



## Alternative host, spatial distribution and economic importance of dodder (*Cuscuta* spp. Cuscutaceae), a parasitic plant on the irrigated perimeter of Konni in Niger

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### Abstract

This present work was carried out on the irrigated perimeter of Birni N'konni in the Tahoua region. The objective was to contribute to a better knowledge of the parasitic plant called "dodder", in order to suggest possible solutions. To do this, a survey sheet was administered to the 150 market gardeners in the Konni irrigated perimeter. The choice of each producer is random. The data collected was analyzed after cleaning. At the end of the analyzes, the results found showed that the producers are confronted, in their plots, with attacks of various parasitic plants including the dodder. These parasitic plants cause farmers to use pesticides, especially herbicides, which are not registered according to the data analysis. Analysis of the data collected also showed that most producers (90%) are familiar with dodder and its mode of parasitism. They say they are aware of the impact of parasitism on crops including tomatoes, onions and peppers. Dodder coverage rates on crops vary from 5 to 25% and the highest loss rates recorded are of the order of 18% for onion and 12% for tomato, 10% for potato. and 5% for watermelon. These results are a good indicator for technical services and researchers from a perspective of finding solutions against dodder.

**Keywords:** dodder, alternative hosts, irrigated perimeter of konni, Tahoua region, Niger

### Introduction

Like other countries in the sub-region, Niger's economy is dependent on the agricultural sector which contributes more than 40% to PIB (INS, 2012). But it should be noted that with the advent of climate change and given many factors, the environment becomes more and more hostile so that the land no longer responds favorably to the efforts made by producers. Poor productivity of agricultural land is the result of many factors, including weeds, which find better conditions for their development. These weeds cause enormous damage in Sahelian countries in general, sometimes going as far as total loss of yield in infested crops (Ayensu *et al.*, 1984) [2]. Among these parasitic weeds, the dodder genus is one of the most formidable in terms of its damage, particularly on market garden crops (onion, tomato, potato, carrot, etc.). In Niger, it has been found in the regions of Tahoua (Konni, Galmi, Kalfou) on tomato, cowpea and onion and in Maradi (Djirataoua) on cumin. Its presence was observed in February 2015 on the Konni irrigated perimeter (Haougui *et al*, 2015) [6]. The economic losses that it causes are difficult to bear by developing countries, which are mainly agricultural. The life cycle of the "dodder" has two disproportionate phases. The seeds, small (1 to 2 mm in diameter) are produced in large quantities (2000 to 3000 per stem) and enclosed in capsules. They are covered with a brownish, multi-layered, leathery and impermeable seed coat which gives them dormancy. Their spread is by the wind, the cattle having consumed the contaminated fodder, the contaminated seeds and the

agricultural equipment (BOUSSIM, 2002). A more or less prolonged stay in the soil lifts the integumentary dormancy by altering the leathery envelope. The seed germinates by emitting a "radicle" which elongates and swells (Dembelé *et al*, 1994). Unlike other parasitic plants, dodder seed can germinate even in the absence of a host plant. The emerging seedling grows quickly to find in its immediate environment a green plant to parasitize (Haougui *et al*, 2015) [6]. Parasitism is therefore important and knowledge of the dynamics of this species is necessary for the implementation of control methods strategies.

### Methodology

#### Sampling

The sample was chosen on the basis of the simple random type probabilistic method from the established list. In principle, the list is numbered according to the number of people registered. Then skip two numbers and take the third one as you move up the list, until you have the numbers you want. At the end of the day, a definitive list of respondents was drawn up. However, the sample is made up of men and women. A total of one hundred and fifty (150) producers were chosen.

#### Data collection

Data are collected through an individual interview using a structured questionnaire. The survey sheet includes several parts: the marital status of the producer, identification of the

producer, characterization of the agricultural production system, knowledge of weeds, damage and impact on crops, impact of the parasite on crop yield.

For the inventory of parasitic plants that attack crops, a maintenance guide is administered to Konni technical services working in the field, producers and rural populations.

### Determined parameters

#### Calculation of dodder coverage rate

Observation of the dodder on several crops (tomato, onion, chili, potato and watermelon) at the perimeter made it possible to estimate its coverage rate. This rate is estimated using the following formula:

$$TC = \frac{\text{Number of infested dishes}}{\text{Total number of boards in the plot}} \times 100$$

#### loss rate calculation different cultures

The rate of loss of crop yield is caused by the coverage rate (TC) of the dodder for each speculation on different plots. This rate (TP) was determined as follows:

$$TP = \frac{\text{mean TC of dodder on speculation}}{\text{TC total dmean TC of dodder on speculation}} \times 100$$

### Data processing and analysis

The first step consisted in entering the data collected from each person surveyed in Excel version 2017. The data collected was subsequently cleaned, codified and submitted for analysis using SPSS software. For qualitative data, the frequency of each person was determined. For quantitative data, the mean was determined.

