

# *Celastrus paniculatus*: A Bibliometric Assessment of Global Publications Output during 2001-18

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## ABSTRACT

A bibliometric analysis of global research output on the *Celastrus paniculatus* plant is presented based on selected quantitative and qualitative indicators, using Scopus international database during 2001-18. The study analyzed publication and citations data on a series of bibliometric measures, like growth rate, citations impact, international collaborative papers, most productive countries, organizations, authors, journals and highly cited papers. The *Celastrus paniculatus* global publications registered an annual average growth rate of 16.55% and its citation impact averaged to 14.43 citations per paper. India alone accounting for the highest publication share (73.33%), while all other 9 countries from 1.67% to 7.14% during 2001-18. 99.77% global publication share and more than 100.0% citation share has been contributed by only top 10 countries during 2001-18. Brazil (8.25), Italy (2.51), USA (1.75) and Iran (1.42) registered comparatively the higher relative citation index among top 10 countries during 2001-18. Mohanlal Sukhadia University, Udaipur, India and Banaras Hindu University, Varanasi, India (4 papers each) were the two the most productive organizations and F. Borrelli and A.A. Izzo (4 papers each) were the two most productive authors. *Journal of Ethnopharmacology* (9 papers) and *Phyomedicine* (5 papers) were the two leading journals contributing research on this plant.

**Key words:** *Celastrus paniculatus*, Medicinal plant, Global publications, Citations, International collaborative papers, Bibliometrics, Scientometrics

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## INTRODUCTION

*Celastrus paniculatus* is a woody liana and belong to family Celastraceae (Spike-thorn family). It is commonly known as black oil plant, celastrus, oriental bittersweet, climbing staff tree and intellect tree (also known as jyotishmati in Sanskrit, mal-kangani in Hindi, deng you teng in Chinese).<sup>[1,2]</sup> The plant is extensively used in Ayurveda, Folk medicine, Sowa-Rigpa, Unani, Siddha (the various systems of medicine).<sup>[3]</sup> The plant is mentioned in Ayurveda as 'Tree of life'.<sup>[4]</sup> All the parts of this plant (root, stem, leaves, fruits and seeds) are used for various medical applications.

*Celastrus paniculatus* is an unarmed large woody climber grows at elevations up to 1,800 m. *Celastrus paniculatus* is a deciduous vine with stems up to 10 cm in diameter and 6 m long with rough, pale brown exfoliating bark covered densely with small elongated lenticels. The leaves are simple, broad and oval, obviate or elliptic in shape, with toothed margins. Flowers are borne in large panicles at the end of branches. Male flowers are minute, pale green. Sepals nearly circular, toothed. Petals are oblong or obovate-oblong, entire. Female flowers, having sepals, petals and disk, similar to those of male flowers.<sup>[1,2]</sup>

*Celastrus paniculatus* is distributed in India, Myanmar, Thailand, Vietnam, Southern China, Malesia,

Australia and New Caledonia. In India, it is found throughout in Assam and also spread evenly in other Indian states: Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Nagaland, Meghalaya, Orissa, Madhya Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman Islands.<sup>[3]</sup> Because of its large demand in India, the plant species is highly vulnerable and has become highly endangered plant, particularly in Western and Eastern Ghats of India.

The *Celastrus paniculatus* plant seed is aphrodisiac, bitter, emetic, laxative and stimulant (in folklore). It is used in the treatment of rheumatism, leprosy, gout, fevers and paralysis. Its crushed seeds, a decoction of the seeds or the fixed oil from the seed are applied as a poultice or taken internally. The plant is credited with stimulant and diaphoretic properties and is applied to relieve fevers, joint and muscular pains and paralysis. The oil from the seed of the plant is a powerful stimulant, which is used in the treatment of beriberi. The plant seed oil is also a major component in various products to relieve rheumatic and muscular pain. The seed oil is an ingredient of many more herbal medicines, claiming to enhance the nervous and mental system. It is also considered to be analgesic,

