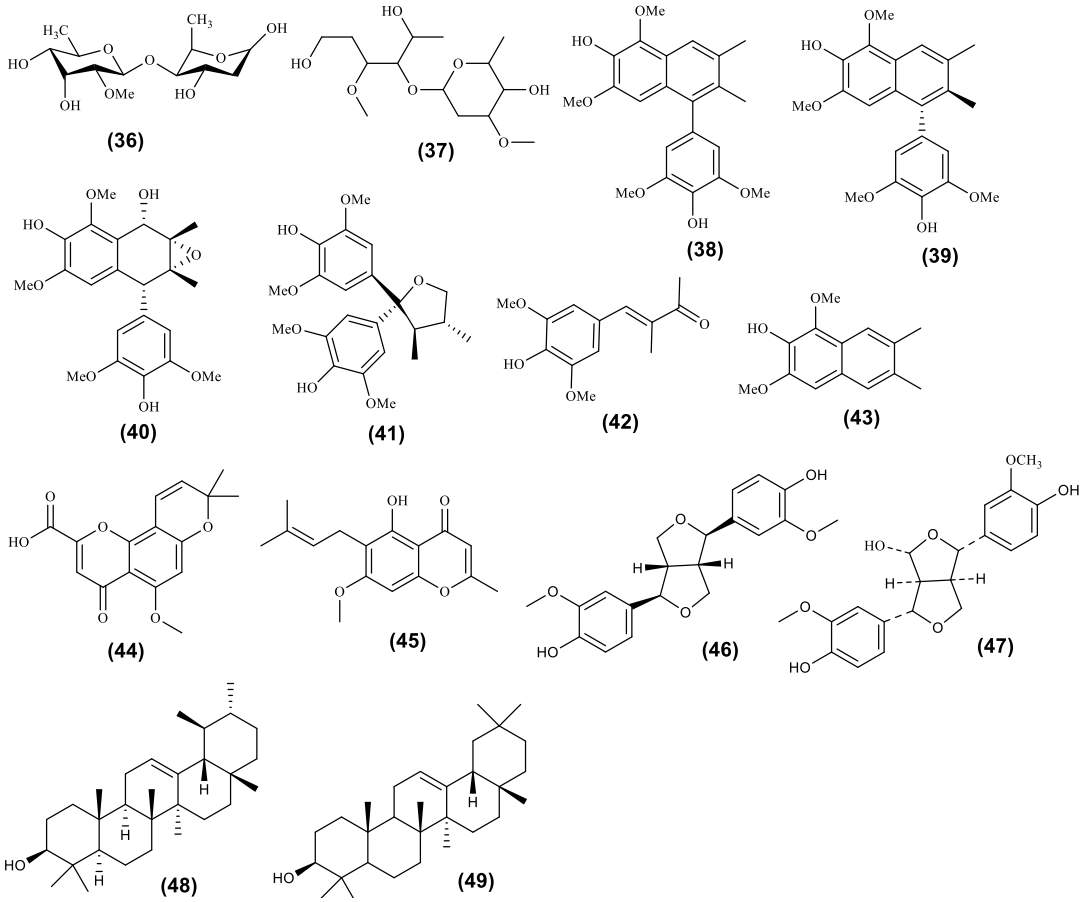


**Figure 4:** Compounds isolated from *S. acidum*

**Table 3:** Biological and pharmacological activities of *I. griffithii*, *P. scandens*, and *S. acidum*

| Plant | Active constituents/ Extracts | Activity reported | Strain | Data/ value | Ref. |
|---|---|---|---|---|---|
| *I. griffithii* | Ethyl acetate extract (fruits) | Cytotoxicity | A549 human lung cancer cell line | 78.7 % toxicity at the dose 500 µg/mL with $IC_{50}$ = 300 µg/ml | [16] |
| | Essential oil (fruits) | Antibacterial | *Staphylococcus aureus* | Zone of inhibition (ZOI) = 14 mm | [19] |
| | Essential oil (fruits) | Antifungal | *Aspergillus niger*, *Penicillium spp.* and *Saccharomyces cerevisiae* | ZOI = 9-13 mm | [19] |
| | Ethyl acetate extract (seeds and fruits) | Antimicrobial | *Staphylococcus aureus, Yersinia enterocolitica*, *vibrio parahaemolyticus, Bacillus subtilis*, *Salmonella paratyphi*, *Enterococcus feacalis*, *Xanthomonas oryzae*, *Pseudomonas aerugenosa* | ZOI = 12-24 mm | [18] |
| | Methanol extract (seeds and fruits) | Antibacterial | *Staphylococcus aureus, Bacillus subtilis* and *Xanthomonas oryzae* | ZOI = 11-13 mm | [18] |

