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A concise profile of parasitism in angiosperms with special prominence to showy mistletoe family loranthaceae

Ajithkumar TG[1*], Rameena K Jamal[1], Lizzy Mathew[2]
[1] Assistant Professor, Department of Botany, KKTM Government College, Kodungallur, Thrissur, Kerala, India
[2] Associate Professor and Research Supervisor, Department of Botany, St. Teresa's College (Autonomous), Ernakulam, Kerala, India

Abstract
Parasitism in among organisms especially that found in flowering plants is always a matter of curiosity from ancient period onwards. Phanerogamic parasites belonging to the family Loranthaceae commonly called as showy mistletoes with pantropic in its distribution. In most forests they form a keystone resource with a high impact of biotic community characteristics. Many members of this family are highly useful in various fields of medicine even though they are the most important parasitic plants that can cause morphological, ecological and socio-economic damages. Revision of this family is still under concern for many taxon and total number of genera found also varied according to them. Many plants are yet to be identified from this family and reports of recent discoveries added the species richness of India

Keywords: loranthaceae, parasitsism, *dendrophthoe, helixanthera, helicanthes, tolypanthus*

Introduction
Angiosperms, the flowering plants are key group in creating green diversity on earth. Varied nature among these groups in terms of habit, their ecology and relationships with in and out made the existence of other flora and fauna much easier. Angiosperms form the most dominant group of plants on earth with at least 2, 34,000 species [1], a number much greater than all other groups of plants combined together. They are also found in a far greater range of habitats than any other group of land plants. Eminent scientists classified angiosperms based on several criteria, from simple morphology to most complicated phylogenetical and molecular level. The continued rapid assembly of data prompted a revision of the APG system published in 1998 to most recent version APG IV, which was mostly molecular based. Parasitic plants have become one of the major issues mainly in the field of agriculture, forestry plantations and various other timber yielding industries. Many of the commercially important trees like Teak, Mango, Rosewood, *Ailanthus*, *Terminalia*, Para rubber, Guava, etc. are affected in various ways by many of the parasitic plants, especially by the members of Loranthaceae and are found to cause severe economic loss to farmers. About 4000 species in 22 dicot families are currently recognized as parasitic in nature [2].

The evolution of parasitism in plants reported by Westwood *et al.*[3] also suggested a multiple independent origin of parasitism and recent estimates showed approximately 1% of species is parasitic in nature. This includes around 4000 species which are either hemi or holoparasitic plants. "*The Biology of Parasitic Flowering Plants*" [4] known to be one of the pioneer comprehensive book on parasitic plants and represent a fascinating group of plants of great interest for botanists and ecologists.

Methodology
A vast literature review was conducted to avail all the available information about works on parasitic angiosperms and genera belonging to family Loranthaceae. Various online databases like Google Scholar, Parasiticplants. siu. edu, Parasitic plants.org, Science Direct, Forest pathology.org, Wiley online library etc. were given prime importance. The key words used were Loranthacea and its medicinal significance, Parasitism in angiosperms and by citing various genus names comes under the family Loranthaceae. The literature survey was also conducted and data accessed from the libraries of Kerala Forest Research Institute, Thrissur and Jawaharlal Nehru Tropical Botanical Garden and Research Institute, Thiruvananthapuram, Kerala. Back references of the published articles were searched and information were gathered during the survey. More than hundred articles were referred including books, bulletins and manuals during the course of literature survey.

Evolution of Parasitism in Angiosperms
The parasitic lifestyle has evolved repeatedly in every major lineage of life and in broad sense it includes several types like brood parasitism, social parasitism, genomic parasitism and nutritional parasitism [5]. Division angiosperms show extensive variation regarding habit, habitat, mode of nutrition, etc. of plants at a glance. Heterotrophic nutrition among angiosperms was a point of curiosity for all who entered in to the garden of flowering plants which are generally autotrophic. This wondering happened in 1822 when the description of an incredible flowering plant from the jungles of Sumatra that produced flower with gigantic dimensions and the plant was *Rafflesia arnnoldii* R.Br, regarded as the 'Queen of Parasites' [4]. The insectivorous and parasitic plants were interesting not only because of their nature but also in terms of diversity in obtaining food, appearance, flowering, etc. It is astonishing to know that these parasitic flowering plants are important pathogens

causing severe damage to their host plants. Some parasitic plants like *Striga* and *Orobranche* alter the host physiology to the extend resulting in crop failure [6].