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aphrodisiac, diaphoretic, emetic, emmenagogue, stimulant and tonic. The plant leaf sap has been used as an antidote for opium poisoning. The plant root is used as an antimalarial and antipyretic. The plant wood is used in the treatment of tuberculosis. The bark is abortifacient. The juice from the bark is used in the treatment of indigestion. The stem bark of the plant is used as an anti-dysenteric and a decoction of the stem as a diuretic in the treatment of kidney disorders. The plant fruits are considered anti-flatulent, a blood tonic and a relief for fainting.<sup>[3]</sup>

The *Celastrus paniculatus* plant was in use from time immemorial to treat brain related disorders and to enhance learning and memory. The oil extracted from the seeds of *Celastrus paniculatus* is known to have effect on Central Nervous System. The plant has shown many activities along with main activity i.e memory enhancing effect. The plant reported activities are antiviral, antibacterial, insecticidal, anti-inflammatory, antispermatogetic, sedative, anti-fatigue and analgesic, hipolipidemic. The plant is arthralagenic, antirhumatic, aphrodisiac, emetic, laxative, nervine tonic.<sup>[4]</sup>

The *Celastrus paniculatus* plant parts are broadly used to cure many diseases such as: appetizer, aphrodisiac, arthritis, asthma, antipyretic, amenorrhea, anti-inflammatory, acrid, arthralgia, beriberi, cardiogenic, diuretic, diaphoretic, depression, emollient, skin-diseases, paralysis, thermogenic, intellect-promoting, emetic, expectorant, leprosy, leucoderma, cephalalgia, nephropathy, abdominal disorders, sores abortifacient and treatment of the snake bite. The plant are naturally used in the treatment of vaginal discharge, a sensation of burning, blood purification after delivery, menstruation cycle and abortion.

The plant seed oil contains steroid alkaloids and bright natural coloring matter, celapanine, celapanigine, celapagine, celastrine and paniculatine are the important alkaloids. It contains the fatty acid it's in founding; oleic acid (54.42%), palmitic acid (20.0%), linoleic acid (15.51%) and stearic acid (4.18%). The sesquiterpene alkaloids are derived from a new sesquiterpene (celapanol), which is alternately esterified by acetic, benzoic, nicotinic and  $\beta$ - furoic acids.<sup>[5]</sup>

## Literature Review

Despite the availability of few review papers on *Celastrus paniculatus* plant, not a single bibliometric study is available in the literature till to date. Similar research studies, however, are available in the literature, which quantitatively and qualitatively assess global and Indian literature on other individual medicinal plants, including on *Aloe vera*,<sup>[6]</sup> *Azadirachta indica*,<sup>[7]</sup> *Curcuma longa*,<sup>[8]</sup> *Glycyrrhiza glabra*,<sup>[9]</sup> *Nigella sativa*,<sup>[10]</sup> *Ocimum Santum*,<sup>[11]</sup> *Phyllanthus emblica*,<sup>[12]</sup> *Rhodiola Rosea*,<sup>[13]</sup> *Tinospora Cordifolia*<sup>[14]</sup> and *Withania Somnifera*,<sup>[15]</sup> *Aegle marmels*<sup>[16]</sup> and *Andrographis paniculata*.<sup>[17]</sup>

## Objectives

In this study, the global research output on *Celastrus paniculatus* plant was assessed, based on publications recorded and citations registered, deriving basic publications data from Scopus international database during 2001-18. The major focus of this study was on the distribution of global publication output and of 10 most productive countries. The study analyzed distribution of global output by document type and source type, the growth rate of its annual and cumulative output, the share of its international collaborative publications, its broad subject-wise scatter across sub-fields, the identification of its significant keywords, the publication and citation impact of its top 10 global organizations, authors and journals and the identification of its leading journals for publications.

## Methodology

The global publication on *Celastrus paniculatus* plant was derived in the present study from the Scopus database (<http://www.scopus.com>) during 2001-18. Keywords, such as "*Celastrus paniculatus*" was searched in "Keyword" and "Title of Paper" tags of the Scopus database during 2001-18, to derive global publication data on this plant (120 records). For specific information on global publication data of this plant, the search string was further restricted to individual country by name in "country tag" one by one to ascertain publication output of top 10 most productive countries (including India). The various analytical tags available in the Scopus database, such as "subject area tag", "country tag", "source title tag", "journal title name" and "affiliation tag" were subsequently were used after the search, to obtain the desired data/information on the distribution of publications output by subject, collaborating countries, author-wise, organization-wise and journal-wise, etc. Citations to publications were also collected from date of publication till 23 August 2019.

