

An account of parasitic angiosperms of Purulia District, West Bengal

Manoranjan Paramanik, Asit Mahato and Subrata Raha*

Mycology and plant pathology laboratory, Department of Botany, Sidho-Kanho-Birsha University, Purulia, West Bengal

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Abstract

The present work is a systematic enumeration of parasitic angiosperm diversity of Purulia district, the western most part of West Bengal and last step of Chhota Nagpur plateau. A total of 16 species of parasitic plants under 13 genera belonging to 5 angiosperms families are so far recorded during the survey. The family Orobanchaceae with 6 species stands for the most dominant family followed by Santalaceae (4 spp.), Loranthaceae (3 spp.), Convolvaceae (2 spp.) and Lauraceae (1 sp.). Among the 16 species, 9 species are stem parasites and rest 7 species are root parasites. The phenological data, host range and nature of parasitism are stated as recorded during the study.

Key Words: Purulia, Parasitic plants, Accounts, Host Plants

1. Introduction

The flowering plants which are attach to their host plants by the haustoria and completely or partially depend on host for nutrition, carbon, water to complete their life cycle are referred as parasites. They can share several elements like, RNA, proteins, and hormonal pathways with their respective hosts [1-4]. The parasitic angiosperms are mainly two types i.e., holoparasite or total parasite and hemiparasite or partial parasite according to their mode of parasitism. This group of plants have awakened a sense of curiosity among the plant scientists since a long time. Parasitic angiosperms weaken the host plants and even leads to the death of hosts. A total of 4750 species of parasitic angiosperms have been recorded (as 1% of the total recorded angiosperms species) throughout the world under 292 genera [5]. The number, distribution and host range of the parasites are increasing throughout the world in a rapid way. According to a current literature survey on parasites, mainly two genera as *Orobanche* L. and *Striga* Lour. (Orobanchaceae) involve as pathogens to wide range of vegetable crops [6]. Apart from these two genera about 23 genera are considered as pathogens and create a negative impact on host plants which are often cultivated [7]. India is the home of biodiversity together with its various landscapes and climate, which harbours about 132 species of parasitic angiosperms and many more yet to be discovered in future [8]. The district Purulia, popularly referred as “Jangal Mahal”, is the westernmost part of the state of West Bengal (Fig. 1). The study area is located

within 22.60 - 23.50 degrees north latitudes and 85.75 - 86.65 degrees east longitudes with total geographical area of 6259 sq. km. Physiographically, the entire district can be divided into two units as, the hilly regions in western and southern parts which are the continuation of the last step of Chhota Nagpur Plateau and another unit constitutes the undulating plains with isolated mounds and hills, covering 80% of total area [9]. Total forested area is 919.24 sq. km. i.e., 14.69% of the total geographical area of the district and that can be divided in three units namely dense forest covering 37.38 sq. km., moderately dense forest comprising of 307.36 sq. km. and open forest of 574.50 sq. km as shown in fig. 2 [10]. Moreover, the entire district has been divided into three forest divisions as, Purulia Forest Division, Kangsabati North Forest Division and Kangsabati South Forest Division. The main forest types of the study area are Dry Peninsular Sal Forest (5B/C1c), Northern Dry Mixed Deciduous Forest (5B/C2), Dry Deciduous Forest (5/DS1) [11]. Dominated species are *Shorea robusta* C.F.Gaertn. (Sal) and *Butea monosperma* (Lam.) Kuntze (Palas) with other miscellaneous trees species like *Albizia odoratissima* (L.f.) Benth. (Sajne sirish), *Buchanania lanzan* Spreng. (Piyal), *Cleistanthus collinus* (Roxb.) Benth. ex Hook.f. (Parasi), *Cochlospermum religiosum* (L.) Alston (Galgali), *Cordia macleodii* (Griff.) Hook.f. & Thomson (Sita Patra), *Croton persimilis* Müll.Arg. (Putla), *Dalbergia latifolia* Roxb. (Seti Sal), *Dillenia aurea* Sm. (Ban Chalta), *Diospyros malabarica* (Desr.) Kostel. (Makar Kend), *Diospyros melanoxylon* Roxb. (Kend), *Firmiana colorata* (Roxb.) R.Br., *Garuga pinnata* Roxb. (Damru Doka), *Holarrhena pubescens* Wall. ex G.Don (Kurchi), *Lagerstroemia parviflora* Roxb. (Sidha), *Madhuca longifolia* var. *latifolia* (Roxb.) A.Chev. (Mahua), *Mitragyna parvifolia* (Roxb.) Korth. (Keli kadam), *Semecarpus anacardium* L.f. (Bhela), *Schleichera oleosa* (Lour.) Oken (Kusum), *Soymida febrifuga* (Roxb.) A.Juss. (Raura), *Sterculia urens* Roxb. (Tele), *Symplocos racemosa* Roxb. (Lodhra), *Syzygium nervosum* A.Cunn. ex DC. (Raj Jam), *Terminalia anogeissiana* Gere & Boatwr. (Dha), *Terminalia bellirica* (Gaertn.) Roxb. (Bahera), *Terminalia chebula* Retz. (Haritaki), *Terminalia elliptica* Willd. (Asan) etc., orchids [12-13], and pteridophytes [14]. Purulia district is highly blessed with rich floral and faunal diversity, cultural races and diverse tribal