Parasitism by means of haustorial connections to a host is widespread in flowering plants [2]. The parasitic plant groups include more than 3000 species distributed in 18 families [1] and occupy important position in several classifications. Phylogenetic studies based on mtDNA revealed that there were 11 independent origins of parasitism in angiosperms, eight of which consists entirely of holoparasitic species that lacks photosynthesis [7]. Parasitic plants can be classified as hemiparasites which are photosynthetic and holoparasites that are completely devoid of chlorophyll. Hemiparasites are again divided in to obligate and facultative depending on the degree of host dependence. Facultative hemiparasites can be found in several root-parasitic families like Olacaceae, Opiliaceae, Santalaceae (Santalales), Krameriaceae (Fabales) and Scrophulariaceae (Lamiales) [8].

The order Santalales contains of 18 families, 160 genera and over 2200 species in which, except the family Olacaceae which includes both non-parasitic and parasitic plants, the rest is entirely comprised of parasitic plants [9]. Mistletoes are found in five families of Santalales that include Amphorogynaceae, Loranthaceae, Misodendraceae, Santalaceae and Viscaceae. These families do not form a monophyletic group, suggesting that parasitism of aerial branches evolved multiple times throughout the evolution of Santalales [10]. Taxonomically mistletoes form a highly peculiar and assorted group of parasitic flowering plants. In India, the phanerogamic parasites of mistletoe group mainly fall under Loranthaceae and Viscaceae have been the object of curiosity for thousands of years. The family Loranthaceae represents most number of genera and species. All of them are hemiparasites on stem except the three root parasites namely *Nuystia*, *Gaiadendron* and *Atkinsonia* [11]. Their victims mostly dicotyledons and gymnosperms, include horticultural plants as well as forest trees. The degree of damage varies with the species of parasite, its persistence and potency of parasitism. The effects on the hosts include reduced vigour and growth, poor fruit and seed production, formation of burrs in the wood, reduction in foliage and premature death.

The number of times parasitism has evolved in flowering plants (angiosperms) has long been debated. The ability of plants to fulfill the nutritional needs by parasitizing its nearby plants has originated several times in angiospermic evolution [3]. Parasitic flowering plants have been known and described since the days of Theophrastus, but for a long time even botanists were doubtful about the nature of parasitic plants, mainly the species of Rafflesiaceae and some Balanophoraceae [12]. According to Nickrent [13] placement of holoparasites in the traditionally recognized families like Balanophoraceae, and Rafflesiaceae among the photosynthetic angiosperms had been difficult. For this reason, traditional classifications were often conflicted among different workers and even in different treatments by the same worker. Relationships between parasitic and non-parasitic angiosperms have been greatly clarified through DNA sequencing and molecular phylogenetic analysis. For example, the holoparasite family Balanophoraceae, previously placed in its own order Balanophorales [14], has been shown from molecular evidence [15] to be related to Santalales. A detailed molecular phylogenetic analysis of the entire order was reported by Su *et al.* [16] and Balanophoraceae was found not to be monophyletic. According to Soltis *et al.* [17] sandalwood order resolved as monophyletic, but this clade was part of a large polytomy among the core eudicots involving caryophyllids, rosids and asterids. Molecular analysis using complete chloroplast genomes from over 80 angiosperms [18] indicated that Santalales is very closely related to Caryophyllales and Asteroids. Barkman *et al.* [7] used molecular methods but could not give an exact number for the origin of parasitism. Earlier, Nickrent[13] had represented all clades of parasitic plants placed on the global angiosperm phylogenetic tree showing 12 origins of parasitic plants.