**ISSN 2616-0684 (Print)**
**ISSN 2616-0692 (Electronic)**

| | | | | | |
|---|---|---|---|---|---|
| *P. scandens* | Hexane fraction | Antimicrobial | MRSA bacteria | ZOI = 6.59 mm | [36] |
| | Ethyl acetate fraction | Antimicrobial | *Candida albicans* | ZOI = 8.30 mm | [36] |
| | Stigmast-4,22-diene-3-one (**30**) | Antiestrogenic | Cancer cell lines MCF-7 and T47D | 90% at 10 µM | [35] |
| | 24-methylenecycloartanol (**32**) | Antiestrogenic | Cancer cell lines MCF-7 and T47D | 90% at 0.01 µM | [35] |
| | 24-methylenecycloartanylferulate (**35**) | Antiestrogenic | Cancer cell lines MCF-7 and T47D | 90% at 0.01 µM | [35] |
| | Methanol fraction | Antibacterial | Gram positive bacteria (*Staphylococcus aureus* MTCC-902, *Clostridium perfringens* MTCC-450) | MIC = 250-200 µg/ml | [38] |
| | | | Gram negative (*Escherichia coli* MTCC-405, *Klebsiella pneumoniae* MTCC-432, *Salmonella typhimurium* MTCC-1252, *Pseudomonas aeruginosa* MTCC-1934) | MIC = 400-500g/ml | [38] |
| | Methanol extract | Antifungal | *Aspergillus niger* MTCC478, *Candida albicans* MTCC1637, *Microsporium gypsium* MTCC2819, *Chrysosporium keratinophilum* MTCC1367, *Trichophytum rubrum* MTCC3272, *Chrysosporium indicum* MTCC4965 | ZOI = 8-11 mm | [39] |
| | Methanol fraction, Pothobanoside B (**22**), Pothobanoside C (**23**), Canthoside B (**24**) | Antiestrogenic | Human breast cancer cell lines MCF-7 and T47D | 50% suppressive activity at concentrations lower than 0.1 µM | [34] |
| | 50% ethanol fraction | Cytotoxicity | MCF-7 | $IC_{50}$ = 90.18 ± 5.20 µg/ml | [48] |
| | Methanol fraction | Cytotoxicity | MCF-7 | $LC_{50}$ = 14.195 µg/ml | [40] |
| | Methanol extract | Antipyretic | Wistar albino rats | 200 and 400 mg/Kg doses | [37] |
| | Ethanol extract | Burn wound healing | Formulations of extracts (4% w/v) | Epithelized in 22 days | [43] |
| | Ethanol extract | Burn wound healing | Formulations A1, A2, A3 and A4 at 0.5, 1.0, 1.5 and 2.0 % | No signs of irritation | [49] |
| | Pothobanoside A | Hyaluronidase inhibitory | Type-I allergy | 46.7% inhibition rate at 200 µM. | [34] |
| | Pothobanoside B (**22**), Pothobanoside C (**23**), Pothobanol (**28**) | Histamine release inhibition | Human basophillic KU812F cells | At concentrations of 10, 50, 100 µM | [34] |
| | Methanol extract | Anti-diabetic | α-amylase enzyme | $IC_{50}$ = 1.49 mg/mL | [50] |
| | Leaf | Anticariogenic | *Streptococcus mutans* | ZOI = 1.1-1.9mm | [51] |