*Electronic mail: subrata-raha@skbu.ac.in

communities due to its unique topography [15-17, 12-14, 18-19]. Though few works have been published about the diversity of angiospermic parasitic plants in nearby districts [20-22] but this piece of work is the first attempt to document them from the Purulia district.

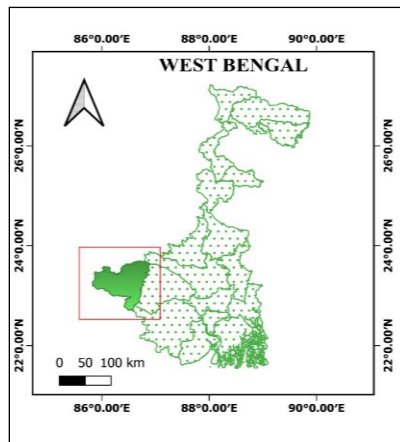


Fig. 1: Location map of the study area – District Purulia, West Bengal.

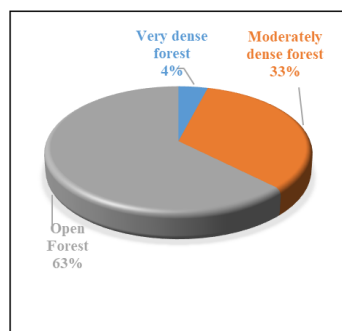


Fig. 2: Graphical representation of percentagewise forest cover of the study area of Purulia, West Bengal.

2. Materials and Methods

An extensive survey was carried out from 2019 to 2022 for the preparation of complete angiospermic parasitic flora of the district through random sampling of all type vegetation of the study area in different seasons. The characteristic features, flowering and fruiting times, nature of parasitism and host ranges were recorded during field survey. The collected specimens were processed for herbarium preservation following Jain and Rao [23].

The collected specimens were identified in the laboratory of the Department of Botany, S.K.B.U by using available standard literatures [24-28], experts and authentic websites like [<http://flora-peninsulaindica.ces.iisc.ac.in/>]; [<https://efloraindia.bsi.gov.in/>]. International Plant Names Index [<https://www.ipni.org/>], The WFO Plant List [<https://wfpantlist.org/plant-list/>], India Biodiversity Portal [<https://indiabiodiversity.org/>] Flowers of India [<http://www.flowersofindia.net/>] were consulted for correct nomenclature. APG IV

(2016) was followed for the delimitation of families of studied taxa [29].