Establishment of Host-Parasitic Interactions

Unlike ordinary weeds, parasitic plants are heterogeneous plant organisms that are not able to synthesize sufficient nutrients needed for their development, due to that they lodge to other host plants and extract nutrients through specially modified sucking root called haustoria that are the anatomically connected binding channels of two plants. One of the important characteristics of parasitic plants, mainly mistletoes is their host specificity. They are generalists rather than specific, some showing preference to certain hosts. Host specificity is a composite measure of the number of host species on which mistletoe parasitizes and its relative abundance on these parasitized hosts [19]. Many factors may determine the local degree of host specificity in mistletoes, for example, the relative occurance of hosts, bird perch preferences [20], branch architecture [21], bark thickness [22] and mistletoe-host compatibility [23]. Compatibility in terms of chemical signals produced by host favours the establishment of parasite. In the case of *Striga*, successful parasitism depends on a series of chemical signals produced by the hosts and interruption of one or two signals results in the failure of parasitism [24]. Chemicals released by the host helps the parasite to recognize the host and trigger germination as well as haustorial initiation. However, in some instances this process does not always require any chemical signal but depends on light requirement. Finding a host involves detecting the lower red light to far-red light ratio near a potential host plant by phytochrome and a contact signal is also necessary for haustorium induction with in the host plant [25].

Infection by parasites always reduces the fitness of the hosts by affecting their normal physiology and reproduction. In many host–parasite interactions the effect of parasitism extends beyond the direct negative effect of the parasites on host's growth, reproduction, and survival. Parasites manipulate host behavior and affect host vulnerability to predation [26]. According to Koskela *et al.* [27] parasitic plants may impose selection for host traits that either prevent or limit the infection (resistance) or decrease the amount of damage caused by the infection (tolerance). Hosts evolve to reduce the deleterious effects of a parasite by resistance mechanisms whereas parasites evolve to optimize host exploitation [28]. This type of co-evolution is happening always in the case of host-parasitic interaction. In order to create connection between the host and the parasite, some kind of stimulus is needed. The substance for stimulation of connecting the host and the parasite is highly unstable, so the distance between the parasite seed and the root of the host plays a vital role in creating a contact in case of *Orobranche* species [29].

The establishment of parasite on host depends on the haustorial invasion whether it is a holoparasite or a hemiparasite. Accessibility of host resources can be made possible only through haustoria. Hemiparasite establishes its connection with xylem whereas holoparasite makes haustorial link with both xylem and phloem as they are photosynthetically inert. True parasites do not kill the host before successful production of its offspring or they may not have the intention to kill its host because the survival and further expansion of parasite's population truly depends on host's existence. The extent of infection depends on various factors such as biomass ratio of host to parasite, number of parasites growing, length of life cycle of parasite and the degree of co-evolution happening between host and parasite. Despite variations in pathogenicity and life cycle dynamics, all parasitic plant species have evolved under the constraint that they do not kill their hosts prior to successful reproduction [8].

Loranthaceae, the Showy Mistletoes Need Extensive Exploration

Loranthaceae which is the most distributed family of the group of parasitic plants called mistletoe has been plagued with alarming rates of misidentification at the generic and specific levels [30]. They are mainly pantropical in distribution mostly in southern hemisphere extending to temperate zones [31].The family is of particular interest as it is considered as monophyletic group that includes terrestrial root parasites and aerial branch parasites [32]. Moreover mistletoes, while only a minor vegetation component in forest and wood land ecosystems, have large impact on species richness and are considered as keystone resource [33]. Some Loranthaceae are of real pestilences in the natural forests, plantations, orchards and ornamental plants through the world where they reduce yield appreciably or affects the quality of the outputs. This family consists of epiphytic and hemi parasitic plants which adhere to the tree branches by means of haustoria which penetrate into the host tissues to absorb water and nutrients and are popularly known as mistletoes. 'Vrikshabhakshi' ('Vriksha' means tree and 'Bakshi' means 'eating') is the Sanskrit term for mistletoes that means 'eating trees' because of the damage caused by them to host plants. Haustoria are typically large causing host tissue proliferation at the point of contact. Loranthaceae species play an important and keystone role in the biological system like forests where they live by interacting with insects, birds and mammals.

