

# Investigation on The Distribution of *Cuscuta* in Chengdu

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**Abstract.** *Cuscuta* is an annual parasitic herb in Convolvulaceae family *Cuscuta*. This project investigated the spread of *Cuscuta* in 12 towns and 1 street that have 71 plots of the Chengdu, Tianfu New District by selecting a certain area of strip and circular plots, and proved the distribution pattern and growth situation of *Cuscuta* in this area. The results showed that: (1) *Cuscuta* in this area 1 genus 2 species, respectively for *Cuscuta chinensis* and *Cuscuta japonica*, of which *Cuscuta chinensis* accounted for 80%, the *Cuscuta japonica* accounted for 20%; (2) The two *Cuscuta* species parasitized 40 plants of 30 families, 37 genera in 14 sites, and three host plants of Magnoliaceae were found for the first time in this survey. (3) The parasitism of the *Cuscuta* showed the following pattern: plot afforestation > road afforestation > park afforestation > unmanaged wasteland, and the host plant species of plot afforestation was the largest, and the infection of road afforestation was the most serious. (4) *Cuscuta* for the parasitic environment selection tends to high light intensity, air humidity about 80%, high plant density, more plant species conditions, in the selection of the parasitic site, is more likely to appear in the middle and upper region of the host plant. The results of this project can provide a theoretical reference for the study of local landscape protection, and provide a theoretical basis for the development of local greening and tree cultivation.

**Keywords:** *Cuscuta*; Parasitic plants; Urban greening; Environmental protection; Plant investigation.

## 1. Introduction

*Cuscuta* is an annual parasitic herb of *Cuscuta* in the family Convolvulaceae of Angiospermae. It likes high temperature and humid climate, has lax requirements for soil and strong adaptability. When it meets a suitable host, it wraps around the host, forms a suction root at the contact and extends into the host tissue. After that, some tissues of *Cuscuta* differentiated into ducts and sieve tubes, which were connected with the host ducts and sieve tubes respectively, and absorbed nutrients and water from the host. It is reported that *Cuscuta* likes to parasitize in Leguminosae, Rosaceae, Oleaceae and other plants (Bai Ruixia et al., 2015). The parasitism of *Cuscuta* will pose a great threat to the growth and yield of the host and have a negative impact on the urban landscape. It is characterized by abnormal withered and yellow leaves or even falling off of host plants, delayed flowering period, few flowers, small flowers and poor flower type (Peng Lixia, 2009). If it is not controlled in time, it will even cause forest death (Wang Ningning & Lou Xiaoming, 2003). Although *Cuscuta* has great harm, its seeds have medicinal value and are also an important traditional Chinese medicine. In modern society, people have a fast pace of life, great life pressure and are often in a sub-health state. The data show that China has a high incidence of infertility due to various reasons (Sun Wenxi & Hu Lingjuan, 2019). Chinese traditional medicine believes that *Cuscuta* can tonify the liver and kidney, benefit essence and build up a strong body, even the antidiarrheal function (Guo Cheng et al., 1990), also plays an important role in treating male infertility and helping women have an abortion. Therefore, the investigation on the distribution of *Cuscuta* not only helps to guide the urban landscaping design and agricultural production planning, but also has multiple guiding functions for the planting of traditional Chinese medicine of *Cuscuta*.

Chengdu Tianfu new area covers an area of 564 square kilometers, accounting for 35.74% of the total planned area of Sichuan Tianfu new area. It governs 12 towns and 1 Street, including Wan'an Town, Xinglong Town, Zhengxing Town, Baisha Town, Yongxing Town, Jitian Town, Dalin Town, Jiancha Town, Xinxing Town, Taiping Town, Sanxing Town, Hejiang town and some areas of

Huayang Street (Qiu Jian, 2014). Among them, Huayang street, Wan'an town and Zhengxing town take industrial development as the main economic source. Their urbanization level ranges from high to low, with a total population of 528000, 103000 and 81000 respectively. Its population accounts for 49.3%, 9.6% and 7.6% respectively, and its area accounts for 6.8%, 5.5% and 7.5% respectively; Jitian Town, Jiancha Town, Baisha Town, Xinglong Town, Xinxing Town, Yongxing Town, Dalin Town, Taiping Town, Hejiang town and Sanxing town take agricultural development as the main economic source. Their urbanization level ranges from high to low, with a total population of 52000, 43000, 39000, 36000, 36000, 35000, 33000, 31000, 27000 and 26000 respectively. Its population accounts for 4.9%, 4.0%, 3.6%, 3.4%, 3.4%, 3.3%, 3.1%, 2.9%, 2.5% and 2.4% respectively, and its area accounts for 13.0%, 10.1%, 6.8%, 7.0%, 6.8%, 7.9%, 8.4%, 7.4%, 7.2% and 7.1% respectively (Chai Hailong & Yu Bingjie, 2018).

