Host range of *Cuscuta reflexa* Roxb. in the Kathmandu Valley, Nepal

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Summary

***Cuscuta reflexa* Roxb. occurs as a common parasite of plants in the Kathmandu Valley of Nepal. A total of 39 plant species, representing 28 families, is reported as being either primary (13 species) or secondary hosts (26 species). *Duranta repens* was found to be the most susceptible host plant showing the highest intensity of parasitism. Haustorial development occurred on 37 species but was not present on two grasses. A positive correlation existed between the intensity of infestation, status of the host (primary or secondary) and haustorial development.**

Introduction

Cuscuta reflexa Roxb. (Cuscutaceae) is one of the best known angiospermic parasites because of its conspicuous appearance and behaviour (Malik and Singh 1980). It is widespread, particularly on the Indian subcontinent, and has a wide host range, for example, Prasad (1966) recorded it parasitizing 83 species at Namkum, Ranchi, in northern India. Morphologically, *C. reflexa* consists of slender, twining, yellow-coloured, thread-like stems with scaly leaves in the young stage and no leaves or roots at maturity. The parasitism of *C. reflexa* is economically significant because of its detrimental effect on many useful plants. Moisture and nutrients are absorbed from the host plants through haustoria resulting in poor growth and lowered productivity of many cash and pasture crops, exotic ornamentals and food crops such as vegetables. Nagar *et al.* (1984) have listed 12 plants of economic value as being susceptible to *C. reflexa* in India.

Despite the wide occurrence of *C. reflexa* there is no record of previous work related to its parasitism in Nepal. Hence, the present study attempts to provide information on the current status of parasitism by *C. reflexa* in the Kathmandu Valley of Nepal.

Kathmandu Valley is part of the central midland region of Nepal (Stainton 1972). It covers an area of 650 km^2 consisting of three towns and about 100 villages, and lies at an average altitude of 1350 m above sea level. This valley is a dried ancient lake bed surrounded on all sides by hills which rise in some places (e.g. Phulchoki) to a height of 2765 m above sea level. The average annual maximum and minimum temperatures are 25°C and 12°C respectively and average annual rainfall is 1356 mm. The climate and vegetation are a warm-temperate type. The floor of the valley is very fertile and the major agricultural crops are rice and vegetables. The vegetation of the region is characterized by the following dominant species: *Schima wallichii* (DC.) Korth., *Castanopsis indica* (Roxb.) Miq., *Pinus roxburghii* Sarg., *Alnus nepalensis* D. Don, *Lyonia ovalifolia* (Wallich) Drude, *Quercus glauca* Thunb., *Q. semecarpifolia* Smith, and *Rhododendron arboreum* Smith. The vegetation of settled areas of the valley consists of several native as well as cultivated exotic species. A majority of the suburban population practices agriculture and rears livestock. Many indigenous plants are used for fodder for the animals, as fertilizer and for medicinal purposes. Both indigenous and exotic plants are used as hedge plants on the farm lands.

Method

Field Observations

A survey of the host plants of *C. reflexa* at 20 selected sites in Kathmandu Valley (Figure 1) was carried out. Records were made of the intensity of parasitism and status of parasitism (whether primary of secondary, see later) on each host at each site. The status of host plants was also noted.

Intensity of parasitism was determined according to the percentage cover of *C. reflexa* on the host plant, as assessed visually by three observers. Plants were categorized according to percentage cover in five groups: <20%, 20 to 40%, 40 to 60%, 60 to 75% and >75%. Host plants were categorized as primary hosts where *C. reflexa* was found to be growing on them in different localities quite independent of any other plants. Host plants were considered secondary hosts where they were attacked only in the presence of a primary host plant.

Field collections of plants attacked by *C. reflexa* were made and later identified, wherever necessary, by comparison with material held at the Botanical Survey and Herbarium Section, Department of Medicinal Plants, Kathmandu. Stem pieces of hosts and of associated *C. reflexa* with haustoira growth were collected and preserved in 4% formalin.