### Results

#### Diversity of weeds on the perimeter

Table 1 shows the diversity of weeds at the level of the konni irrigated area. Thus the analysis of this table indicates that 17 different species including the dodder belonging to 13 families have been identified. The family of Cyperaceae, Fabaceae, Euphorbiaceae and Poaceae are each represented by two species. The other families are represented by only one species. The species *Kyllinga squamulata* seems to be better known by producers with a proportion of 20.7%, followed by *Cyperus rotundus* (19.3%). The dodder is also represented and is well known to producers with a proportion of 7.4%.

**Table 1:** Family, scientific name and frequency of each weed

Family	Scientific name	Frequency	Percentage
Cyperaceae	<i>Kyllinga squamulata</i>	135	20,7%
	<i>Cyperus rotundus</i>	126	19,3%
Fabaceae	<i>Ingofera Nummularii folia</i>	31	4,8%
	<i>Alysicarpus ovalifolius</i>	7	1,1%
Euphorbiaceae	<i>Euphorbia aegyptia</i>	20	3,1%
	<i>Euphorbia hirta</i> L	8	1,2%
Poaceae	<i>Pennisetum pedicellatlm</i>	8	1,2%
	<i>Digitaria horizonta</i> LIS Willd.	56	8,6%
Malvaceae	<i>Corchorus trideus</i> L	40	6,3%
Molluginaceae	<i>Mollugo cerviana</i>	23	3,5%
Commelinaceés	<i>Commelina benghalensis</i>	46	7,1%
Astéracées	<i>Acanthospermum hispidum</i>	15	2,3%
Gisekiaceae	<i>Gisekia pharmacioides</i>	10	1,5%
Phyllanthaceae.	<i>Phyllanthus pentandrus</i>	5	0,8%
Convolvulaceae	<i>Ipomoea vagans</i>	42	6,4%
Cuscutaceae	<i>Cuscuta spp</i>	48	7,4%
Nyctaginaceae	<i>Boerhavia sepens</i> L	32	4,9%
13 Familles	17 specie's	652	100%

### Characteristics of pesticides used by producers

Analysis of Table 2 shows that Konni market gardeners use herbicides and insecticides against crop pests. Thus, Farae force seems to be the herbicide (46.97%) the most used by

producers, followed by perfect killer (23.48%). It also emerges from the analysis of this table that all pesticides are represented only four active ingredients.

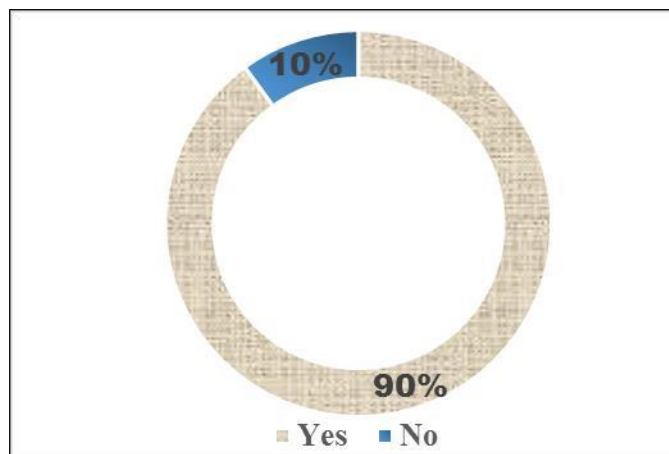
**Table 2:** Commercial name, active ingredient and proportion of producers for each pesticide used.

Commercial specialties	Active ingredients	Type	Percentage
Farae force	Paraquat dichlorid 200g/l	Herbicide	46,97%
Perfect Killer	Chlorpyrifos 20%	Insecticide	23,48%
Force UP	Glyphosate 360 g/	Herbicide	8,72%
Eagrownk	Chlorpyrifos 480 g/l	Insecticide	8,05%
Rambo	Permethrin 0,6 %	Insecticide	7,38%
Dimeto 40 EC	Diméthoate (400g/L	Insecticide	5,37%
Total			100%

**Knowledge of the parasitic plant by producers**

The data in figure 1 reveals that 90% of the producers

surveyed know the dodder well against only 10% who say they do not know it.



**Fig 1:** Proportion of producers knowing or not knowing the parasitic plant

**Different types of dodder alternative hosts**

The data reported in Table 3 show the diversity of dodder host ranges at the Konni perimeter. Thus, analysis of the data

reveals that onion (76.51%), tomato (63.76%) and chili (20.13%) seem to be the most attacked by dodder. The other crops seem to be weakly attacked.