With the development of China's society and cities, urban managers pay more and more attention to urban appearance, environmental sanitation, green environmental protection and so on. Therefore, how to effectively eliminate the "vampire" of urban greening, that is, all kinds of parasitic plants, becomes more and more important (Wu Yan et al., 2018). By investigating the spread of *Cuscuta*, which is widely parasitic on various plants, in Tianfu new area of Chengdu, this experiment explores the distribution pattern and law of *Cuscuta* in this area, so as to provide theoretical reference for the relevant research of agriculture and gardens. By investigating the growth environment of *Cuscuta*, it provides a theoretical basis for local greening development and forest cultivation.

## 2. Materials and methods

### 2.1 Respondents

Species, host species and parasitism of *Cuscuta*.

### 2.2 Investigation location

This experiment takes into account the development focus of each township and street in the directly managed area and the differences in the level of urbanization development. For example, Yongan Town and Jitian town are mainly agricultural development, while Wan'an town and Huayang Street are mainly modern high-end industrial development, showing the current situation of low urbanization level before and high urbanization level after. Therefore, the investigation scheme is designed according to the actual situation. In the villages and towns with high urbanization level, priority is given to the modernization construction area, while in the villages and towns dominated by agricultural development, priority is given to the sample plots with small population density according to the actual situation. Investigate the community greening, an unregulated wasteland, park greening and road greening in 12 towns and 1 Street directly under the jurisdiction of the District, select the type of sample land according to the actual situation of the survey site, and randomly select 2-3 survey sample lands for community greening, an unregulated wasteland, park greening and road greening in 13 towns. The sample plots are divided in two ways: the strip sample plots with a length of 200m and a width of 10m and the circular sample plots with a radius of 25m. A total of 71 survey sample plots are selected. In terms of sample plot selection, we pay attention to the diversity of sample plot types and the representativeness of sample plots selected in each survey area.

### 2.3 Research methods

#### 2.3.1 Investigation method

The investigation records of *Cuscuta* parasitism and host include: the location of the sample plot, the sample plot environment, the division of the harm degree of the parasitic area; Growth period of *Cuscuta chinensis*, species and analysis of *Cuscuta chinensis*; The species, living state, parasitic intensity and parasitic position of host plants.

Impregnation rate = (number of impregnated samples / total number of samples) × 100%

Note: The impregnation rate can represent the proportion of the number of samples parasitized by *Cuscuta* in the total number of samples in the survey site, and reflect the parasitic intensity of *Cuscuta* in each survey site from the perspective of impregnation number. During calculation, the survey sample plot is divided into quadrats with one square meter as a unit. In the quadrats, trees, solitary shrubs, etc. that can be calculated per plant, the single plant is recorded as a quadrat; If hedgerows, patch flowers and shrubs cannot be calculated, one square meter is recorded as a quadrat (DU Xiaoli et al., 2011).

$$\text{Hazard index} = (0) \times (X1 + 1 \times X2 + 2 \times X3 + 3 \times X4 + 4 \times X5) / [5 \times (X1 + X2 + X3 + X4 + X5)] \times 100\%$$

Note: The hazard index can represent the coverage degree obtained after comprehensive analysis according to the coverage classification standard in the survey sample plot parasitized by *Cuscuta*, and reflect the hazard degree of *Cuscuta* in each survey site from the perspective of coverage degree. Where 0, 1, 2, 3, 4 and 5 are the visual coverage grade of *Cuscuta*; X1, X2, X3, X4 and X5 are the number of quadrats at each level. The coverage classification standard (MA Yuefeng et al., 2013) is grade 0 uninfected *Cuscuta*, with grade 1 coverage of 1% to 5%, grade 2 coverage of 6% to 25%, grade 3 coverage of 26% to 50%, grade 4 coverage of 51% to 75%, and grade 5 coverage of 76% to 100%.

### 2.3.2 Plant species identification

The species of *Cuscuta* and its host plants were identified by using the data and literature websites such as: Flora of China, Dictionary of Higher Plant Species in China, PPBC Chinese Plant Image Library, CVH Chinese Digital Herbarium, etc.