Laboratory study

Preserved stem pieces were stained in safranin/haematoxylin and haustoria penetration confirmed by microscopic examination.

Results

The list of host species of *C. reflexa* with their corresponding families, habit, status, intensity of parasitism, primary or secondary host status and level of haustorial development are given in Table 1.

Discussion

The present study shows that the extent of *C. reflexa* parasitism in Kathmandu Valley is high because it involves 38 genera and 39 species, and is consistent with the results of Prasad (1966) in northern India. According to Malik and Singh (1980), *C. reflexa* can parasitize diverse species thus illustrating non-specificity of the host or else points towards the versatility of the parasite. Our findings correspond well with their conclusion.

Of the total 39 host plants, 11 were parasitized at <20% cover, 11 between 20 and 40%, 10 between 40 and 60%, 6 between 60 and 75% and only one species, *Duranta repens*, was more than 75% covered. This level of coverage of *D. repens* occurred at all sites and thus this species appears to be the principal host of *C. reflexa* in the Kathmandu Valley (Figure 2). Other prominent host plants with high intensity of parasitism were *Buddleja asiatica*, *Citrus medica*, *Ficus pumila*, *Jasminum officinale*, *Muehlenbeckia playtclados* and *Sambucus canadensis*. This is a diverse group and we do not recognize any single common factor predisposing them to a high level of parasitism. It is of note in Prasad's (1966) study that *D. repens* was one of only two principal hosts; the other was *Lantana camara* which, in our study, was found to be a secondary host with only 20 to 40% cover. *D. repens* is the most popular hedge plant in the Kathmandu Valley (Shrestha 1982) and is grown either alone or with other hedge plants. Effective hedges are very important for animal management in Kathmandu Valley and any factor which reduces their effectiveness could lead to serious crop damage.

Our results showed that of the 39 host species, 13 were primary and 26 secondary hosts. Many of the secondary hosts were parasitized when in close proximity of *D. repens*. This indicates a degree of selectivity of *C. reflexa* as well as a level of non-specificity. The 1 : 2 ratio of primary to secondary hosts would suggest the possibility of achieving a level of control of the parasitism, if this were desired, by selectively removing the primary hosts, particularly *D. repens*.

Regarding the haustorial formation by *C. reflexa*, 37 out of 39 recorded host species showed positive haustorial development on microscopic observation and only in two species, namely the grasses *Arundinaria maling* and *Dendrocalamus strictus*, was haustorial growth not found. The reason for this lack of

Table 1. Hosts of *C. reflexa*.