(KEY("*Celastrus paniculatus*") OR TITLE("*Celastrus paniculatus*")) AND PUBYEAR > 2000 AND PUBYEAR < 2019

## Analysis

The global publication output of *Celastrus paniculatus* plant cumulated to 120 publications during 2001-18, which increased from 4 in the year 2001 to 14 in 2012 in the year 2012 and then decreased to 7 in the year 2018, registering 16.55% growth per annum. The plant cumulative publication output increased from 42 (2001-09) to 78 (2010-18), registering 85.71% growth. The *Celastrus paniculatus* plant global publications citation impact averaged to 14.43 citations per publication (CPP) during 2001-18; its nine-yearly citation impact, however, averaged to 25.45 CPP for the period 2001-09, which sharply declined to 8.50 CPP for the period 2010-18 (Table 1). Of the total global publications output, 80.83% (97) appeared as articles, 16.67% (20) as reviews, 1.67% (2) as conference papers and 0.83% (1) as note.

## Countries Leading on *Celastrus paniculatus* plant

21 countries participated in global *Celastrus paniculatus* research output during 2001-18, of which, 19 published 1-5 papers each and 1 country each 6 and 88 papers. The top 10 most productive countries have contributed 2 to 88 publications each on *Celastrus paniculatus* during 2001-18 (Table 2). The 10 leading countries on *Celastrus paniculatus* research together accounted for 99.77% global publication share and more than 100.0% citation share during 2001-18; it however accounted for 102.38% global publication share during 2001-09, which decreased to 97.44% during succeeding nine-year period 2010-18. Country-wise, the global publication share of 10 leading countries varied widely 1.67% to 73.33% during 2001-18, with India alone accounting for the highest publication share (73.33%), while all other 9 countries from 1.67% to 7.14% during 2001-18. The global publications registered an increasing publication share in Italy, USA, China, Brazil and Pakistan (from 0.39% to 3.3%), as against decrease in India, Thailand, Iran, Germany and Egypt (from 0.06% to 3.59%) in nine years period (2001-09 and 2010-18). Four of the top 10 countries scored relative citation index above the world average of 1.03: Brazil (8.25), Italy (2.51), USA (1.75) and Iran (1.42) during 2001-18. India has comparatively contributed the largest global share and ranked 1st in world output, but registered citation per paper of 12.15, its performance in terms of relative citation index has below the world average (0.84).

## International Collaboration

The international collaborative output of 10 leading countries on *Celastrus paniculatus* research as a national share in the country-wise

output varied widely from 0.00% to 100.0%, with average share of 14.29% during 2001-18. Most surprisingly, India's international collaborative share in its national output in *Celastrus paniculatus* research was comparatively small, 6.82%.

**Table 1: Annual and Cumulative publications on *Celastrus paniculatus* during 2001-18.**

Publication Period	World		
	TP	TC	CPP
2001	4	320	80.00
2002	4	93	23.25
2003	5	126	25.20
2004	4	43	10.75
2005	4	111	27.75
2006	6	133	22.17
2007	3	94	31.33
2008	4	64	16.00
2009	8	85	10.63
2010	9	112	12.44
2011	6	93	15.50
2012	14	157	11.21
2013	7	82	11.71
2014	13	173	13.31
2015	5	14	2.80
2016	9	18	2.00
2017	8	7	0.88
2018	7	7	1.00
2003-11	42	1069	25.45
2012-18	78	663	8.50
2003-18	120	1732	14.43