This family includes evergreen shrubs and sometimes trees (*Nuytsia*) and is aerial or terrestrial hemiparasites. *Nuytsia* is a root parasitic tree of Western Australia and *Atkinsonia*, a root parasitic shrub of eastern Australia. *Gaiadendron*, a terrestrial shrub or small tree in the neotropics and may even exist in the canopy, possibly parasitizing fellow epiphytes [34]. Members often produce epicortical roots that traverse the host surface and form intermittent haustorial connections. Loranthaceae constitutes the most important parasitic plants that can cause morphological, ecological and socio-economic damages. These damaging effects make such angiosperm parasites as true agronomic menace affecting varied crops. Loranthaceae Juss. popularly called the "showy mistletoe" family comprises hemiparasitic shrubs on the branches of woody dicotyledons, attached by woody haustoria, with or without surface runners producing secondary haustoria. In 2008, molecular phylogenetic work of this family was carried out by Russell and Nickrent [10] who provided evidence for several clades within Loranthaceae. The family was formally reclassified by Nickrent *et al.* [9]. Total genera worked out in this family found still obscure. This family constitutes the largest group of parasitic plants with about 950 species distributed in 77 genera [35]. According to Nickrent *et al.* [10], Loranthaceae composed of 73 genera mainly of the old and new world tropics with some genera occurring in the temperate regions. The sub-familial name Loranthoidaea Eaton was used by Engler and Krause [36] for the taxon equivalent to Loranthaceae. The family because of its size is divided in to tribes and subtribes [10].

Most taxonomists consider family Loranthaceae as a single family without Viscaceae. Danser [37] has also accepted the concept of a single family Loranthaceae, including both Viscoid and Loranthoid mistletoes. According to Maheshwari [38] the subfamily Loranthoideae is distinct from the Viscoideae at the embryological level [39]. Later Kujit [4] suggested that these two subfamilies should be treated as separate families, as they are distinct from each other in many characters and each deserves the status of an independent family. According to Barlow *et al.* [40] the members of Loranthaceae are predominantly tropical in distribution with about 1000 species in 74 genera.

Loranthaceae from India

In India, Loranthaceae is comprised of 9 genera with 35 species and the 7 widely distributed South Indian species include *Dendrophthoe*, *Helicanthes*, *Macrosolen*, *Tolypanthes*, *Helixanthera*, *Taxillus* and *Scurulla* [41]. Rajasekaran [31] reported that 8 genera and 49 species of this family found in the Indian subcontinent. Inventory studies on the distribution of Loranthacean members was carried out by Vijayan *et al.* [42] and found that 2 species, *Loranthus europeus* and *Dendrophthoe falcata* were abundant in the Sitheri Hills of Eastern Ghats. *Scurrula paramjitii* was for the first-time report from Andaman Nicobar Islands of India [43]. Prabhu *et al.* [44] reported *Helixanther*a *wallichiana* as a rare and endemic plant of Western Ghats. Extended distribution of *Tolypanthus maclurei* (Merrill) Danser in India found out in the Bhuyapara Range of Manas National Park of Assam [45] and this species earlier believed as an endemic to China and present record extends the known geographic distribution from China to South Asia. *Dendrophthoe gamblei* (Loranthaceae) is a new species from the Peninsular India [46] and species is similar to *Dendrophthoe memecylifolia* (Wight and Arn.) Danser but strictly differs in respect to its morphology of vegetative and floral characters. A list of loranthacean members found in India is given in Table 1.