Host	Family	Habit	Status	Intensity of Parasitism[A]	Status of Parasitism[B]	Level of Haustorial Development[C]
Alnus nepalensis D. Don	Betulaceae	tree	timber, fuelwood	+	S	+
Artemisia indica Willd.	Asteraceae	perennial	weed, herb	+ +	S	+
Arundinaria maling Gamble	Poaceae	herb	hedge, timber	+	S	0
Bougainvillea glabra Choisy	Nyctaginaceae	shrub	ornamental	+ + +	P	+
Buddleja asiatica Lour.	Loganiaceae	shrub	ornamental, weed	+ + + +	P	+
Callistemon citrinus (Curtis) Skeels	Myrtaceae	tree	ornamental, fuelwood	+ +	S	+
Cestrum parqui L'Her.	Solanaceae	shrub	weed	+ +	S	+
Citrus medica L.	Rutaceae	tree	fruit plant	+ + + +	P	+
Clerodendrum philippinum Schauer	Verbenaceae	shrub	weed, hedge	+ +	S	+
Cucumis sativus L. var. *sikkimensis* Hook.f.	Cucurbitaceae	annual herb	vegetable	+	S	+
Dendrocalamus strictus Nees	Poaceae	shrub	fodder, fuel, timber for cottage industry	+	S	0
Diospyros kaki Thunb.	Ebenaceae	tree	fruit plant	+ +	S	+
Diplocyclos palmatus (L). C. Jeffrey	Cucurbitaceae	annual herb	weed	+	S	+
Duranta repens L.	Verbenaceae	shrub	hedge	+ + + + +	P	+
Eupatorium adenophorum Spreng.	Asteraceae	annual herb	weed	+	S	+
Ficus pumila L.	Moraceae	perennial vine	ornamental	+ + + +	P	+
Hibiscus rosa-sinensis L.	Malvaceae	shrub	ornamental	+	S	+
Holmskioldia sanguinea Retz.	Verbenaceae	shrub	ornamental	+ + +	P	+
Hypericum cordifolium Choisy	Clusiaceae	perennial herb	weed	+ +	S	+
Ipomoea purpurea (L.)Roth.	Convolvulaceae	annual herb	weed	+ +	S	+
Jasminum officinale L.	Oleaceae	shrub	ornamental	+ + + +	P	+
J. mesneyi Hance	Oleaceae	shrub	ornamental	+ + +	P	+
Justicia adhatoda L.	Acanthaceae	shrub	hedge, medicinal	+	S	+
Lantana camara L.	Verbenaceae	shrub	weed	+ +	S	+
Lonicera japonica Thunb.	Caprifoliaceae	perennial vine	ornamental	+ + +	P	+
Lycium barbarum L.	Solanaceae	shrub	ornamental	+ +	S	+
Macfadyena unguis-cati(L.) A. Gentry	Bignoniaceae	perennial vine	ornamental	+ + +	P	+
Melia azedarach L.	Meliaceae	tree	timber, fuelwood	+ + +	S	+
Muehlenbeckia platyclados Mei	Polygonaceae	shrub	ornamental	+ + + +	P	+
Phragmites karka (Retz.) Trin. ex Steud.	Poaceae	perennial herb	weed	+ +	S	+
Psidium guajava L.	Myrtaceae	tree	fruit	+ + +	S	+
Pyrus pashia Buch.-Ham. ex. D. Don	Rosaceae	tree	fruit	+ + +	S	+
Quercus leucotrichophora A. Camus	Fagaceae	tree	timber	+ + +	P	+
Reinwardtia indica Dum.	Linaceae	shrub	weed, ornamental	+	S	+
Rosa brunonii Lindl.	Rosaceae	shrub	weed	+ + +	S	+
Rubia manjith Roxb. ex Fleming	Rubiaceae	annual herb	weed, medicinal	+	S	+
Sambucus canadensis L.	Sambucaceae	shrub	hedge, weed	+ + + +	P	+
Thuja occidentalis L.	Cupressaceae	tree	ornamental	+	S	+
Urtica dioica L.	Urticaceae	annual herb	weed	+ +	S	+

A - Intensity of parasitizm:
+ = below 20% coverage
+ + = 20 to 40% "
+ + + = 40 to 60% "
+ + + + = 60 to 75% "