## 3. Results and analysis

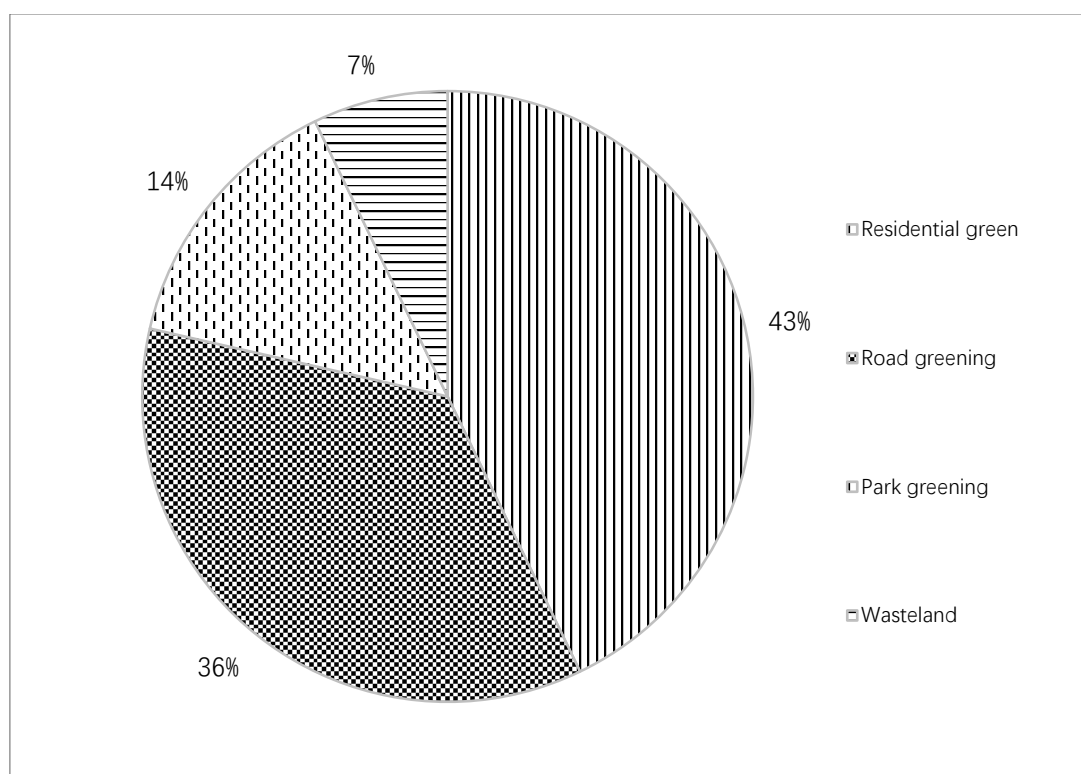
### 3.1 Types and distribution

**Table 1.** Species and distribution of *Cuscuta* in Chengdu, Tianfu New Area

| Species name             | Area of distribution | Major economic sources (industry & agriculture) | Sample name                                   | Sample type          |
|--------------------------|----------------------|-------------------------------------------------|-----------------------------------------------|----------------------|
| <i>Cuscuta chinensis</i> | Zhengxing Town       | Industry                                        | Qinhuangyuan Community                        | Community green belt |
|                          |                      |                                                 | Liyuan Community                              | Community green belt |
|                          |                      |                                                 | Guangdong Street Section                      | Road green belt      |
|                          | Huayang Street       | Industry                                        | Wasteland near Xiamen Road                    | Unmanaged wasteland  |
|                          |                      |                                                 | Angong Square Park                            | Park green belt      |
| <i>Cuscuta chinensis</i> | Jiancha Town         | Agriculture                                     | Xihe Garden Community                         | Community green belt |
|                          | Jitian Town          | Agriculture                                     | Chengnanxinju Community                       | Community green belt |
|                          |                      |                                                 | Dongshan Avenue Section                       | Road green belt      |
|                          | Xinglong Town        | Agriculture                                     | Tianyuanshiyi Community                       | Community green belt |
|                          |                      |                                                 | Section I of Dongshan Avenue                  | Road green belt      |
|                          | Baisha Town          | Agriculture                                     | Baisha Street Section                         | Road green belt      |
|                          | Yongxing Town        | Agriculture                                     | Jinzhushangyuan Community                     | Community green belt |
|                          |                      |                                                 | Hexie Community                               | Community green belt |
| <i>Cuscuta japonica</i>  | Taiping Town         | Agriculture                                     | Qingximen Street Section                      | Road green belt      |
|                          |                      |                                                 | East Street and Teacher Street                | Road green belt      |
|                          | Zhengxing Town       | Industry                                        | Shunsheng Road Section                        | Road green belt      |
|                          | Wan'an Town          | Industry                                        | Park near the Second Section of Lushan Avenue | Park green belt      |