3. Result and Discussion

The present study aims to prepare an account of angiospermic parasitic plant diversity of the study area. During the survey a total of 16 species of parasitic angiosperms under 13 genera belonging to 5 families were recorded (Table 1, Fig. 3) of which 9 species are stem parasite and 7 species are root parasite. Two species were holoparasite on both root and stem, 6 species were both root and stem hemiparasite. (Table 1 and Fig. 4). All the species are arranged alphabetically in table 1 for easy accessibility.

In the present study, except *Santalum album* all the parasitic angiospermic species occur in wild condition. The family Orobanchaceae includes the maximum number of parasites as 6 and among them 4 species are hemiparasite and rest 2 species (*Aeginetia indica* and *Orobanche cernua*) are total parasite on roots of the host plants. Among the hemi parasites taxa on root under Orobanchaceae, *Centranthera tranquebarica* and *Striga angustifolia* are mainly found in the grass lands but *Striga densiflora* occurs in the field of *Sorghum bicolor*, whereas *Parasopubia delphinifolia* occurs mainly along the margins of the paddy fields and rivulets. The recorded two total root parasites of Orobanchaceae, *A. indica* mainly found in the 'Sal' dominated forest floor and *O. cernua* is occurring in crop fields of *Solanum melongena*, *Beta* sp. and *Brassica* sp. The family Santalaceae is the second dominated one representing 4 species and most of them are hemiparasite on stem except *Santalum album* which is partial root parasite. The family Loranthaceae is another dominant one to represent 3 species of parasites and all of them are hemiparasite on stem of different hosts. They mainly infect wide number of timbers yielding plants of the dry deciduous forest of this district. The family Convolvulaceae represents only 2 species of parasites as, *Cuscuta chinensis* and *C. reflexa* which are total parasite on stems of a wide range of plants. The family Lauraceae represents only one species as, *Cassytha filiformis*, a hemiparasite on stem in open forest areas. The family Loranthaceae occupies a prominent position due to its ability to cause serious damages (Fig. 5) to a large number of species from gymnosperms to angiosperms [30-36].

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Table 1: List of recorded angiospermic parasitic plants with their scientific name, family and nature of parasitism (* = cultivated; Fl & fr. = Flowering and fruiting time

Sl. no.	Name of the species	Name of the family	Name/s of the host	Nature of parasitism	Fl. & fr. time
1.	<i>Aeginetia indica</i> L. (Plate 1)	Orobanchaceae	<i>Shorea robusta</i>	Total root parasite	Aug.-Oct.
2.	<i>Centranthera tranquebarica</i> (Biehler) Merr. (Plate 1)	Orobanchaceae	Grasses and other herbaceous plants, mainly <i>Aristida</i> sp. <i>Chrysopogon aciculatus</i> (Retz.) Trin., <i>Eragrostis</i> sp. etc.	Root hemiparasite	Jul. -Sep.
3.	<i>Cassytha filiformis</i> L. (Plate 2)	Louraceae	<i>Acacia auriculiformis</i> A.Cunn. ex Benth., <i>Alstonia scholaris</i> (L.) R.Br., <i>Shorea robusta</i> etc.	Stem hemiparasite	Most of the year
4.	<i>Cuscuta chinensis</i> Lam. (Plate 1)	Convolvulaceae	Prefers herbaceous hosts, mainly <i>Colocasia esculenta</i> (L.) Schott, <i>Cynodon dactylon</i> (L.) Pers., <i>Duranta erecta</i> L., <i>Mikania micrantha</i> Kunth, <i>Tridax procumbens</i> L. etc.	Total stem parasite	Jul.-Dec.
5.	<i>Cuscuta reflexa</i> Roxb. (Plate 2)	Convolvulaceae	<i>Calotropis gigantea</i> (L.) W.T.Aiton, <i>Clerodendrum infortunatum</i> L., <i>Duranta erecta</i> , <i>Streblus asper</i> Lour., <i>Vachellia nilotica</i> (L.) P.J.H.Hurter & Mabb., <i>Vitex negundo</i> L., <i>Ziziphus mauritiana</i> Lam. etc.	Total stem parasite	Oct.-Feb.
6.	<i>Dendrophthoe falcata</i> (L.f.) Ettingsh. (Plate 2)	Loranthaceae	<i>Acacia auriculiformis.</i> , <i>Annona squamosa</i> L., <i>Bombax ceiba</i> L., <i>Butea monosperma</i> , <i>Eucalyptus tereticornis</i> Sm., <i>Lannea coromandelica</i> (Houtt.) Merr., <i>Manilkara zapota</i> (L.) P.Royen, <i>Melia azedarach</i> L., <i>Shorea robusta</i> , <i>Syzygium cumini</i> (L.) Skeels, <i>Terminalia arjuna</i> Wight & Arn., <i>Terminalia catappa</i> L.	Stem hemi parasite	Nov.-Mar
7.	<i>Orobanche cernua</i> Loeffl. (Plate 1)	Orobanchaceae	<i>Brassica</i> sp., <i>Solanum melongena</i> L., <i>Beta</i> sp.	Total root parasite	Nov.-Jan.
8.	<i>Macrosolen cochinchinensis</i> (Lour.) Tiegh. (Plate 2)	Loranthaceae	<i>Bombax ceiba</i> , <i>Gmelina arborea</i> Roxb. ex Sm., <i>Melia azedarach</i> , <i>Mangifera indica</i> L.	Stem hemiparasite	Mar.-Sep.
9.	<i>Parasopubia delphiniifolia</i> (L.) H.-	Orobanchaceae	Grasses <i>Chrysopogon aciculatus</i> (Retz.) Trin.,	Root hemiparasite	Jul.-Sep.