B - Status of parasitizm:
P = primary
S = secondary

C - Level of haustorial development:
+ = Positive
0 = Absent

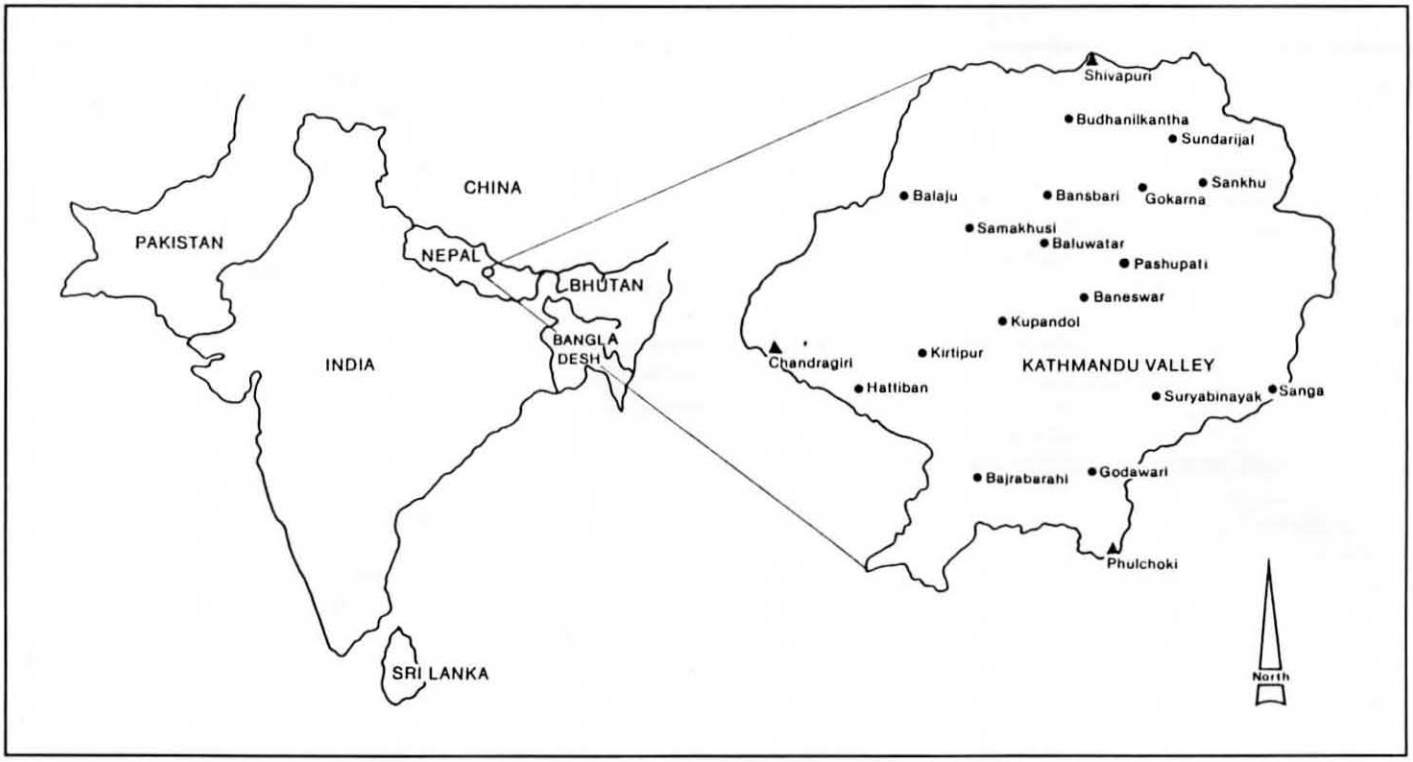

Figure 1. Kathmandu Valley

haustorial growth might possibly be due to the hard cuticle and epidermal cells of the host plants, but this is yet to be ascertained.

In the present study, 33 perennial and six annual plants were found to be parasitized by *C. reflexa*, indicating a preference of *C. reflexa* parasitism towards the perennial plants. Out of 13 primary host plants identified, 11 species were shrubs or trees and two were woody vines. This suggests that woody plants are more vulnerable to *C. reflexa* parasitism than herbaceous plants and this corresponds with the finding of Pizzolongo (1964). Out of the total, 36 host species were dicotyledons and three were monocotyledons, indicating that dicotyledons are more frequently parasitized that monocotyledons, as is generally recognized. The losses incurred by *C. reflexa* appear to have minor agricultural significance in the Kathmandu Valley because most of the plants parasitized, in the present study, have little agricultural value. Also, out of the 14 species listed as weeds, only two are primary hosts. This is in contrast to observations in other countries where many common weeds are parasitized by some species of dodder (Parsons 1973; Ashton and Santana 1976).

As would be expected there was a correlation between the degree of parasitism, the status of the host (primary or secondary) and the formation of haustoria, i.e. those plants which were heavily parasitized were also primary hosts and *C. reflexa* showed positive hausotira formation on these. In contrast, those hosts which were little parasitized (<20% cover) were invariably secondary hosts and contained the only two species that had no haustorial growth on them.

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Figure 2. *Duranta repens* parasitized by *C. reflexa*.