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

| | | | | | |
|---|---|---|---|---|---|
| | (methanol) | | (SM-1 to SM-13) | | |
| | Leaf (methanol) | Thrombolytic | Clot lysis | 19.451±1.711% lysis of clot | [50] |
| | Leaf (methanol) | Bronchodilator | On Wister rat | 41.56% protection at 100mg/kg dose | [50] |
| | Ethanol extract | Anti-inflammatory | RAW 264.7 cells | Decreased in NO, $PGE_2$ production | [25] |
| *S. acidum* | 70% methanolic | Antimicrobial | *Bacillus cereus*, *Candida albicans*, *Escherichia coli*, *Klebsiella pneumoniae*, *Streptococcus pneumoniae*, *Staphylococci aureus*, *Salmonella paratyphi* | ZOI = 13–22 mm and MIC = 500 µg, 500 µg, 1000 µg (against *Staphylococci aureus*, *Escherichia coli* and *Candida albicans* respectively) | [77] |
| | Aqueous extract | Antimicrobial | Same microbes as used in 70% methanolic | ZOI = 11–17 mm and MIC = 500 µg, 500 µg, >1000 µg (against *Staphylococci aureus*, *Escherichia coli* and *Candida albicans* respectively) | [77] |
| | 70% methanolic | Antifertility | Male albino rats | 80% reduction fertility | [56] [57] [73] |
| | β-amyrin (**49**) | Antifeedant | Tobacco cutworm, *Spodoptera litura* | Inhibition of growth | [72] |
| | Ethyl acetate extract | Anti-inflammatory | Human red blood cell membrane | 30, 42.8, 54 and 67.6% protection of HRBC | [76] |
| | Ethyl acetate extract | Antipsychotic | Cataleptic Scoring test | Inhibition | [78] |
| | Ethyl acetate extract | CNS inhibitory | Wistar albino rats | Increase in locomotors activity | [78] |
| | Ethyl acetate extract | Hepatoprotective | Hepatic damage agent | Elevation levels | [79] |
| | Ethyl acetate extract | Anxiolytic | Elevated Plus maze and Hole Board | Reduced anxiety | [78] |
| | Ethanolic extract | Antiulcer | Indomethacin induced ulcer models in Wistar rats | Decrease in level (Ulcer index, volume, total acidity and pH of gastric fluid) | [75] |

## Future Directions

As illustrated in this review, *I. griffithii*, *P. scandens* and *S. acidum* are abundant source of chemical constituents which have shown promising bioactivities. The study of different biological properties to those isolated compounds with wide range of activities could lead to the identification of promising lead compounds. Though various studies have been carried out for *in vitro* biological activities of the isolated compounds, we can study further for in vivo evaluation of toxicity profiles, which will lead to the development of an effective as well as safer herbal drug formulation.

## Conclusion

The species *I. griffithii*, *P. scandens* and *S. acidum* provides an attractive bio resource for drug discovery research. The extracts and chemical constituents isolated from them have shown promising several biological activities and would be potential for further research. Knowing the importance of the plants, in recent years, the scientific interest has increased greatly for further scientific exploration of this species, to ascertain their therapeutic efficacy and commercial exploitation.

## Conflict of interest

The authors declare no conflict of interest.

## Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

**Acknowledgements**

We would like to thank Director, Sikkim Manipal Institute of Technology, Majitar, Sikkim and the Director, CSIR-North East Institute of Technology, Jorhat, Assam for providing research facilities.