In this experiment, it is found that there are two species of dodder in Chengdu direct management area of Tianfu new area, namely *Cuscuta chinensis* and *Cuscuta japonica*. There are great differences in the morphological characteristics of stem, inflorescence, calyx, corolla, stamen, style, ovary, capsule and seed between the two kinds of *Cuscuta*. This experiment mainly takes the difference between the stems of two kinds of *Cuscuta* as the identification basis. The survey results (Table 1) show that dodder is distributed in 7 towns and one street, and jindengteng is distributed in 2 towns. It can be seen that in Tianfu new area of Chengdu, most of the parasitic dodder is dodder, and the distribution of jindengteng is less, of which dodder accounts for 80% and jindengteng accounts for 20%.

Through the investigation of 14 plots with dodder parasitism in 71 plots, the selection proportion of two kinds of dodder to parasitic plots (Fig. 1) shows that the selection of parasitic plots by two kinds of dodder in Chengdu direct management area of Tianfu new area shows the law of community greening > Road Greening > park greening > unmanaged wasteland, The results showed that the more human activities and population density, the more serious the parasitic situation of dodder.



**Fig.1** Selection ratio of *Cuscuta* parasitism sample in Chengdu, Tianfu New District

### 3.2 Host plant selection

The survey results (Table 2) show that there are 30 families, 37 genera and 40 species of dodder parasitism in Chengdu direct management area of Tianfu new area, including 29 species of dodder parasitism in 19 families, 26 genera and 11 species of golden lantern vine parasitism in 11 families and 11 genera. According to the results, the selection of host plants of the two kinds of dodder mostly tended to shrubs and trees, with mulberry, Oleaceae, Leguminosae, Rosaceae and Magnoliaceae accounting for 37.5%.