	P.Hofm. & Eb.Fisch. (Plate 1)		<i>Eragrostis</i> sp. etc.)		
10.	* <i>Santalum album</i> L.	Santalaceae	<i>Casuarina equisetifolia</i> L. <i>Pongamia pinnata</i> (L.) Pierre, <i>Senna siamea</i> (Lam.) H.S.Irwin & Barneby, <i>Vachellia nilotica</i> etc.	Root hemiparasite	Mar.-Jan.
11.	<i>Scurrula parasitica</i> L. (Plate 2)	Loranthaceae	<i>Butea monosperma</i> , <i>Gmelina arborea</i> , <i>Melia azedarach</i>	Stem hemiparasite	Nov.-Mar.
12.	<i>Striga angustifolia</i> (D.Don) C.J.Saldanha (Plate 1)	Orobanchaceae	Grasses (<i>Aristida</i> sp. <i>Chrysopogon aciculatus</i> , <i>Eragrostis</i> sp. etc.)	Root hemiparasite	Jul.-Nov.
13.	<i>Striga densiflora</i> (Benth.) Benth. (Plate 1)	Orobanchaceae	<i>Sorghum bicolor</i> (L.) Moench	Root hemiparasite	Jul.-Dec.
14.	<i>Viscum articulatum</i> Burm.f. (Plate 2)	Santalaceae	<i>Diospyros melanoxylon</i> Roxb., <i>Madhuca longifolia</i> var. <i>latifolia</i> , <i>Schleichera oleosa</i>	Stem hemiparasite	Nov.-May
15.	<i>Viscum monoicum</i> Roxb. ex DC. (Plate 2)	Santalaceae	<i>Diospyros melanoxylon</i> , <i>Madhuca longifolia</i> var. <i>latifolia</i> , <i>Schleichera oleosa</i>	Stem hemiparasite	Aug.-Feb.
16.	<i>Viscum orientale</i> Willd. (Plate 2)	Santalaceae	<i>Diospyros melanoxylon</i> , <i>Erycibe paniculata</i> Roxb., <i>Helicteres isora</i> L., <i>Madhuca longifolia</i> var. <i>latifolia</i> , <i>Mallotus philippensis</i> (Lam.) Müll. Arg., <i>Schleichera oleosa</i> , <i>Woodfordia fruticosa</i> (L.) Kurz	Stem hemiparasite	Jan.-Dec.

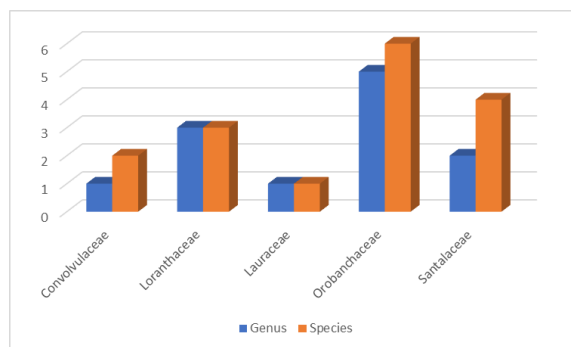


Fig. 3: Family wise graphical representation of recorded species and genera of parasites.

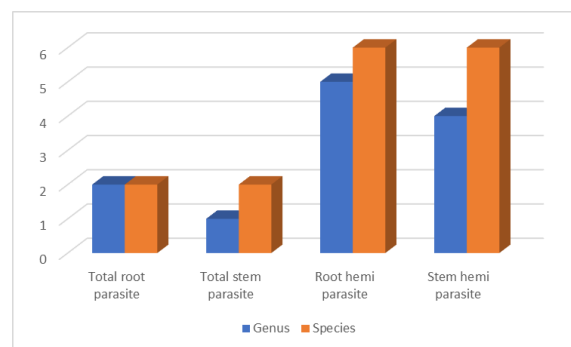


Fig. 4: Graphical representation of recorded species and genera with their mode of parasitism.



Fig. 5: Dying *Butea monosperma* plant by *Scurrula parasitica*.



Fig. 6: *Ziziphus mauritiana* plant highly infested by *Cuscuta reflexa*.

The golden yellow twiner *Cuscuta chinensis*, *C. reflexa* (dodder) and the green wiry twiner *Cassytha filiformis* cause considerable damage to trees, shrubs, and herbaceous vegetation (Fig.6). During the survey an interesting phenomenon of hyperparasitism by *Viscum* sp. on *Dendrophthoe falcata* is also noticed infrequently in hilly forest area of Purulia. Apart from the negative impact on forest vegetation, the parasitic plants were exploited by the human societies worldwide for food, medicine and cultural purposes [22, 37-39]. A large number of angiospermic parasites are also used as ethnomedicine in the various parts of the world, mainly Asia, Europe, and Africa [40]. They play an important role in ecological services like the fruits of most mistletoes are the edible to the

birds which act as seed dispersers and pollinators [36, 41-42].

4. Conclusion

The angiospermic parasitic plants have a major role in the tropic structure of the ecosystem and used as food and as well as medicine worldwide, pose a great threat to the cultivated crops as well as forest vegetation for survival and yield. It was noticed that three major species of forest trees viz. *Shorea robusta*, *Butea monosperma* and *Diospyros melanoxylon* were greatly affected by different stem parasites, leading to death thus reducing forest coverage. The host ranges of a particular parasitic plants are definitely helpful for the foresters, agriculturists, and farmers to take proper precaution and to predict loss of yield and take the proper strategies for the management of parasitic plants.

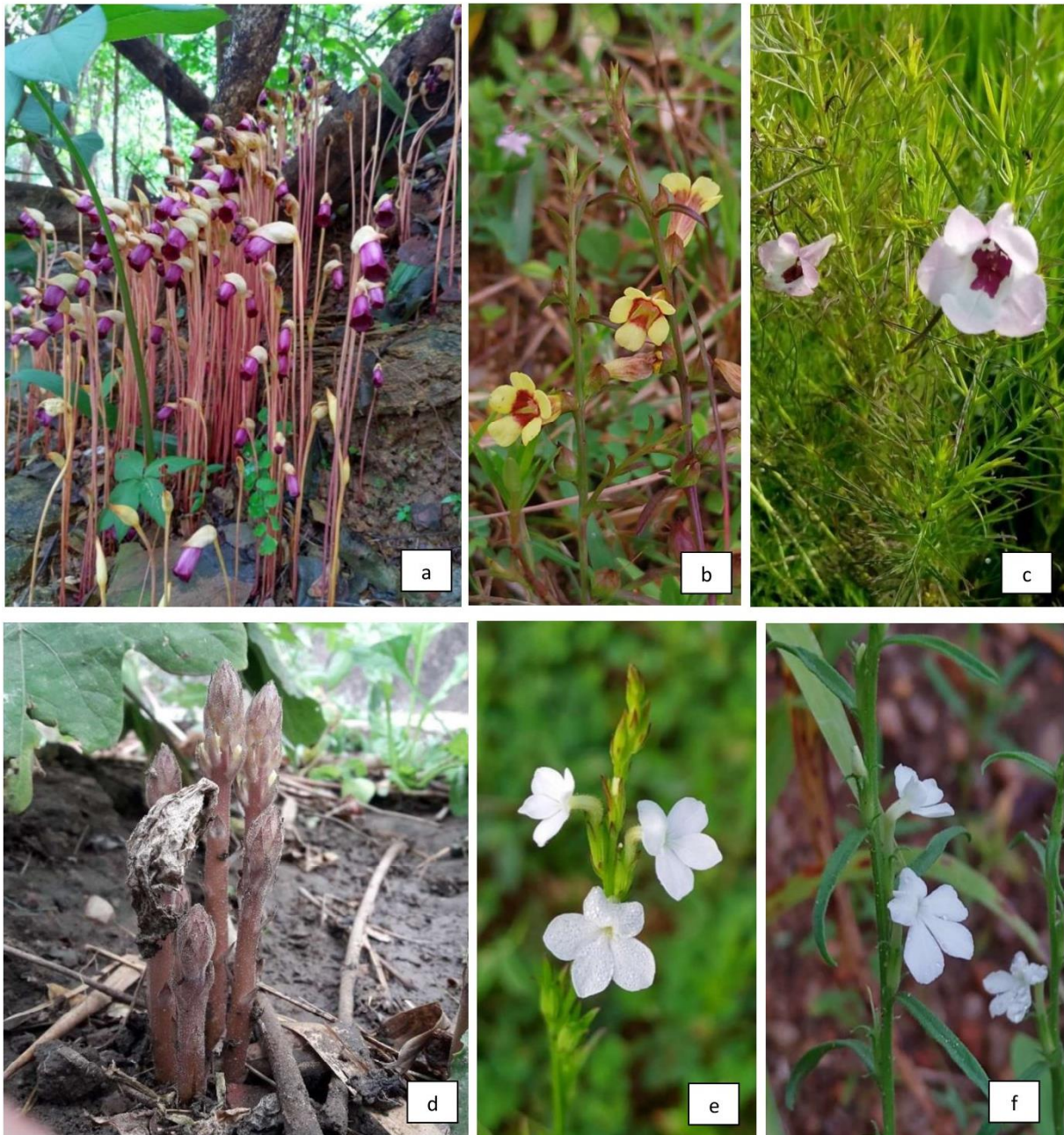


Plate 1: Photographs of angiospermic root parasites: a. *Aeginetia indica*; b. *Centranthera tranquebarica*; c. *Parasopubia delphiniifolia*; d. *Orobanche cernua*; e. *Striga angustifolia*; f. *Striga densiflora*

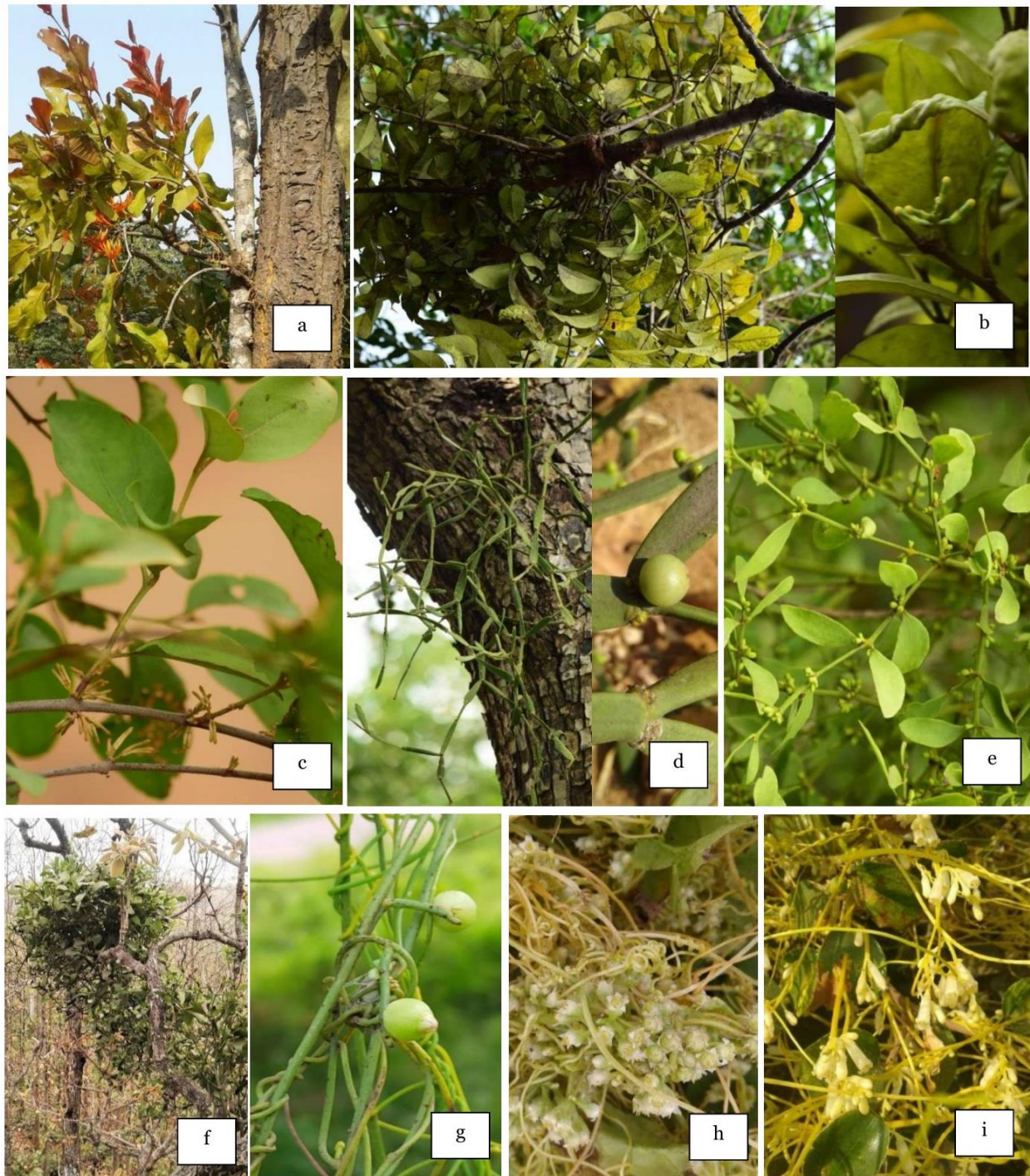


Plate 2: Photographs angiospermic stem parasites: a. *Dendrophthoe falcata*; b. *Macrosolen cochinchinensis*; c. *Scurrula parasitica*; d. *Viscum articulatum*; e. *Viscum orientale*; f. *Viscum monoicum*; g. *Cassytha filiformis*; h. *Cuscuta chinensis*; i. *Cuscuta reflexa*

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