Table 1: Loranthacean members found in India

Sl. No	Genus	Species reported	Synonyms	Common name
1	*Dendrophthoe*	*D. trigona* (Wight & Arn.) Danser ex Santapau	*Elytranthe trigona* (Wight & Arn.) Engl	Three angled mistletoe
		D. falcata (L.F.)Ettingsh.	*D. falcata var. amplexifolia* (DC.) Rajasek., *D. bicolor* (Roxb.) Mart, *D.cordifolia* (Wall.) Mart, *D. discolor* Barlow, *D. falcata var. pubescens* (Hook.f.) V. Chandras, *D. indica* (Desr.) Miq., *D. koenigiana* (C.Agardh ex Schult.f.) Blume, *D. longiflora* (Desr.) Ettingsh., *Etubila longiflora* (Desr.) Raf., *Loranthus amplexifolius* DC.	Honey suckle mistletoe, Clasping mistletoe
		D. gamblei L J Singh, V Ranjan, Rasingam, J Swamy		Gamble's mistletoe
		D. falcata var. coccinea		Red honey suckle mistletoe
		D. neelghereensis (Wight & Arn.) Tiegh	*Loranthus neelgherrensis* Wight & Arn	Nilgiri mistletoe
		D. pentandra (L.) Miq	*Dendrophthoe farinosa* (Desr.) Mart., *Dendrophthoe leucobotrya* Miq., *Dendrophthoe venosa* (Blume) Mart.,*Elytranthe farinosa* (Desr.) G.Don, *Elytranthe rigida* (DC.) *G.Don, Loranthus pentandrus* L.	
		D. memecilifolia (Wight & Arn.) Danser		
		D. curvata (Blume) Miq	*Amyema pilosa* Danser, *Dendrophthoe leptopetala* (Blume) Danser	
		D. glabrescens (Blakeley) Barlow		
2	*Helicanthes*	*H. elasticus* (Desv) Danser	*Loranthus elasticus* Desv	Rubbery mango mistletoe
3	*Scurrula*	*S. buddleoides* (Desr.) G. Don	*Loranthus buddleioides* Desr.,*Loranthus scurrula var. buddleioides* (Desr.) Kurz, *S. buddleioides var. buddleioides*	Butterfly bush mistletoe
		S. pulverulenta (Wall.) G. Don		Powdery mistletoe
		S.elata (Edgew.) Danser	*Loranthus elatus* Edgew	Tall mistletoe
		S.cordifolia G.Don	*Loranthus cordifolius* Wall.	Heart leaf mistletoe
		S.parasitica L.	*Loranthus chinensis* var. *formosanus* Lecomte,*Loranthus parasiticus* (L.) Merr,*Loranthus scurrula* L.,*Scurrula parasitica var. parasitica,Taxillus parasiticus* (L.) S.T. Chiu	Cinnamon mistletoe
		S.ferruginea (Jack) Danser		
4	*Tolypanthus*	*T.lageniferus* Tiegh.		Indian tolypanthus
		T. maclurei (Merr.) Danser	*Loranthus maclurei* Merr.	
5	*Helixanthera*	*H.obtusatus* (Wall.) Danser	*Loranthus obtusatus* Wall.	Blunt leaf mistletoe
		H.wallichiana Danser		Wallich's mistletoe
		H. intermedia Danser		Intermediate mistletoe
6	*Macrosolen*	*M. parasiticus* (L.) Danser	*Elytranthe parasitica* (L.) Danser	Parasiste honey suckle
		M. capitelatus (Wight & Arn.) Danser	*Loranthus capitellatus* Wight & Arn.	South Indian mistletoe
7	*Elytranthe*	*E.albida* (Blume) Blume	*Elytranthe henryi* Lecomte,*Elytranthe leucosiphon* (Griff.) Tiegh., *Loranthus albidus* Blume,*Loranthus leucosiphon* Griff.	Pale bark mistletoe
8	*Taxillus*	*T.heyneanus* Danser		Heyne's mistletoe
		T. tomentosus Tiegh.		Hairy mistletoe
		T. recurvus Tiegh		Curved flower mistletoe
		T. vestitus (Wall.) Danser	*Loranthus vestitus* Wall.	Rusty mistletoe

Conclusion

Angiospermic parasites are peculiar to botanical world for many years due to its varied habit and habitats. The evolutionary trends and establishment of host-parasitic relationships became subject matter for many taxonomists of India and overseas. Loranthaceae is one of the family that includes hemi-parasitic plants generally called as showy mistletoes. Various revision have occurred in this family around the world but Indian loranthaceae needs a comprehensive revision at the molecular taxonomy level for the exact updates of this family.