**Table 2.** Host plant selection of *Cuscuta* in Chengdu , Tianfu New Area

| Cuscuta species          | Scientific name                                          | Genus name    | Family name    | Plant type            |
|--------------------------|----------------------------------------------------------|---------------|----------------|-----------------------|
| <i>Cuscuta japonica</i>  | <i>Loropetalum chinense</i> var. <i>rubrum</i>           | Loropetalum   | Hamamelidaceae | Evergreen shrub       |
|                          | <i>Buddleja lindleyana</i>                               | Buddleja      | Loganiaceae    | Semi evergreen shrub  |
|                          | <i>Nandina domestica</i>                                 | Nandina       | Berberidaceae  | Evergreen shrub       |
|                          | <i>Cinnamomum japonicum</i>                              | Cinnamomum    | Lauraceae      | Evergreen tree        |
|                          | <i>Lagerstroemia indica</i>                              | Lagerstroemia | Lythraceae     | Small evergreen trees |
|                          | <i>Elaeocarpus decipiens</i>                             | Elaeocarpus   | Elaeocarpaceae | Evergreen tree        |
|                          | <i>Photinia serrulata</i>                                | Photinia      | Rosaceae       | Evergreen shrub       |
|                          | <i>Schefflera octophylla</i>                             | Schefflera    | Araliaceae     | Evergreen shrub       |
|                          | <i>Celtis sinensis</i>                                   | Celtis        | Ulmaceae       | Deciduous tree        |
|                          | <i>Koelreuteria bipinnata</i> var. <i>integrifoliola</i> | Koelreuteria  | Sapindaceae    | Deciduous tree        |
| <i>Cuscuta chinensis</i> | <i>Cayratia japonica</i>                                 | Cayratia      | Vitaceae       | Deciduous vine        |
|                          | <i>Ficus concinna</i>                                    | Ficus         |                | Evergreen tree        |
|                          | <i>Ficus virens</i>                                      | Ficus         | Moraceae       | Semi deciduous tree   |
|                          | <i>Broussonetia papyifera</i>                            | Broussonetia  |                | Deciduous tree        |
|                          | <i>Gardenia jasminoides</i>                              | Gardenia      | Rubiaceae      | Evergreen shrub       |
|                          | <i>Osmanthus fragrans</i>                                | Osmanthus     |                | Evergreen tree        |
|                          | <i>Ligustrum lucidum</i>                                 | Ligustrum     | Oleaceae       | Evergreen shrub       |
|                          | <i>Cinnamomum japonicum</i>                              | Neocinnamomum | Lauraceae      | Evergreen tree        |
|                          | <i>Chimonanthus praecox</i>                              | Chimonanthus  | Calycanthaceae | Deciduous shrub       |
|                          | <i>Erythrina variegata</i>                               | Erythrina     |                | Deciduous tree        |
|                          | <i>Erythrina crista-galli</i>                            | Erythrina     | Leguminosae    | Deciduous tree        |
|                          | <i>Bauhinia purpurea</i>                                 | Bauhinia      |                | Evergreen tree        |
|                          | <i>Pyracantha fortuneana</i>                             | Pyracantha    |                | Evergreen shrub       |
|                          | <i>Prunus cerasifera</i>                                 | Prunus        |                | Deciduous tree        |
|                          | <i>Eriobotrya japonica</i>                               | Eriobotrya    | Rosaceae       | Evergreen tree        |
|                          | <i>Photinia serrulata</i>                                | Photinia      |                | Evergreen shrub       |
|                          | <i>Magnolia denudata</i>                                 | Magnolia      |                | Deciduous tree        |
|                          | <i>Magnolia grandiflora</i>                              | Magnolia      | Magnoliaceae   | Evergreen tree        |
|                          | <i>Michelia maudiae</i>                                  | Michelia      |                | Evergreen tree        |
|                          | <i>Ginkgo biloba</i>                                     | Ginkgo        | Ginkgoaceae    | Deciduous tree        |
|                          | <i>Bougainvillea spectabilis</i>                         | Bougainvillea | Nyctaginaceae  | Evergreen shrub       |
|                          | <i>Pterocarya stenoptera</i>                             | Pterocarya    | Juglandaceae   | Deciduous tree        |
|                          | <i>Citrus maxima</i>                                     | Citrus        | Rutaceae       | Evergreen tree        |
|                          | <i>Pittosporum tobira</i>                                | Pittosporum   | Pittosporaceae | Evergreen shrub       |
|                          | <i>Fatsia polycarpa</i>                                  | Fatsia        | Araliaceae     | Evergreen shrub       |
|                          | <i>Loropetalum chinense</i> var. <i>rubrum</i>           | Loropetalum   | Hamamelidaceae | Evergreen shrub       |
|                          | <i>Tradescantia pallida</i>                              | Tradescantia  | Commelinaceae  | Perennial herb        |
|                          | <i>Elaeocarpus decipiens</i>                             | Elaeocarpus   | Elaeocarpaceae | Evergreen tree        |
|                          | <i>Sambucus chinensis</i>                                | Sambucus      | Caprifoliaceae | Evergreen herb        |
| <i>Cuscuta chinensis</i> | <i>Acer palmatum</i>                                     | Acer          | Aceraceae      | Deciduous tree        |

### 3.3 Selection of parasitic sample plot environment

Through the analysis of the environmental selection results of the parasitic sample plots of dodder plants (Table 3), it is shown that both dodder species tend to choose the environment with high light intensity, general air humidity, high plant density and more plant species in the Chengdu direct management area of Tianfu new area.

**Table 3.** Environmental selection of *Cuscuta* parasitism plot in Chengdu, Tianfu New District

| Survey site    | Sample type         | <i>Cuscuta</i> species                              | Light intensity | Air dampness | Plant density | Plant species |
|----------------|---------------------|-----------------------------------------------------|-----------------|--------------|---------------|---------------|
| Zhengxing Town | community greening  | <i>Cuscuta chinensis</i>                            | ****            | ***          | ****          | ****          |
|                | unmanaged wasteland | <i>Cuscuta chinensis</i>                            | *****           | **           | ***           | **            |
|                | road greening       | <i>Cuscuta chinensis</i><br><i>Cuscuta japonica</i> | ****            | **           | ****          | ****          |
| Huayang Street | park greening       | <i>Cuscuta chinensis</i>                            | ***             | ****         | ****          | ***           |
| Jiancha Town   | community greening  | <i>Cuscuta chinensis</i>                            | ****            | ***          | ***           | ****          |
| Jitian Town    | community greening  | <i>Cuscuta chinensis</i>                            | ****            | ***          | ***           | ****          |
|                | road greening       | <i>Cuscuta chinensis</i>                            | ***             | ***          | ***           | ***           |
| Xinglong Town  | community greening  | <i>Cuscuta chinensis</i>                            | ***             | ****         | ****          | ***           |
|                | road greening       | <i>Cuscuta chinensis</i>                            | ****            | ***          | ***           | **            |
| Baisha Town    | road greening       | <i>Cuscuta chinensis</i>                            | ****            | ***          | ***           | ****          |
| Yongxing Town  | community greening  | <i>Cuscuta chinensis</i>                            | ****            | ***          | ****          | ****          |
| Taiping Town   | community greening  | <i>Cuscuta chinensis</i>                            | ****            | ***          | ***           | ****          |
|                | road greening       | <i>Cuscuta chinensis</i>                            | ***             | **           | ***           | **            |
| Wan'an Town    | park greening       | <i>Cuscuta japonica</i>                             | **              | ****         | *****         | ****          |