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper

## Subject-Wise Distribution of Research Output

The *Celastrus paniculatus* global research output as per the Scopus classification is distributed across seven sub-fields during 2001-18. The pharmacology, toxicology and pharmaceuticals accounted for the highest publications share (55.0%) and agricultural and biological sciences (37.63%) contributed the largest global publication share and environment science (5.83%) and neuroscience (4.17%) the least during 2001-18. Its activity index, which computes change in research activity in the discipline over time 2001-09 to 2010-18 (world average activity index of a given subject is taken as 100), witnessed increase in only agricultural and biological sciences, while in all other 6 subjects it showed decrease activity from 2001-09 to 2010-18. Biochemistry, Genetics and Molecular Biology (24.89) and medicine (21.40) registered the highest citations impact per paper while environment science (3.57) and agricultural and biological sciences (9.46) registered the least during 2001-18 (Table 3).

## Profile of Most Productive Global Organizations

One hundred fifty three (153) organizations participated in global *Celastrus paniculatus* research during 2001-18, of which 123 organizations contributed 1 paper each, 26 organizations 2 papers each, 9 organizations 3 papers each and 2 organizations 4 papers each.

The productivity of top 10 most productive global organizations on *Celastrus paniculatus* research varied from 3 to 4 publications and together they contributed 27.50% (33) global publication share and 32.62% (565) global citation share during 2001-18. The scientometric profile of these top 10 organizations is presented in Table 4.

- **Two of these organizations** registered publications output greater than the group average of 3.3: Mohanlal Sukhadia University, Udhapur, India and Banaras Hindu University, Varanasi, India (4 papers each) during 2001-18;
- **Four organizations** registered citation impact above the group average of 17.12 citations per publication and relative citation index of 1.19 during 2001-18: Università degli Studi di Napoli Federico II, Italy (36.25 and 2.51), Mohanlal Sukhadia University, Udhapur, India (32.25 and 2.23), Naval Medical Research Center, USA (22.67 and 1.57) and Walter Reed Army Institute of Research, USA (22.67 and 1.57);

**Table 2: Global Publication Profile of Top 10 Countries on *Celastrus paniculatus* during 2001-18.**

S.No	Name of the Country	Number of Papers			Share of Papers			TC	CPP	ICP	%ICP	RCI
		2001-09	2010-18	2001-18	2001-09	2010-18	2001-18					
1	India	28	60	88	66.67	76.92	73.33	1069	12.15	6	6.82	0.84
2	China	3	3	6	7.14	3.85	5.00	74	12.33	3	50.00	0.85
3	Thailand	1	4	5	2.38	5.13	4.17	47	9.40	1	20.00	0.65
4	Italy	4	0	4	9.52	0.00	3.33	145	36.25	0	0.00	2.51
5	USA	3	1	4	7.14	1.28	3.33	101	25.25	0	0.00	1.75
6	Egypt	1	2	3	2.38	2.56	2.50	26	8.67	3	100.0	0.60
7	Germany	1	2	3	2.38	2.56	2.50	26	8.67	3	100.0	0.60
8	Brazil	1	1	2	2.38	1.28	1.67	238	119.0	0	0.00	8.25
9	Iran	0	2	2	0.00	2.56	1.67	41	20.50	0	0.00	1.42
10	Pakistan	1	1	2	2.38	1.28	1.67	5	2.50	1	50.00	0.17
	Total	43	76	119	102.38	97.44	99.17	1772	14.89	17	14.29	1.03
	World	42	78	120				1732	14.43			

Share of 10 Countries in World Total

**Table 3: *Celastrus paniculatus* Global Publications Distribution by Subjects during 2001-18.**

S.No	Subject*	Number of Papers (TP)			Activity Index		TC	CPP	%TP
		2001-09	2010-18	2001-18	2001-09	2010-18			
1	Pharmacology, Toxicology and Pharmaceutics	26	40	66	112.55	93.24	1237	18.74	55.00
2	Agricultural and Biological Sciences	11	24	35	89.80	105.49	331	9.46	29.17
3	Medicine	11	19	30	104.76	97.44	642	21.40	25.00
4	Biochemistry, Genetics and Molecular Biology	12	16	28	122.45	87.91	697	24.89	23.33
5	Chemistry	6	3	9	190.48	51.28	139	15.44	7.50
6	Environment Science	3	4	7	122.45	87.91	25	3.57	5.83
7	Neuroscience	0	5	5	0.00	153.85	97	19.40	4.17
	World Output	42	78	120			1732	14.43	