References

1. Thorne RF. Classification and geography of flowering plants. Botanical Reviews,1992:58:225-348.
2. Nickrent DL, Duff RJ, Colwell AE, Wolfe AD, Young ND *et al*. Molecular phylogentic and evolutionary studies of parasitic plants. In: Soltis, D., Soltis P, Doyle J (eds). Molecular systematic of plants II: DNA sequencing. Kluwer, Boston USA,1998:211-241.
3. Westwood JH, Yoder JI, Timko MP, dePamphilis CW. The evolution of parasitism in plants. Trends in Plant Science,2010:758:1-9.
4. Kujit J. The Biology of Parasitic Flowering Plants. University of California. Press, Berkeley, CA.1969.
5. Bush AO, Fernandez JC, Esch GW, Seed JR. Parasitism: the diversity and ecology of animal parasites. Cambridge. Cambridge University Press, 2001.
6. Parker C, Riches CR. Parasitic weeds of the world: biology and control.CAB International, Wallinford, UK.1993
7. Barkman TJ, McNeal JR, Lim SH, Coat G, Croom HB, *et al*. Mitochondrial DNA suggests at least 11 origins of parasitism in angiosperms and reveals genomic chimerism in parasitic plants. BMC Evolutionary Biology,2007:7(248):1-15.
8. Nickrent DL. Parasitic plants of Iberian Peninsula and Balearic Islands. Chapter:2 Lopz-Saez JA, Catalan P, Saez, L. (eds.),2002:7-27.
9. Nickrent DL, Malecot V, Russel RV, Der JP. A revised classification of Santalales. Taxon, 2010:59: 538-558.
10. Russell RV, Nickrent DL. Evolutionary relationships in the showy mistletoe family (Loranthaceae). American Journal of Botany,2008:95:1015-1029.
11. Puneetha CK. Phytochemical investigation of the selected taxa of Loranthaceae and their biological activities. Ph.D. Thesis. University of Mysore,2015.
12. Heide-Jorgensen HS. Parasitic Flowering Plants. Koninklijke Brill, Boston,2008:504-510.
13. Nickerent DL. Parasiticplants.siu.edu/relations-flowering html,1997
14. Takhtajan A. Diversity and classification of flowering plants. Columbia University Press, New York,1997.
15. Nickrent DL, Der JP, Anderson FE. Discovery of the photosynthetic relatives of the "Maltese mushroom" Cynomorium. BMC Evolutionary Biology,2005:5:38.
16. Su HJ, Hu MJ, Anderson FE, Nickrent DN. Phylogenetic relationships of Santalales with insights into the origins of holoparasitic Balanophoraceae. Taxon,2015:64(3):491-506.
17. Soltis DE, Soltis PS, Chase MW, Mort ME, Albach DC *et al*. Angiosperm phylogeny inferred from 18S rDNA, rbcL, and atpB sequences. Botanical Journal of Linnean Society,2000:133:381-461.
18. Moore MJ, Soltis PS, Bell CD, Burleigh JG, Soltis DE. Phylogenetic analysis of 83 plastid genes further resolves the early diversification of eudicots. Proceedings of National Academy of Sciences, U S A. 2010:107:4623-4628.
19. Mathiasen RL, Nickrent DL, Shaw DC, Watson DM. Mistletoes: pathology, systematics, ecology and management. Plant Disease,2008:92:988-1006.
20. Cazetta E, Galetti M. Frugivoria e especifi dade por hospedeiros na erva-de-passarinho *Phoradendron rubrum* (L.) Grised (Viscaceae). Revista Brasileira de Botanica,2007:30:345-351.
21. Arruda R, Carvalho LN, Del-Claro K. Host specificity of a Brazilian mistletoe, *Struthanthus aff. polyanthus* (Loranthaceae), in Cerrado tropical savanna. Flora, 2006:201:127-134.
22. Sargent S. Seed fate in tropical mistletoe: the importance of host twig size. Functional Ecology, 1995:9:197-204.
23. Fadini RF. Non-overlap of hosts used by three congeneric and sympatric loranthaceous mistletoe species in an Amazonian savanna: host generalization to extreme specialization. Acta Botanica Brasilica,2001:25:337-345.
24. Ejeta G, Butler LG. Host-parasite interactions throughout the *Striga* life cycle and their contributions to *Striga* resistance. African Crop Science Journal, 1993:1(2):75-80.
25. Takeshi F, Katsuhisa F, Wolfram W. The parasitic mechanism of the holostemparasitic plant *Cuscuta*. Journal of Plant Interactions,2011:6(4):207-219.
26. Susanna P, Pia M. Host–parasite–herbivore interactions: Implications of host cyanogenesis. Ecology,2001:82(7):2059-2071.
27. Koskela T, Salonen V, Mutikainen P (2001). Interaction of a host plant and its holoparasite: effects of previous selection by the parasite. Journal of Evolutionary Biology,2001:14(2001):910-917.
28. Ebert D, Hamilton WD. Sex against virulence: the coevolution of parasitic diseases. Trends Ecol. Evol, 1996:11:79-82.
29. Blagojevic M, Konstantinovic B, Samardzic N, Popov M, Konstantinovic B. Biological characteristics of some parasitic flowering plants. Herbologia,2014:14(2):71-80.
30. Franklin UO, Wintola OA, Afolayan AJ. Micromorphological Studies of the Loranthaceae, *Phragmanthera capitata* (Sprengel) Balle. Journal of Botany,2017:2017(id 5603140):1-9.
31. Rajasekaran K. Studies in Indian Loranthaceae VIII-Inflorescence. Journal of Economic and Taxonomic Botany,2007:31(1):177-180.
32. Wilson C A, Calvin CL. An origin of aerial branch parasitism in the mistletoe family, Loranthaceae. American Journal of Botany,2006:93(5):787-796.
33. Watson DM. Mistletoe: a keystone resource in forests and woodlands worldwide. Annual Review of Ecology and Systematics,2001:32:219-249.
34. Watson L, Dallwitz MJ. The families of flowering plants: descriptions, illustrations, identification, and information retrieval,1992. Version: 13th March 2017. delta-intkey.com/angio'.
35. Engone ONL, Salle G. Faut-il eradiuer Phragmanthera capitata, parasite des heveas en Afrique. Comptes Rendes Biologies,2006:329:185-195.
36. Engler A, Krause K (1935). Loranthaceae. Engler, A. & Prantle, K. (eds). Die naturlichen Planzenfamilien. 16b. Leipzig; Engelmann: 98-203.
37. Danser BH. On the taxonomy and nomenclature of the Loranthaceae of Asia and Australia. Bulletin du Jardin Botanique Buitenzorg,1929:10:291-373.
38. Maheshwari P. Embryology and Taxonomy. Journal of Indian Botanical Society,1958:1: 1-9.