Note: In the table, light intensity, air humidity, plant density, and plant species are recorded in a relative hierarchy, where "\*\*\*\*\*" means very high, "\*\*\*\*" means high, "\*\*\*" means average, "\*\*" means low, and "\*" means very poor.

### 3.4 Hazard analysis

#### 2.4.1 Harmful symptoms

Through this investigation, it is found that shrubs have weaker resistance to dodder than trees, and are prone to large-area infection. When the host plant is entangled by a small amount of dodder, its growth is basically not affected. However, with the continuous spread of dodder, the host plant spreads outward from the place with the highest degree of infection, and the leaves wither and even fall off. In the most serious case, the whole leaves fall off and then die. In Shunsheng Road, Zhengxing Town, there are a large number of parasitic phenomena of golden lantern vine. About 50% of *Loropetalum chinense* and tung trees in the sample plot are parasitic, of which 40% of *Loropetalum chinense* and tung trees have withered and withered leaves, and 10% of *Loropetalum chinense* and

tung trees have fallen off their whole leaves. It was found that dodder mostly parasitized on the middle and upper parts of shrub host plants, that is, from the beginning of leaf growth to the top of shrub; For arbor host plants, dodder mostly parasitizes from the main branches to the lower part of the tree crown, that is, where there are many branches and avoid direct sunlight.

#### 2.4.2 Hazard index

Parasitism occurs in 14 of the 71 sample plots directly under the jurisdiction of Chengdu in Tianfu new area. The analysis of the critical degree of parasitism (Table 4) shows that the dodder infection rate of road greening is the highest. In terms of hazard index, the indexes of community greening, road greening and park greening are greater than 30, indicating that the parasitic situation is relatively serious, among which the parasitic situation of road greening is the most serious.

**Table 4.** Cuscuta damage index of Tianfu New Area Chengdu direct management area

| Sample type        | Survey site      | Major cuscuta species          | Major host plant                                                                                           | Impregnation rate (%) | Hazard index |
|--------------------|------------------|--------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------|--------------|
| Road greening      | Zhengxing Town   | Guangdong Street Section       | <i>Erythrina variegata</i> ,<br><i>Pyracantha fortuneana</i> ,<br><i>Pittosporum tobira</i>                | 10.61                 | 39           |
|                    |                  |                                |                                                                                                            |                       |              |
|                    |                  | Shunsheng Road Section         | <i>Cuscuta japonica</i>                                                                                    |                       |              |
|                    | Jitian Town      | Dongshan Avenue Section        | <i>Cuscuta chinensis</i>                                                                                   | 0.69                  | 20           |
|                    |                  | Xinglong Town                  | Section I of Dongshan Avenue<br><i>Cuscuta chinensis</i>                                                   | 0.73                  | 40           |
|                    | Baisha Town      | Baisha Street Section          | <i>Cuscuta chinensis</i>                                                                                   | 2.43                  | 40           |
|                    | Taiping Town     | Qingximen Street Section       | <i>Cuscuta chinensis</i>                                                                                   | 3.53                  | 25           |
|                    |                  | East Street and Teacher Street | <i>Cuscuta chinensis</i>                                                                                   |                       |              |
|                    | Zhengxing Town   | Qinhuangyuan Community         | <i>Osmanthus fragrans</i> ,<br><i>Loropetalum chinense</i> var.<br><i>rubrum</i> ,<br><i>Acer palmatum</i> | 3.40                  | 22           |
|                    |                  |                                |                                                                                                            |                       |              |
| Community greening | Liyuan Community |                                | <i>Osmanthus fragrans</i> ,<br><i>Erythrina crista-galli</i> ,                                             |                       |              |
|                    |                  |                                |                                                                                                            | Average value         |              |
|                    |                  |                                |                                                                                                            | <b>3.60</b>           | <b>32.8</b>  |