**References**

1. Machairiotis N, Vasilakaki S, Kouroutou P. Natural products: Potential lead compounds for the treatment of endometriosis. Eur J Obst Gynecol Reprod. 2019; 245(11):7-12.
2. Fave YT, Fatima MD, Hafsat AS, Musa AA, Abdulqadir BB. Evaluation of Antidiabetic, Phytochemical and Acute Toxicity of the Methanol Seed Extract of *Senna occidentalis* Linn. Trop J Nat Prod Res. 2021; 5(6):1101-1105.
3. El Ouahdani K, El Moussaoui A, Benbacer L, Bousta D. Ethnobotanical Study of Medicinal Plants Used in the Treatment of Cancers in the City of Casablanca (West-Central of Morocco). Trop J Nat Prod Res. 2021; 5(6):1044-1054
4. Yuan S, Gopal JV, Ren S, Chen L, Liu L, Gao Z. Anticancer Fungal Natural Products: Mechanisms of Action and Biosynthesis. Eur J Med Chem. 2020; 202(18):112502.
5. Elatif RA, Shabana M, Ibrahim LF, Mansour R, Awad HM, Sharaf M. Chemical Composition and Biological Activity of *Salicornia fruticosa* L. Egypt J Chem. 2020; 63(5):1713-1721.
6. Suhitha S, Devi SK, Gunasekaran K, Pakyntein HC, Bhattacharjee A, Velmurugan D. Phytochemical Analyses and Activity of Herbal Medicinal Plants of North- East India for Anti-Diabetic, Anti-Cancer and Anti-Tuberculosis and their Docking Studies. Curr Top Med Chem. 2015; 15(1):21-36.
7. Chatterjee S, Saikia A, Dutta PK, Ghosh D, Pangging G, Goswami AK. Biodiversity Significance of North East India. Technical report, WWF, India. 2006; 71p.
8. Deori C, Roy DK, Talukdar SR, Pagag K, Sarma N. Diversity of the genus *Clerodendrum* Linnaeus (Lamiaceae) in North East India with special reference to Barnadi wildlife sanctuary, Assam. Pleione. 2013; 7(2):473-488.
9. Barua CC, Patowary P, Bordoloi MJ, Dutta PP, Dutta DJ, Purkayastha A, Barua IC. Attenuating Effect of *Elsholtzia Communis* (Collett & Hemsl.) Diels. on Dysregulated HPA Axis in Stressful Conditions. Int J Pharmacog Phytochem Res. 2016; 8(4):651-658.
10. Bhattacharyya NK, Sarmah GK, Goswami BN, Borthakur N, Kataky JCS. New Protolimonoids and Limonoids: Part IV - Transformation of Naturally occurring 6a-Acetoxy azadirone to new limonoids. J Ind Chem Soc. 2004; 81(5):433-435.
11. Sarmah GK, Bhattacharyya NK, Goswami BN, Borua P, Kataky JCS. Derivatives of Paniculatin and their antifungal activities. J Ind Chem Soc. 2003; 80(11):1-6.
12. Bhattacharyya NK and Kataky JCS. A Facile Microwave-induced Synthesis of Heterocyclic Compounds and a Dialdehyde from a Naturally Occurring Limonoids. J Ind Chem Soc. 2009; 86(9):959-962.
13. Kirtikar KR, Basu BD. Indian Medicinal Plants. (2nd ed.). Delhi: Jayyed Press; 1975; 60p.
14. Saha D and Sundriyal RC. Stand structure, phenology and fruit yield of *Illicium griffithii* in western Arunachal Pradesh, North east India. Ind J Forest. 2010; 33(4):475-488.
15. Liu YN, Su XH, Huo CH, Zhang XP, Shi QW, Gu YC. Chemical Constituents of Plants from the Genus *Illicium*. Chem Biod. 2009; 6(7):963-989.
16. Vijayakumar A, Jeyaraj B, Raj MK, Nimal IVS, Das C, Balachandran C, Agastian P, Ignacimuthu S. *In vitro* cytotoxicity, a-glucosidaseinhibition, antioxidant, and free radical scavenging activities of *Illicium griffithii* fruits. Med Chem Res. 2013; 23(6):2769-2779.
17. Vijayakumar A, Kumar PP, Jeyraj B. Antioxidant activity of *Illicium griffithi* Hook. F. & Thoms Seeds - *in vitro*. Asian J Pharm Clin Res. 2013; 6(2):269-273
18. Vijayakumar A, Duraipandiyan V, Jeyaraj B, Agastian P, Raj MK, Ignacimuthu S. Phytochemical analysis and *in vitro* antimicrobial activity of *Illicium griffithii* Hook. f. & Thoms extracts. Asian Pac J Trop Dis. 2012; 2(3):190-199.
19. Saraswathy A, Shakila R, Lavanya SM, Arunmozhidevi A. Essential oil constituents of *Illicium griffithii* and its antimicrobial activity. Pharmacogn Mag. 2010; 6(23):208-211.
20. Bordoloi M, Borah J, Roy K, Dutta C, Baruah C, Rao PG. Method for the Extraction of Shikimic Acid. Council of Scientific and Industrial Research, New Delhi, (IN). 2013. United States patent US 2013/0137895 A1.
21. Sojeetra NH and Acharya R. A review on ethnomedicinal claims and spread of *Pothos scandens* L. Eur J Med Plants. 2020; 31(5):22-28.
22. Kanjilal UN, Kanjilal PC, Das A, Purkayastha C. *Pothos scandens* L. Fl Assam. 1936; 1(2):60-61.
23. Boyce PC. A review of *Pothos* L. (Araceae: Pothoideae: Pothoeae) for Thailand. Thai Forest Bull (Bot). 2009; 37(1):15-26.
24. Zade NS. The Occurrence of Specialized Vessels in the Stem of *Pothos scandens* L, (Araceae). Int J Sci Res. 2015; 4(1):1060-1061.
25. Kim J, Jeong SH, Lee W, Min H. *In vitro* anti-inflammatory activity of *Pothos scandens* extract in RAW 264.7 cells. Food Sci Biotechnol. 2017; 26(3):791-799.
26. Bhandary MJ, Chandrashekar KR, Kaveriappa KM. Medical ethnobotany of the Siddis of Uttara Kannada district, Karnataka, India. J Ethnopharmacol. 1995; 47(3):149-158.
27. Sangwoo L, Chunjie X, Shengji P. Ethnobotanical survey of medicinal plants at periodic markets of honghe prefecture in Yunnan Province, SW China. J Ethnopharmacol. 2008; 117(2):362-377.
28. Deepa MR, Dharmapal S, Udayan PS. Medicinal plants in the selected sacred groves of Kodungallur, Thrissur district, Kerala. J Med Plants Stud. 2016; 4(3):149-155.
29. Ayyanar M and Ignacimuthu S. Traditional knowledge of Kani tribals in Kouthalai of Tirunelveli hills, Tamil Nadu, India. J Ethnopharmacol. 2005; 102(2):246-255.
30. Khare CP. Indian medicinal plant. Springer Science, Berlin; 2007; 515p.
31. Liu H, Bi JL, Wang YH, Gu W, Su Y, Liu F, Yang S, Hu G, Luo J, Yin G, Long C. Methyl Pothoscandensate, a new ent-18(4-3)-Abeokaurane from *Pothos scandens*. Helvetica Chimica Acta. 2012; 95(7):1231-1237.
32. Dogra KS, Chauhan S, Jalal JS. Assessment of Indian Medicinal plants for the treatment of Asthma. J Med Plants Res. 2015; 9(32):851-862.
33. Das AK, Dutta BK, Sharma GD. Medicinal plants used by different tribes of Cachar district, Assam. Ind J Trad Knowledge. 2008; 7(3):446-454.
34. Muhit MA, Izumikawa M, Umehara K, Noguchi H. Phenolic constituents of the Bangladeshi medicinal plant *Pothos scandens* and their anti-estrogenic, hyaluronidase inhibition, and histamine release inhibitory activities. Phytochem. 2015; 121(1):30-37.
35. Muhit MA, Umehara K, Sharmin N, Noguchi H. Cycloartane and stigmastane type triterpenoids from Pothos scandens inhibit estradiol (E2) induced proliferations in breast cancer cells. Dhaka Univ J Pharm Sci. 2019; 18(1):93-102.