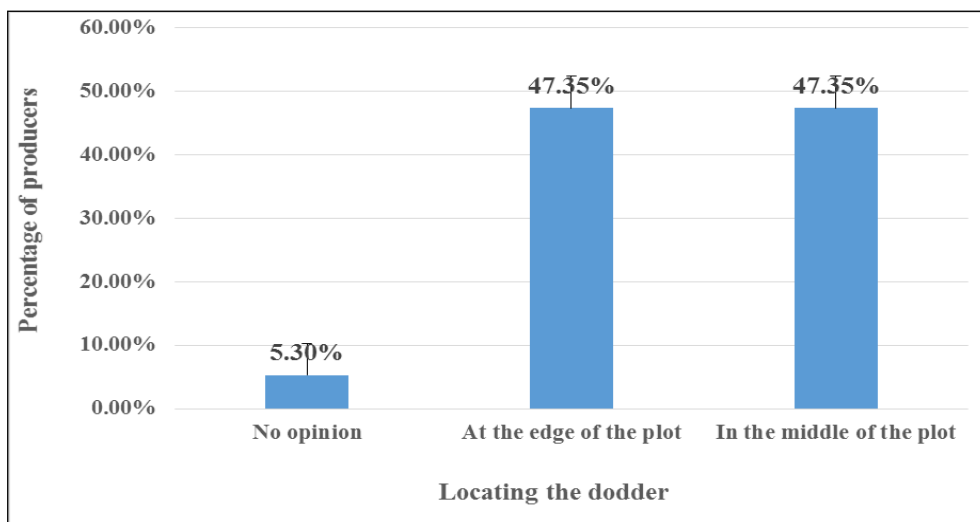
**Table 3:** Different host types of dodder according to producers

Plants attacked by dodder	Frequency	Percentage
Onion	114	76,51%
Tomato	95	63,76%
Peanut	12	8,05%
Potato	10	6,71%
pimento	30	20,13%
Carrot	6	4,03%
Sorghum	5	3,36%
Carrot	1	0,67%
Carrot	1	0,67%
Lucerne	1	0,67%

**Location of the parasitic plant on the plot**

According to the producers surveyed, the parasitic plant is found in the middle and at the edge of the plot. Thus, figure 2

indicates nearly 50% of producers confirm that the dodder is at the edge and in the middle of their plots. Only 5% of growers have no opinion on where the dodder is.



**Fig 2:** Location of the dodder on the plot according to the producers

### Impact of the parasite on crop production

Analysis of the data in Figure 3 shows the impact of dodder coverage rate on crop losses. Thus, figure 3 reveals that the more the coverage rate of the dodder increases, the more the losses inflicted on the crops become important. At a coverage

rate of 2%, the estimated losses on the tomato crop amount to 7%. When the curvature rate of the dodder increases to 20%, the losses also increase to 14% on the tomato (Figure 3). Figure 4 shows some illustrations of the dodder and its parasitism on crops and weeds.