- There is overlapping of literature covered under various subjects

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper

**Table 4: Top 10 Most Productive Global Organizations: Scientometric Profile on *Celastrus paniculatus* Research during 2001-18.**

S.No	Name of the Organization	TP	TC	CPP	HI	ICP	%ICP	RCI
1	Mohanlal Sukhadia University, Udhapur, India	4	129	32.25	3	0	0.00	2.23
2	Banaras Hindu University, Varanasi, India	4	31	7.75	2	0	0.00	0.54
3	Chiang Mai University, Thailand	3	4	1.33	2	0	0.00	0.09
4	Naval Medical Research Center, USA	3	68	22.67	3	0	0.00	1.57
5	Zagazig University, Egypt	3	26	8.67	3	3	100.00	0.60
6	Walter Reed Army Institute of Research, USA	3	68	22.67	3	0	0.00	1.57
7	Kasturba Medical College, Manipal, India	3	49	16.33	3	0	0.00	1.13
8	Manipal Academy of Higher Education, India	3	19	6.33	1	1	33.33	0.44
9	Universita degli Studi di Napoli Federico II, Italy	4	145	36.25	4	0	0.00	2.51
10	Gulbarga University, India	3	26	8.67	3	0	0.00	0.60
	Total of 10 organizations	33	565	17.12	2.7	4	12.12	1.19
	Total of World	120	1732	14.43				
	Share of top 10 organizations in World total output	27.50	32.62					

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index

- **Two organizations** contributed international collaborative publications share above the group average of 12.12%: Zagazig University, Egypt (100.0%) and Manipal Academy of Higher Education, India (33.33%) during 2001-18.
- **One author** contributed international collaborative publications share above the group average of 9.38% of all authors: S.G. Kinni (100.0%) during 2001-18.

### Profile of Most Productive Authors

One hundred sixty (160) authors participated in global *Celastrus paniculatus* research during 2001-18, of which 123 authors contributed 1 paper each, 26 authors 2 papers each, 9 authors 3 papers each and 2 authors 4 papers each.

The research productivity in the field of *Celastrus paniculatus* research of top 10 most productive authors varied from 3 to 4 publications. Together they contributed 26.67% (32) global publication share and 38.89% (665) global citation share during 2001-18. The scientometric profile of these 10 authors is presented in Table 5.

- **Two authors** registered publications output above the group average of 3.2: F. Borrelli and A.A. Izzo (4 papers each) during 2001-18.
- **Four authors** registered citation impact above the group average of 20.78 citations per publication and relative citation index of 1.44: F. Borrelli (36.25 and 2.51), A.A. Izzo (36.25 and 2.51), B.P. Doctor (22.67 and 1.57) and R.K. Gordon (22.67 and 1.57) during 2001-18;

### Medium of Research Communication

Of the total global output on *Celastrus paniculatus* research, 98.33% (118) appeared in journals and the rest 1.67% (2) in book series during 2001-18. 118 journal papers appeared in 83 journals, of which 65 journals published 1 paper each, 14 journals 2 papers each, 1 journal each 3, 4, 5 and 9 papers each during 2001-18. The top 10 most productive journals reported 2 to 9 papers each on *Celastrus paniculatus* research; together they accounted for 29.66% (35 papers) share of total *Celastrus paniculatus* output published in journals during 2001-18, shown decrease from 35.71% to 26.32% share between 2001-09 and 2010-18. The top ranking journal is *Journal of Ethnopharmacology* (with 9 papers), followed by *Phyomedicine* (5 papers), *Asia Pacific Journal of Biomedicine* and *Indian Drugs* (4 papers each), *Asian Journal of Pharmaceutical and Clinical Research* (3 papers), etc. during 2001-18 (Table 6).

### Significant Keywords

43 significant keywords have been identified from the literature which through light on the research trends in *Celastrus paniculatus* plant

**Table 5: Top 10 Most Productive Authors: Scientometric Profile on *Celastrus paniculatus* during 2001-18.**

S.No	Name of the Author	Affiliation of Authors	TP	TC	CPP	HI	ICP	%ICP	RCI
1	F.Borrelli	Universita degli Studi di Napoli Federico II, Italy	4	145	36.25	4	0	0	2.51
2	A.A.Izzo	Universita degli Studi di Napoli Federico II, Italy	4	145	36.25	4	0	0	2.51
3	N.Borbone	Universita degli Studi di Napoli Federico II, Italy	3	47	15.67	3	0	0	1.09
4	R.Capasso	Universita degli Studi di Napoli Federico II, Italy	3	47	15.67	3	0	0	1.09
5	DE.Martino	Universita degli Studi di Napoli Federico II, Italy	3	47	15.67	3	0	0	1.09
6	B.P.Doctor	Walter Reed Army Institute of Research, USA	3	68	22.67	3	0	0	1.57
7	R.K.Gordon	Naval Medical Research Center, USA	3	68	22.67	3	0	0	1.57
8	S.G.Kinni	Zagazig University, Egypt	3	26	8.67	3	3	100.00	0.60
9	D.Montesano	Universita degli Studi di Napoli Federico II, Italy	3	47	15.67	3	0	0	1.09
10	S.D.Purohit	Mohanlal Sukhadia University, Udhapur, India	3	25	8.33	2	0	0	0.58
		Total of 10 authors	32	665	20.78	3.1	3	9.38	1.44
		Total of World	120	1732	14.43				
		Share of top 10 authors in World total output	26.67	38.39					

TP=Total Papers; TC=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index

**Table 6: Top 10 Most Productive Journals Publishing on *Celastrus paniculatus* during 2001-18.**

S.No	Name of the Journal	Number of Papers		
		2001-09	2010-18	2001-18
1	Journal of Ethnopharmacology	5	4	9
2	Phyomedicine	5	0	5
3	Asia Pacific Journal of Biomedicine	0	4	4
4	Indian Drugs	2	2	4
5	Asian Journal of Pharmaceutical and Clinical Research	1	2	3
6	Der Pharmacia Lettre	0	2	2
7	Fitoterpia	2	0	2
8	Industrial Crops and Products	0	2	2
9	International Journal of Pharma and Bio Science	0	2	2
10	International Journal of Pharmaceutical Science Review and Research	0	2	2
	Total of 10 journals	15	20	35
	Total global journal output	42	76	118
	Share of top 10 journals in global journal output	35.71	26.32	29.66

**Table 7: List of Significant Keywords Depicted in Global *Celastrus paniculatus* Research Literature during 2001-18.**

S.No	Keyword	Frequency	S.No	Keyword	Frequency
1	<i>Celastrus paniculatus</i>	113	23	Anti-fungal Activity	8
2	Celastrus	62	24	Bark	8
3	Medicinal Plant	58	25	Cognitive Defeat	8
4	Plant Extract	74	26	Drug Screening	8
5	Plant Seed	27	27	Neuroprotection	8
6	Drug Effect	20	28	Skin Disease	8
7	Traditional Medicine	20	29	Alzheimer Disease	6
8	Herbal Medicine	19	30	Anti-bacterial Activity	6
9	Antioxidant Activity	19	31	Anti-neoplastic Activity	6
10	Herbaceous Agent	18	32	Asthma	6
11	Celastraceae	18	33	Brain	6
12	Phytotherapy	18	34	Drug Safety	6
13	Drug Isolation	15	35	Flavonoid	6
14	Oxidation Stress	14	36	Learning	6
15	Plant Leaf	14	37	Memory Disorders	6
16	Vegetable Oil	14	38	Rheumatic Diseases	6
17	Ayurveda	13	39	Wound Healing	6
18	Enzyme Activity	12	40	Apoptosis	5
19	Anti-Inflammatory Activity	10	41	Contraception	5
20	Cognition	9	42	Diabetes Mellitus	5
21	Plant Root	9	43	Fever	5
22	Seeds	9			

including on its chemical composition, biological and pharmacological activity, traditional and current use of *Celastrus paniculatus* in medicine. These keywords are listed in Table 7 in the decreasing order of the frequency of their occurrence in the literature during 2001-18.

## SUMMARY

The global publication data on *Celastrus paniculatus* plant cumulated to 120 publications during 2001-18. The annual and eight-year cumulative global output on *Celastrus paniculatus* research registered 16.55% and 85.71% growth during the last 18 years. The plant global citation impact averaged to 14.43 citations per paper (CPP) in 18 years, which decreased from 25.45 CPP to 8.50 CPP from 2001-09 to 2010-18. The data for the study has been derived from the Scopus database with a view to study its quantitative and qualitative aspects.

India alone accounting for the highest publication share (73.33%), while all other 9 countries contributed from 1.67% to 7.14% during 2001-18. The top 10 most productive countries among 21 participating countries, in *Celastrus paniculatus* research together accounted for 99.77% global publication share and more than 100.0% citation share during 2001-18. The global publication share of top 10 countries on *Celastrus paniculatus*, however, decreased from 102.38% to 97.44% from 2001-09 to 2010-18. The global publication share registered an increase in Italy, USA, China, Brazil and Pakistan (from 0.39% to 3.3%), as against decrease in India, Thailand, Iran, Germany and Egypt (from 0.06% to 3.59%) in nine years period (2001-09 and 2010-18). Of the top 10 countries, four registered relative citation index above the world average of 1.08: Brazil (8.25), Italy (2.51), USA (1.75) and Iran (1.42) during 2001-18 during 2003-18.

Pharmacology, toxicology and pharmaceuticals was the most sought after subject of *Celastrus paniculatus* research accounting for highest (55.0%) publications share, followed by agricultural and biological sciences (37.63%), etc. during 2001-18. The research activities registered increase only in agricultural and biological sciences and in other all other subjects registered decrease from 2001-09 to 2010-18. Biochemistry, Genetics and Molecular Biology (24.89) registered the highest citations impact per paper while environment science (3.57) registered the least during 2001-18.

The top 10 most productive research organizations and the authors on *Celastrus paniculatus* research collectively contributed 27.50% and 26.67% global publication share and 32.62% and 38.89% global citation share respectively during 2001-18. The leading organizations in terms of publication productivity were: Mohanlal Sukhadia University, Udaipur, India and Banaras Hindu University, Varanasi, India (4 papers each) during 2001-18. The leading organizations in terms of citation impact per paper and relative citation index were: Università degli Studi di Napoli Federico II, Italy (36.25 and 2.51), Mohanlal Sukhadia University, Udaipur, India (32.25 and 2.23), Naval Medical Research Center, USA (22.67 and 1.57) and Walter Reed Army Institute of Research, USA (22.67 and 1.57) during 2001-18. The leading authors in terms of publication productivity were: F. Borrelli and A.A. Izzo (4 papers each) during 2001-18. The leading authors in terms of citation impact per paper and relative citation index were: F. Borrelli (36.25 and 2.51), A.A. Izzo (36.25 and 2.51), B.P. Doctor (22.67 and 1.57) and R.K. Gordon (22.67 and 1.57) during 2001-18.

The journals medium accounted for 98.33% global share in *Celastrus paniculatus* research with top 10 most productive journals accounting for 29.66% of total publications output in journals during 2001-18. *Journal*

*of Ethnopharmacology* contributed the largest number of papers (9), followed by *Phyomedicine* (5 papers), *Asia Pacific Journal of Biomedicine and Indian Drugs* (4 papers each), *Asian Journal of Pharmaceutical and Clinical Research* (3 papers), etc. during 2001-18.

## CONCLUSION

The *Celastrus paniculatus* plant have been confirmed to show a strong potential for therapeutic and health-maintaining effects, in light of their long traditional use and the phytochemical and pharmacological studies carried out in the past. The currently, pharmacological studies of this plant suggest that more pharmacological investigations and other studies on the toxicity, bioavailability and pharmacokinetics, in addition to clinical trials, are indispensable for assessing the safety and efficacy of the secondary metabolites or extracts obtained from plants belonging to this genus.

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