36. Karunathilaka BSB, Priyadarshana YA, Rajapakse S, Jayasinghe L, Wickramasinghe A. Antimicrobial activity and Brine Shrimp Lethality of Some Selected Medicinal Plants. RSU Int Res Conference, Rangsit University, Thailand. 2016.
37. Sajeesh T, Aruachalam K, Parimelazhagan T. Antioxidant and antipyretic studies on *Pothos scandens* L. Asian Pac J Trop Med. 2011; 4(11):889-899.
38. Vinayaka KS, Kekuda TRP, Rajkumar N, Chandrashekar MB, Banakar S, Hegde SV. Studies on Antibacterial, Anthelmintic and Larvicidal Efficacy of *Pothos scandens* L. Res J Pharm Technol. 2009a; 2(4):850-853.
39. Vinayaka KS, Hegde SV, Banakar S, Kekuda TRP. Antifungal potency of Gnidia glauca (Fresen) Gilg and *Pothos scandens* L. J Nat Prod. 2009b; 5(1):146-148.
40. Yusuf ATM, Rashid MMU, Hassan MM, Sayeed MA, Jainul MA. *In-Vitro* Cytotoxic and Thrombolytic Potential of *Pothos Scandens* L. J Pharm Phytochem. 2013; 2(1):193-198.
41. Rani L, Mohan VR, Maruthupandian A. Pharmacognostical and phytochemical studies on *Pothos scandens* L. Int J Phytomed. 2010a; 2(1):277-283.
42. Lalitharani S, Mohan VR, Regini GS. Ethnomedicinal plants used by Kanikkars in Karaiyar of Agasthiamalai biosphere, Tamil Nadu. J Econ Taxon Bot. 2010b; 34(2):472-477.
43. Mohammed HKP, Hanan S, Saraswathi R, Prasad MG, Chandini N. Formulation and evaluation of herbal gel of *Pothos scandens* Linn. Asian Pac J Trop Med. 2010; 3(12):988-992.
44. Mohammad FH, Islam A, Mohammad LB, Moghal MR, Hossain MS. *In vitro* thrombolytic potential of root extracts of four Medicinal plants available in Bangladesh. Ancient Sci Life. 2014; 33(3):162-164.
45. Jethinlalkhosh JP, Arun A, Victor AD. Phytochemicals, antioxidant and free radical scavenging of hydroethanolic extract of aerial parts of *Pothos scandens* L. Asian J Pharm Clin Res. 2016a; 9(3):236-239.
46. Jethinlalkhosh JP, NAIR SS, Praveena P, Victor ADD. Cytotoxicity and Apoptotic inducibility of hydroethanolic extract of aerial parts of *Pothosscandens* L. Int J Pharm Pharm Sci. 2016b; 8(7):274-276.
47. Jethinlalkhosh JP, Praveena P, Victor ADD. Therapeutic Effect of Hydro-Ethanolic Extract of *Pothos scandens* L on key Carbohydrate Metabolizing Enzymes and Xenobiotic Marker Enzymes in DMBA Induced Experimental Mammary Carcinoma. Ind J Pharm Edu Res. 2017a; 51(3):418-426.
48. Jethinlalkhosh JP, Praveena P, Victor ADD. Preliminary Screening of Hydro-ethanolic Extract of *Pothosscandens* L for its Potential Anticancer Activity. J Appl Sci Eng Method. 2017b; 3(3):522-528.
49. Sainuddin T. Formulation & Pharmacological Evaluation of Herbal Gel of *Pothos Scandens* Linn. Webmed Central Wound Healing. 2010; 1(12):WMC001344.
50. Hossain MK, Seal B, Siddiki MAK, Mazumder K. Anti-diabetic and Bronchodilator Activities of *Pothos scandens* Linn Leaves. Int J Pharmacogn Phytochem Res. 2015; 7 (6):1202-1207.
51. Junaid S, Dileep N, Rakesh KN, Pavithra GM, Vinayaka KS, Kekuda TRP. Anticariogenic activity of *Gnidia glauca* (Fresen.) Gilg, *Pothos scandens* L. and *Elaegnus kologa* Schlecht. J Appl Pharm Sci. 2013; 3(3):20-23.
52. Boomibalagan P, Eswaran S, Rathinavel S. Traditional uses of medicinal plants of Asclepiadaceae by Rural people in Madurai district, Tamil Nadu, India. Int J Bot. 2013; 9(3):133-139.
53. Dave BK, Dhirawat R, Kumawat M. Pharmacognostical study of a medicinal plant of India–*Sarcostemma acidum*. Int J Pharmacogn Phytochem Res. 2014; 6(4):690-697.
