Incidence and severity of the mistletoe *Tapinanthus globiferus* on guava and lime and its mechanical control in the Gezira State, Sudan

Mohamed S. