A Preliminary Census And Taxonomic Survey of Host Plants of Cuscuta Reflexa Roxb. In Dimapur District, Nagaland

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Abstract- *Cuscuta reflexa Roxb., commonly called 'giant dodder' belonging to the family Cuscutaceae is non-host specific, above ground stem holoparasite with branched leafless, thread like, yellow or reddish-yellow stem that is directly attached to the host plants through the haustoria. During 2016 to 2017, taxonomic surveys were conducted to find out the host plants of Cuscuta reflexa Roxb. in different localities of Dimapur District of Nagaland. Altogether 34 species (33 dicots and 1 monocot), representing 32 genera belonging to 18 families of Angiosperms have been recognized as host plants of Cuscuta reflexa Roxb. in the district. The ratio of monocot to dicot is 1: 33. Again out of 34 host species, 18 are herbs (52.94%), 2 shrubs(5.88%), 1 undershrub (2.94%), 11 trees (32.35%) and 2 climbers (5.88%). Out of 18 families the attack of C. reflexa Roxb. was more on families Asteraceae and Moraceae affecting 5 (five) and 4 (four) species. Among the hosts, six species are new reports viz. Argyreia nervosa (Burm.f.) Bojer, Digitaria sanguinalis (L.) Scop., Thunbergia grandiflora Roxb., Telanthera philoxeroides (Mart.), Cleome rutidosperma DC. and Mimosa pudica L. These hosts will be helpful in enriching our current knowledge in the field of biology in near future.*

Keywords- Cuscuta, stem parasite, host diversity, Dimapur, Nagaland, India.

I. INTRODUCTION

Holoparasitic species of *Cuscuta* are the most fascinating ones which attracted attention of many researchers all over the world since long time because of their strange growth habit and extraordinary behavior. *Cuscuta* has also gained importance because of its increasing incidence worldwide and its ability to cause severe damage to and loss of yield of the host plants (Nun and Mayer, 1999). Its species have been reported to be a problematic parasite to crop plants in agriculture systems in Africa and Asia (Kelly *et al.*, 1988; Chrtek and Osbornova, 1991; Dawson *et al*., 1994; Jayakodi, 1995; Musselman and Press, 1995; Hyd and Mand Worsten, 2006). In China, *Cuscuta chinensis*, *C. japonica* and *C. australis* have a wide host range (Xiong and Zhou, 1994; Du *et al*., 1998), whereas *Cuscuta gigantean, C. monogyna*, *C. pulchella*, *C. chinensis* and *C. reflexa* are commony found in Afghanistan on many host species (Rajput and Tahir, 1988). Rajput and Tahir (1990) have given the distributional pattern of fourteen species of *Cuscuta* from Pakistan. These are *Cuscuta hyaline*, *C. reflexa*, *C. violacea*, *C. lupuliformis*, *C. gigantean*, *C. monogyna*, *C. lehmania*, *C. epithymum*, *C. capitata*, *C. europaea*, *C. australis*, *C. pulchella*, *C. chinensis* and *C. campestris*. Banergy and Das (1965) recorded *Cuscuta santapaui from* East Nepal. Bhattarai *et al*.(1989) studied the host range of *Cuscuta reflexa* in the Kathmandu valley, Nepal.

In India, among the various reported species of this holoparasite, *Cuscuta reflexa* Roxb. has been recorded as the leading destructive parasite on most economically important hosts from different regions of India .

Cuscuta reflexa Roxb., commonly called as 'giant dodder' belonging to the family Cuscutaceae is an obligate angiosperm parasitic climber commonly found throughout India and its distribution is also extended in Dimapur district of Nagaland. It is non-host specific above ground stem holoparasite with branched leafless, thread like, yellow or reddish-yellow stem that is abundantly found colonizing certain angiospermic plant species in different localities of District Dimapur, Nagaland. It attaches various herbs, shrubs and trees and climbers through haustoria and also affect commercially valuable plants.

A haustorium is a modified root that forms a morphological and physiological link between the parasite and host (Kujit 1969). The haustorium is the key organ that physically and physiologically bridges the parasite and the host plant. Haustorium attachment to host is non-specific; however, mucilaginous substances produced by haustorial hairs facilitate the attachment to a host (Sharma and Kapoor, 2014). It is generally noted that water and essential inorganic nutrients dissolved in water are absorbed through the xylem connections between the host and parasite while organic

substances are transported from the phloem of the host to the parasite through phloem connection.

A few important contributions on host range of plant parasite *Cuscuta reflexa* Roxb. have been reported from various parts of India (Barua *et al.*, 2003; Das, 2011, Dutta, 1993; Kumari *et al.*, 2017; Nikam *et al.*,2014; Ghosh and Das, 2011; Kujit, 1969; Sarka*et al.*,2014; Kapoor, 2007; Kapoor and Sharma, 2008; Sarma and Bhattacharya, 2008; Sharma and Kapoor, 2014) but an authentic document on taxonomic survey of host plants of *Cuscuta reflexa* Roxb. in Dimapur district of Nagaland is not available, as such there is a ample scope to work on this.

The present investigation is emphasizing on diversity of the host plants of *Cuscuta reflexa* Roxb. from different localities of district Dimapur, Nagaland, India.

II. STUDT AREA

Dimapur is the 8th district of Nagaland established in December 1997 and lies between 25° 48´ and 26° 00´ North latitude and 93° 30´ and 93° 54´ East longitude. The total area of the District is 927 km². The district is bounded by Assam on its North and West, Kohima on the East and Peren District in the South. The district has a magnificient floral diversity. Under the district is mostly Northern Tropical Semi-Evergreen forest. Forest cover of the district includes Dense forest (140.00 km²), Open forest (266.00 km²), scrub forest (6.00 km²) and non-forest (4.00 km²). The division with a total dense forest cover of 140 km² includes reserve forest for 62.66 km² and purchased land for 8.1238 km² (Source: DFO, Dept of Forest, Dimapur). The climate is warm and temperate in Dimapur. In winter, there is much less rainfall in Dimapur than in summer. The average temperature in Dimapur is 24°C, the average annual rainfall is 1560 mm.The driest month is December, with 14 mm of rainfall. With an average of 275 mm, the most precipitation falls in July. The warmest month of the year is July, with an average temperature of 28.6°C. January has the lowest average temperature of the year. It is 16.6°C. This climatic condition favours the rapid growth of plants as well as this destructive angiospermic parasite *Cuscuta reflexa* Roxb.

III. MATERIALS AND METHODS

During extensive field survey in some areas of Dimapur District of Nagaland in 2016 to 2017, the diversified host species of *Cuscuta reflexa* Roxb. were studied in the fields, photographed and collected from different localities of Dimapur District of Nagaland and identified with the help of existing literature [Cooke (1958), Hooker (1872-1879), David Prain (1903)] and herbaria available in Botanical Survey of India, Calcutta. The host plants were categorized in herbs, shrubs, climbers, trees; angiosperms, gymnosperms and their families; medicinal and economically important plants(Plate-1).

IV. RESULTS AND DISCUSSION

During 2016 to 2017, taxonomic surveys were conducted to find out the host plants of *Cuscuta reflexa* Roxb. in different localities of Dimapur District of Nagaland. Altogether 34 species (33 dicots and 1 monocot), representing 32 genera belonging to 18 families of Angiosperms have been recognized as host plants of *Cuscuta reflexa* Roxb. in the district (Table-1).

Table 1. List of host plantsattacked by *Cuscuta reflexa* Roxb. so far recorded from district Dimapur, Nagaland are arranged with their families.

Sl. No.	Family	Monocot/ Dicot	Habit	Botanical names of *Cuscuta*host plants	Percentage of parasitic attack
1.	Acanthaceae	Dicot	Herb	*Adhatoda zeylanica* Medic.	20%
		Dicot	Herb	*Ruellia tuberosa* L.	20%
		Dicot	Climber	*Thunbergia grandiflora* Roxb.	60%
2.	Amaranthaceae	Dicot	Herb	*Achyranthes aspara* L.	50%
		Dicot	Herb	*Aerva lanata* L.	10%
		Dicot	Herb	*Telanthera philoxeroides* (Mart.) Griseb.	90%
3.	Apocynaceae	Dicot	Tree	*Alstonia scholaris* (L.) R.Br.	20%
		Dicot	Tree	*Holarrhena antidysenterica* Wall.	30%
4.	Araceae	Dicot	Herb	*Colocasia esculenta* (L.) Schott.	40%
5.	Asteraceae	Dicot	Herb	*Ageratum conyzoides* L.	60%
		Dicot	Herb	*Eclipta alba* (L.) Hussk.	20%
		Dicot	Herb	*Eupatorium odoratum* L.	50%
		Dicot	Climber	*Mikania scandens* Willd.	70%
		Dicot	Herb	*Vernonia cinerea* (L.) Less.	60%
6.	Caesalpiniaceae	Dicot	Tree	*Cassia siamea* (Lam.) Irwin *et* Barneby	30%
7.	Convolvulaceae	Dicot	Climber	*Argyreia nervosa* (Burm.f.) Bojer	70%
8.	Capparidaceae	Dicot	Herb	*Cleome rutidosperma* DC.	80%
9.	Euphorbiaceae	Dicot	Herb	*Euphorbia hirta* L.	40%
		Dicot	Herb	*Euphorbia tirucalli* L.	10%
10.	Malvaceae	Dicot	Herb	*Urena lobata* L.	60%
11.	Meliaceae	Dicot	Tree	*Azadirachta indica* A. Juss.	20%
12.	Mimosaceae	Dicot	Tree	*Albizzia lebbek* (L.) Benth.	30%
		Dicot	Undershrub	*Mimosa pudica* L.	80%
13.	Moraceae	Dicot	Tree	*Artocarpus heterophyllus* Lam.	20%
		Dicot	Tree	*Ficus glomerata* Roxb.	10%
		Dicot	Tree	*Ficus religiosa* L.	30%
		Dicot	Tree	*Streblus asper* Lour.	40%
14.	Papaveraceae	Dicot	Herb	*Argemone maxicana* L.	50%
15.	Papilionaceae	Dicot	Tree	*Dalbergia sissoo* Roxb.	30%

16.	Poaceae	Monocot	Herb	*Digitaria sanguinalis* (L.) Scop.	70%
17.	Urticaceae	Dicot	Tree	*Trema orientalis* Bl.	40%
18.	Verbenaceae	Dicot	Herb	*Clerodendrum viscosum* Vent.	40%
		Dicot	Shrub	*Duranta repens* L.	30%
		Dicot	Shrub	*Lantana camara* L.	50%

The ratio of monocot to dicot is 1: 33. Again out of 34 host species (Table 2), 18 are herbs (52.94%), 2 shrubs (5.88%), 1 undershrub (2.94%), 11 trees (32.35%) and 2 climbers (5.88%).

Table 2: Total number of host plants parasitized by *Cuscuta reflexa Roxb*. in Dimapur District of Nagaland along with percentage of herbs, shrubs, under-shrubs and trees and climbers.

Total no. of host plants	Total no. of herbs	% of herbs	Total no. of shrubs	% of Shrubs	Total no. of undershrub	% of undershrub	Total no. of trees	% of trees	Total no. of climbers	% of climbers
34	18	52.94	2	5.88	1	2.94	11	32.35	2	5.88

Out of 16 families the attack of *C. reflexa* Roxb. was more on families Asteraceae and Moraceae affecting 5 (five) and 4 (four) species, then on Acanthaceae, Amaranthaceae and Verbenaceae affecting 3(three) species of each. The attack of *C. reflexa* Roxb.was less on Apocynaceae, Euphorbiaceae and Mimosaceae affecting 2(two) species of each. The attack of *C. reflexa* Roxb.was least on Araceae, Caesalpiniaceae, Convolvulaceae, Capparidaceae, Malvaceae, Meliaceae, Papaveraceae, Papilionaceae, Poaceae, Urticaceae, affecting 1(one) host plant species of each (Table-3).

The present results clearly indicate that giant dodder ranges in severity based on the species of host.

Table 3: Number of host species parasitized by *Cuscuta reflexa* Roxb.under each family in Dimapur District of Nagaland; 34 (Thirty) host species in total belong to 18 (Eighteen) families.

Sl. No.	Host plant families	Number of host species parasitized by *C Reflexa* Roxb. under each family
1.	Acanthaceae	3
2.	Amaranthaceae	3
3.	Apocynaceae	2
4.	Araceae	1
5.	Asteraceae	5
6.	Caesalpiniaceae	1
7.	Convolvulaceae	1
8.	Capparidaceae	1
9.	Euphorbiaceae	2
10.	Malvaceae	1
11.	Meliaceae	1
12.	Mimosaceae	1
13.	Moraceae	4
14.	Papaverceae	1
15.	Papilionaceae	1
16.	Poaceae	1
17.	Urticaceae	1
18.	Verbenaceae	3

V. CONCLUSION

The present investigation clearly indicates that the common plants viz. *Achyranthes aspara* L. (50%), *Ageratum conyzoides* L. (60%), *Argyreia nervosa* (Burm.f.) Bojer (70%), *Cleome rutidosperma* DC. (80%),*Digitarias anguinalis*(L.) Scop. (70%), *Telanthera philoxeroides* (Mart.) Griseb. (90%), *Thunbergia grandiflora* Roxb. (60%) and *Vernonia cinerea* (L.) Less. (60%) etc. are most favourable hosts of *C. reflexa*. Roxb. (Plate 1) and when other suitable host plants are present nearby *Cuscuta* shoots, it spreads from one host plant to other often forming a dense mat of intertwined stems. Hence it is very clear that *Cuscuta* infection or multiplication is mostly caused by vegetative method via stems or shoots. It is non-host specific i.e. it grows on any type of plants. It is also found that the twinning and attachment of *C. reflexa* Roxb. on host plants is greatly reduced in shaded areas.

It also indicates that this parasite harbors mostly dicot herbs as well as tree species. Infection on monocot plants is comparatively less.

Redy *et al.* (1990) reported *Vitex negundo* Linn. hedge plant as a new host for *Cuscuta reflexa* Roxb. in Bidar, Karnataka. Liu (1992) reported tobacco (*Nicotiana tabacum*) as a new host for *C. japonica* in China. Ghosh *et al*. (2011) reported two new host species (*Malachra capitata* and *Catharanthu spusillus*) of *Cuscuta reflexa* Roxb.from Cooch Behar district of West Bengal, India.

Approximately 26 new host plants contain some rarely found hosts reported by Tanase *et al*. (1998) in Sibu, Romania. Maity and Chauhan (1998) made survey of hosts of *C. reflexa* in Gangtok, Sikkim, India and identified the 53 hosts from 27 families. They include both herbaceous species (42%), shrub (26%), climbers (21%) and trees (11%) and concluded that tree species are parasitized in their early stages of growth only. According to Jayasinghe *et al*. (2004) *Cuscuta* is widely distributed in Srilanka. They searched 161 host species including rice, belonging to 59 families and 139 genera. Nikam *et al.* (2014) reported *Vitex negundo* and *Duranta plumier* plants are most favourable host plants in Baramati area of Pune district of Maharashtra. Patel *et al*. (2004) presented tabulated data of 48 host plants parasitized by *Cuscuta* species in North Gujarat, India. From different experimental studies, Schoolmaster (2005) concluded that ,*Impatiens capensis* Meerb. (Balsaminaceae) was a necessaey nurse host for the parasitic plant (*Cuscuta grovonii* in Schultes in Southeastern Michigan wetlands. One very interesting thing was revealed by Kelly (1992) i.e. in greenhouse experiments *C. europaea* accept (coil) host of high nutritional status and grow away from (reject) hosts of poor quality. Das (2007) reported new record regarding the highest percentage of parasitic attack (90%) is found with *Excoecaria agallocha*, followed by *Acanthus ilicifolius* (80%) by *Cuscuta reflexa* Roxb. Host on which *Cuscuta reflexa* has been described include *Camellia sinensis* from Assam by Ahlawat and Sardar (1973). Ramaiah *et al*. (1981) reported new recorded of *Cuscuta reflexa* on various hosts such as *Spathodea campanulata, Jasminum obsimile, Codium variegatum, Anacardium occidentale* and *Tabebuia argente*a from Karnataka. Mishra and Prasad (1988) recorded 15 (fifteen) plant species belonging to 12 (twelve) different families including fruit plants such as *Ziziphus mauritiana, Prunus persica, Litchi chinensis,* ornamentals, hedges and others as hosts of *Cuscuta reflexa* as hosts of *Cuscuta reflexa* from Bihar. Day and Pati (1998) have records the parasitism of *Cuscuta reflexa* on *Digitaria ciliaris* in West Bengal.

The above review of literature reveals that there is no record of angiospermic parasite *Cuscuta reflexa* Roxb. parasitising host plants like *Argyreia nervosa* (Burm.f.) Bojer, *Digitaria sanguinalis*(L.) Scop., *Thunbergia grandiflora* Roxb., *Telanthera philoxeroides* (Mart.) Griseb., *Cleome rutidosperma* DC. and *Mimosa pudica* L.

In the present investigation, among the 34 hosts of *Cuscuta reflexa* Roxb., six host species are new reports viz. *Argyreia nervosa* (Burm.f.) Bojer, *Digitaria sanguinalis* (L.) Scop., *Thunbergia grandiflora* Roxb., *Telanthera philoxeroides* (Mart.), *Cleome rutidosperma* DC. and *Mimosa pudica* L. from Dimapur district of Nagaland. These hosts will be helpful in enriching our current knowledge in the field of biology in near future.

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Fig.1. Cleome rutidosperma DC

Fig 2.*Argyreia nervosa* (Burm.f.) Bojer

Fig.3.Mikania scandens Willd.

Fig. 4. *Telantheraphiloxeroides* (Mart.) Griseb.

Fig. 5. Digitaria sanguinalis (L.)Scop.

Fig. 6. *Vernonia cinerera* (L.) Less.

Fig.7 Colocasia esculenta (L.) Schott.

Fig. 8. *Thunbergia grandiflora* Roxb.

Fig. 9. Urena lobata L.

Fig. 10. *Mimosa pudica* L.

Plate 1: Hosts of *Cuscuta reflexa* Roxb. in Dimapur area.