54. Reddy KN, Trimurthulu G, Reddy CS. Plants used by the ethnic people of Krishna district, Andhra Pradesh. Ind J Trad Knowledge. 2010; 9(2):313-317.
55. Karuppusamy S. Medicinal plants used by Paliyan tribes of Sirumalai hills of southern India. Nat Prod Rad. 2007; 6(2):436-442.
56. Soni PK, Luhadia G, Sharma DK, Mali PD. Antifertility activates of traditional medicinal plants in male with emphasis on their mod active: A review. J Global Biosci. 2015; 4(1):1165-1179.
57. Sharma J, Gairola S, Gaur RD, Painuli RM, Siddiqi TO. Ethnomedicinal plants used for treating epilepsy by indigenous communities of sub-Himalayan region of Uttarakhand, India. J Ethnopharmacol. 2013; 150(1):353-370.
58. Upadhyay B, Singh KP, Kumar A. Ethno-veterinary uses and informants consensus factor of medicinal plants of, Sariska region, Rajasthan, India. J Ethnopharmacol. 2011; 133(1):14-25.
59. Mariappan SM and Sivashankaran P. Ethnomedicinal practices among a minority groups of Malayali tribes residing in Vathal hills of Eastern Ghats. World J Pharmacocogn Pharm Sci. 2017; 6(6):1334-1350.
60. Gan L, Zhao X, Zhou C. Sarcidumitol, a new naturally occurring 2,6-dideoxy-disaccharidtol from *Sarcostemma acidum*. Chem Nat Comp. 2010; 46(1):5-6.
61. Savithramma N, Yugandhar P, Devi PS, Ankanna S, Damai S, Koya SP. Documentation of ethnomedicinal information and antimicrobial validation of Thespesia populnea used by Yanadi tribe of Ganugapenta village, Chittoor district, Andhra Pradesh, India. J Int Ethnopharmacol. 2017; 6(2):158-169.
62. Bhaskar V and Kushalappa CG. Siddarabetta in Tumakuru district, Karnataka - A rich biodiversity heritage site and the hill that heals. J Forest Allied Sci. 2015; 51(1):15-36.
63. Meerabai G. Plants used as antivenin by traditional healers of Rayalaseema region, Andhra Pradesh. Ind J Drugs. 2014; 2(2):44-48.
64. Venkata RK, Reddy GT, Raju RR. Herbal remedies for eye infections used by the tribals of Nallamala forests, Andhra Pradesh. Ind J Trad Knowledge. 2010; 9(4):765-767.
65. Warrier PK, Nambiar VPK, Ramankutty C. Indian Medicinal Plants A Compendium of 500 Species. Orient Longman Private Limited, Chennai; 1993; 394p.
66. Hu RS. *Sarcostemma acidum* (Roxb.) voigt. Hort Suburb Calcutt. Fl China; 1845; 542p.
67. Shah NC. The discovery and mystery of soma plant and its identification. Scitech J. 2014; 1(11):26-36.
68. Sinha BK and Dixit RD. Ethnobotanical studies on *Sarcostemma acidum* (Asclepipiadaceae) from Khargaon district, Madhya Pradesh. Ethnobot. 2001; 13:116-117.
69. Warrier PK, Nambiar VP, Ramankutty C. Indian Medicinal Plant: A Compendium of 500 Species. Hyderabad: V Orient Black Swan/Universities Press; 1996; 73-75p.
70. Khare DP, Tiwari SS, Khare A, Khare MP. Structure of brevobiose. Carbohydr Res. 1980; 79 (2):279-286.
71. Gan LS, Yang SP, Fan CQ, Yue JM. Lignans and their degraded derivatives from *Sarcostemma acidum*. J Nat Prod. 2005; 68(2):221-225.
72. Kannan S, Vijayakumar B, Sureshkumar C, Mohankumar R, Narasimhan S. Insect antifeedant and growth regulating activities of β-amyrin from *Sarcostemma acidum*. Asian J Chem. 2013; 25(2):1167-1168.
73. Verma PK, Sharma A, Mathur A, Sharma P, Gupta RS, Joshi SC. *Sarcostemma acidum* stem extract on spermatogenesis in male albino rats. Asian J Androl. 2002; 4(1):43-47.
74. Rathore MS and Shekhawat NS. *In vitro* regeneration in Sarcostemma acidum (Roxb.) -an important medicinal plant of semi-arid ecosystem of Rajasthan, India. Physiol Mol Biol Plants. 2013; 19(1):269-275.