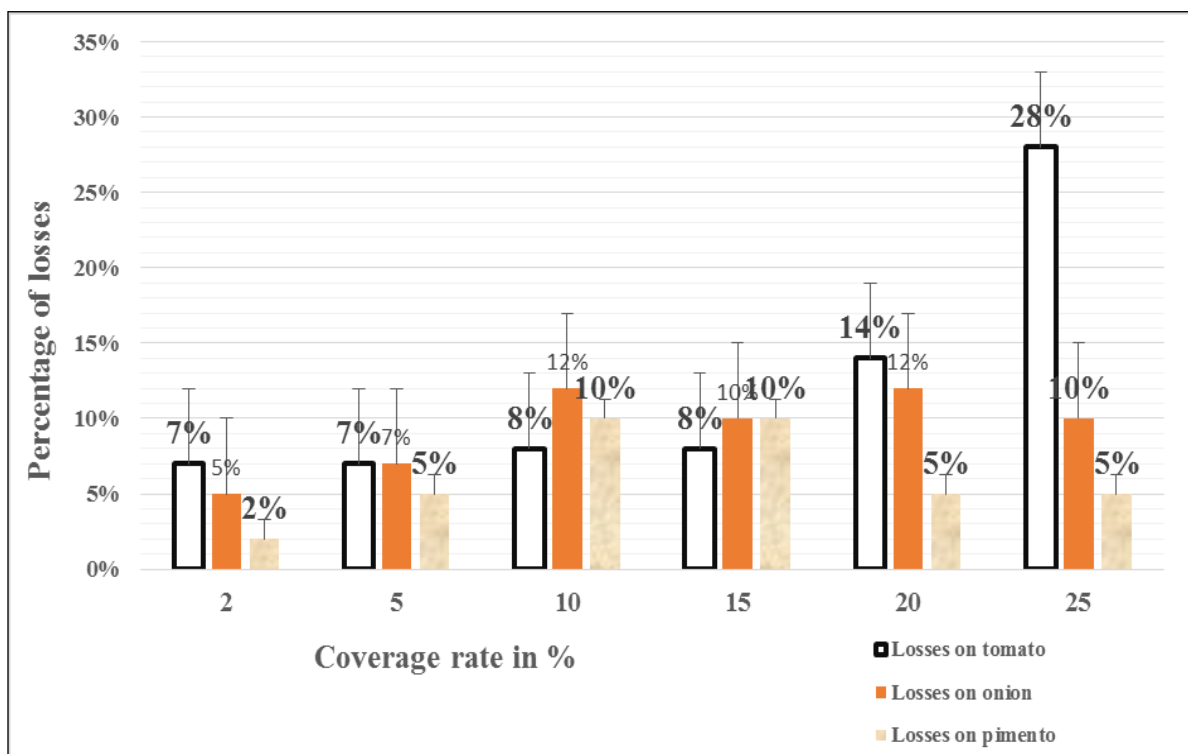


Fig 3: Impact of dodder coverage rate on crop loss



Fig 4: A / Dodder attack on tomato; B / dodder on weeds; C / start of attack on tomato and C / Photo of dodder

### Discussion

Dodder is an invasive plant with significant problems due to its rapid development, invasiveness and difficulty in management. In Niger there are hardly any studies on this parasitic plant. The literature provides very little information

on the host ranges of this parasitic species on crops. This work is one of the first to deal with knowledge, coverage rate and different host ranges of dodder in Niger. The data found show a diversity of weeds on the irrigated perimeter. This is normal because weeds adapt and attack crops and cause enormous damage: damage to the foliage, yellowing of the leaves, curling, leaf fall, root transformation, parasitism. These results are in agreement with those found by Doggett (1988) who asserts that weeds do indeed attack several cereal crops, to which they inflict damage which causes a significant decrease in their yield. In sorghum, losses can reach 70%. The results found also showed a diversity of hosts on the perimeter. The list of these dodder host plants is far from exhaustive because the species can attack many more plant species, especially horticultural species (Sawadogo *et al.*, 2018). Zhang *et al.* (2014) [11] reported that dodders are obligate parasitic plants and most of these species have wide host ranges. Dawson *et al.* (1994) [4] also specified that some species of *Cuscuta* have narrow-ranked hosts while others parasitize many species of dicotyledons, mainly legumes such as alfalfa (*Medicago sativa*), several species of clover (*Trifolium* spp.), tomato (*Lycopersicon esculentum*), carrot (*Daucus carotta*) and other crops such as potato (*Solanum tuberosum*), sugar beet (*Beta vulgaris*) and many ornamental species. They also reported that *Cuscuta* attacks some monocots such as asparagus (*Asparagus officinalis*) and onion (*Allium cepa*) but lawns and

many grasses are considered immune to dodder. According to Lanini and Kogan (2005) in addition to these cultures, dodder grows on garlic (*Allium sativum* L.), chili (*Capsicum annuum* L.), melon (*Cucumis melo* L.), cucumber (*Cucumis sativus* L.), sweet potato (*Ipomoea batatas* L. (Lam.)) And several species of Citrus. These results also corroborate those of Narayana Rao and Rao (1991) who reported that dodders cannot develop without the proximity of another plant. Our results report that producers are familiar with the dodder, which corroborates those obtained by Basso *et al.* (2015) on the N'konni irrigated perimeter who affirms after discussions with the producer and his neighbors, it appeared that these The latter know this plant well and have nicknamed it "sarka", a Hausa word which means "chain", because it strangles the stems of attacked plants and has no roots. In fact, the higher the coverage rate, the greater the losses, resulting in a linear relationship between the coverage rate and the losses. Okonkwo (1966) asserts that during severe infestations, grubbing by growers would occur too late in the life cycle of the pest, allowing a much greater loss of crop yield. This could be explained by the fact that the producers of the perimeter do not have the control of the fight against this parasite. In the end, the dodders which are harmful to crops are nevertheless useful because they play a medicinal role. During our surveys, two old women told us that the dodder in decoction heals sickly children well. Also, Auric (2009) indicated that these parasites (*C. epithymum*, *C. europaea*,) are fully used in Europe for the problems of hepatic insufficiency, intestinal gas, aerophagia, constipation (in infusion, 5g for a liter of water to take 3 cups per day). They also have external use on wounds and abscesses (in decoction, 25 g per liter of water).

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