| Sample type            | Survey site       |                                                     | Major<br>cuscutea<br>species | Major host plant                                                                                                                  | Impregnation<br>rate<br>(%)  | Hazard<br>index |
|------------------------|-------------------|-----------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------|
| Park<br>greening       | Jiancha<br>Town   | Xihe Garden<br>Community                            | <i>Cuscuta<br/>chinensis</i> | <i>Loropetalum<br/>chinense</i> var.<br><i>rubrum</i>                                                                             | 2.82                         | 38              |
|                        |                   |                                                     |                              | <i>Osmanthus<br/>fragrans</i> ,<br><i>Ligustrum<br/>lucidum</i> ,<br><i>Cinnamomum<br/>japonicum</i> ,<br><i>Fatsia polycarpa</i> |                              |                 |
|                        | Jitian Town       | Chengnanxinju<br>Community                          | <i>Cuscuta<br/>chinensis</i> | <i>Osmanthus<br/>fragrans</i> ,<br><i>Cinnamomum<br/>japonicum</i> ,<br><i>Chimonanthus<br/>praecox</i> ,<br><i>Citrus maxima</i> | 2.41                         | 40              |
|                        | Xinglong<br>Town  | Tianyuanshiyi<br>Community                          | <i>Cuscuta<br/>chinensis</i> | <i>Ficus concinna</i>                                                                                                             | 0.71                         | 20              |
|                        | Yongxing<br>Town  | Jinzhushangyuan<br>Community                        | <i>Cuscuta<br/>chinensis</i> | <i>Osmanthus<br/>fragrans</i> ,<br><i>Prunus cerasifera</i> ,<br><i>Bougainvillea<br/>spectabilis</i>                             | 0.91                         | 28              |
|                        | Taiping<br>Town   | Hexie Community                                     | <i>Cuscuta<br/>chinensis</i> | <i>Ficus virens</i> ,<br><i>Gardenia<br/>jasminoides</i> ,<br><i>Osmanthus<br/>fragrans</i> ,<br><i>Chimonanthus<br/>praecox</i>  | 2.17                         | 38              |
|                        |                   |                                                     |                              |                                                                                                                                   | Average value<br><b>2.07</b> | <b>31.0</b>     |
|                        | Huayang<br>Street | Angong Square Park                                  | <i>Cuscuta<br/>chinensis</i> | <i>Ligustrum<br/>lucidum</i> ,<br><i>Photinia serrulata</i>                                                                       | 2.68                         | 33              |
|                        | Wan'an<br>Town    | Park near the Second<br>Section of Lushan<br>Avenue | <i>Cuscuta<br/>japonica</i>  | <i>Celtis sinensis</i> ,<br><i>Cayratia<br/>japonica</i> ,<br><i>Pittosporum<br/>tobira</i> ,<br><i>Elaeocarpus<br/>decipiens</i> | 4.12                         | 32              |
|                        |                   |                                                     |                              |                                                                                                                                   | Average value<br><b>3.40</b> | <b>32.5</b>     |
| Unmanaged<br>wasteland | Zhengxing<br>Town | Wasteland near<br>Xiamen Road                       | <i>Cuscuta<br/>chinensis</i> | <i>Sambucus<br/>chinensis</i>                                                                                                     | <b>0.64</b>                  | <b>20</b>       |

Note: The infection-rate and hazard index in the table are mean values.

#### 4. Conclusion and discussion

At present, there are about 170 species of *Cuscuta* in Convolvulaceae, which are distributed in tropical to temperate zones all over the world, and about 10 species in China. In the United States, the former Soviet Union and many Eurasian countries, beets, onions, grapes and fruit trees are seriously damaged by dodder (song Hongmin & Xu Rumei, 2004); Alfalfa is also infested by dodder in some areas of the former Yugoslavia; In Belarus and the near and Middle East, sugar beet and other cash crops are seriously damaged by dodder; In Turkey, Greece, Lebanon, Iraq and Iran, about 15% of farmland is invaded by dodder, resulting in a large number of deaths of cultivated crops (Huang Daqing & Yao Jian, 2005). In China, the landscaping in Shijiazhuang is disturbed by Chinese dodder and Japanese dodder (Bai Ruixia et al., 2015); *Cuscuta japonica*, *Cuscuta japonica*, *Cuscuta chinensis* and *Cuscuta australis* appeared in Kunming and its adjacent areas (Guo Fenggen et al., 1999); *Cuscuta japonica*, *Cuscuta japonica* and *Cuscuta australis* appeared in Nanning, Guangxi (DU Xiaoli et al., 2011). Six species of dodder, including Chinese dodder, European dodder and Japanese dodder, have been found in Sichuan Province (Zhao Ru & Zhu Jun, 1995); In 2005, *Cuscuta chinensis* and *Cuscuta japonica* appeared in Chengdu for the first time, which had a serious impact on Urban Greening (Jiang Yongyu, 2005). Only dodder (*Cuscuta chinensis*) and golden lantern vine (*Cuscuta japonica*) were found in the direct management area of Chengdu, Tianfu new area, and no new *Cuscuta* plants have been found yet.