**ISSN 2616-0684 (Print)**
**ISSN 2616-0692 (Electronic)**

75. Gulshan M, Chandrasekhar GNSS, Kumar BV, Ramarao N. Anti-Ulcer activity of Ethanolic *Sarcostemma acidum* stem extracts. Int Res J Pharm. 2017; 8(6):91-94.
76. Gupta S, Kohli S, Dwivedi S. *In-vitro* anti-inflammatory activity of *Sarcostemma acidum* Wight. & Arn. Indian herb by Human red blood cell membrane stabilization method. Int J Pharm Teaching Prac. 2011; 2 (4):184-188.
77. Mallam A, Angothu S, Gurajala S, Khuddus GA. Antimicrobial activity of *Sarcostemma acidum* Voigt. (Apocynaceae) stem. Int J BioPharm Res. 2012; 3(6):752-757.
78. Ittiyavirah SP and Rahees T. Evaluation of psychopharmacological activity of ethyl acetate extract of *Sarcostemma acidum* (Roxb.) Voiget. J Psychopharmacol. 2013; 2(5):1-7.
79. Lalitha KG and Sethuraman MG. Phytochemical and pharmacological evaluation of theflowers of *Sarcostemma brevistigma* Wight. Oriental Pharm Exp Med. 2009; 9(3):252-258.
80. Pandey S. Ethnomedicinal Potential of *Sarcostemma acidum* in different regions in India. Asian J Pharm Clin Res. 2018; 11(5):395-400.