39. Calder DM. Mistletoes in focus: An introduction. In: Calder, D.M. and Bernhardt, P. (eds.). The Biology of Mistletoes. Academic Press. Sydney. Australia,1983:1-18.
40. Barlow BA, Hawksworth FG, Kuijt J, Polhill RM, Wiens D. Genera of mistletoes. The Golden Bough, 1989:11:1-4.
41. Thriveni MC. Studies on Loranthaceae and Viscaceae of Karnataka. PhD Thesis. University of Mysore,2013.
42. Vijayan A, Santhakumar S, Vivekraj P, Kalavathy S. Parasitism of host trees by the Loranthaceae in the region of Sitheri Hills (Eastern Ghats), Tamil Nadu, India. Bulletin of Environment, Pharmacology and Life Sciences,2015:4(3):104-109.
43. Singh LJ. *Scurrula paramjitii* L. J. Singh: A New Species (Loranthaceae) from the Andaman and Nicobar Islands, India. Taiwania,2015:60(3):123-128.
44. Prabhu KMP, Sreeraj V, Thomas B, Manudev KM Rajendran A. Validation and documentation of rare endemic and threatened (RET) plants from Nilgiri, Kanuvai and Madukkarai forests of southern Western Ghats, India. Journal of Threatened Taxa, 2012:4(15):3436-3442.
45. Baro D, Bawri A, Borthakur SK. *Tolypanthus maclurei* (Merrill) Danser (Loranthaceae): An Addition to Flora of India, from Manas National Park, Assam. National Academy Science Letters, 2019:42:437-439.
46. Lal Ji Singh, Vinay Ranjan, L. Rasingam, J. Swamy, A new species of genus *Dendrophthoe* Mart. (Lorantheae-Loranthaceae) from the Peninsular India. Journal of Asia-Pacific Biodiversity,2020;13(3):487-493.