According to the survey results, both kinds of *Cuscuta* prefer to parasitize shrubs and arbors, among which mulberry, Oleaceae, Leguminosae and Rosaceae are more likely to be parasitized by *Cuscuta* (Zhao Ru & Zhu Jun, 1995). In this survey, three species of Magnoliaceae host plants of *Cuscuta* were found for the first time, and Chinese *Cuscuta* has strong selective parasitism to Magnoliaceae plants.

The survey also found that the selection of parasitic sample plots of two kinds of dodder showed the law of community greening > Road Greening > park greening > unmanaged wasteland. At the same time, it was found that dodder mostly tended to the environment with high light intensity, air humidity of about 80%, high plant density and more plant species, and parasitic on the middle and upper part of the host plant. The survey results show that among the 14 sample plots with dodder parasitism, the dodder infection rate of road greening is the highest, and the hazard index is the largest, reaching 32.8.

There may be several reasons for this:

1). The area where the community and road greening are located is generally sunny, the environmental humidity is appropriate, and the plant species and plant density are high, which provides a good environmental basis for the parasitism of dodder and expands the host selection range. The survey results of wasteland show that *Humulus* grows in large quantities in the sample area, so that *Cuscuta* cannot choose suitable plants to parasitize. Due to sparse plant growth and lack of management in some parks, weeds grow and multiply in large numbers, seizing the living space of dodder. The other part of the park is located in the urban area, and the local municipal administration pays more attention to it, so it can clean up the parasitic plants in time, resulting in less investigation results of dodder parasitism.

2). Due to the lack of management of the property management department and the inadequate implementation of the department responsibility allocation, the dodder cannot be cleaned in time. Due to improper daily supervision of some road greening, dodder will multiply in large numbers once it appears, and the treatment difficulty continues to increase, so that the subsequent cleaning cannot be cured, and dodder appears repeatedly in this area.

3). Compared with park greening and wasteland, there are more large trees in community greening and road greening, which provides a prerequisite for nesting, feeding and reproduction of birds. According to the query results of Baidu Encyclopedia, the feeding behavior of birds can promote the seed transmission of dodder, and its seeds can spread outward through bird feces. However, due to the lack of relevant literature, this conclusion needs further research.

In view of the above discussion, some suggestions are put forward for the management of community greening, road greening and park greening in the area directly under the jurisdiction of Chengdu in Tianfu new area.

First, giving priority to the planting of gymnosperms, herbs, plants with fewer branches or leaves, plants with thinner branches or fewer leaves can reduce the parasitic situation of dodder.

Second, combined with the problems existing in the greening of residential areas (Yang Xiangjie, 1997), it is suggested to reasonably allocate the planting density of plants, avoid planting a certain plant in a high density, and reduce the transmission intensity of dodder by separate planting.

Third, when planting mulberry, Oleaceae, Leguminosae, Rosaceae, Magnoliaceae and other plants that are easy to be parasitized by dodder, some gymnosperms or herbs can be planted during them, so as to avoid a large number of transmissions of dodder.

Fourth, relevant departments should strengthen daily management and monitoring, and timely carry out prevention and treatment if dodder parasitism is found (Gao Zhaoyuan & Gan Jing, 1992).

Fifth, for plants with prunable branches, the pruning method should be the first choice in the control of dodder to minimize the economic loss.

Sixth, use plants harmful to the survival of dodder or plants with competitive relationship for biological control (Shu Yixing et al. 2013). For example, when investigating wasteland, it was found that when there were a large number of *Humulus*, dodder did not appear parasitic. In this investigation, it is found that the selection of host plants by dodder does not include thorny plants. Therefore, it can effectively prevent a large number of parasitism of dodder from this aspect.

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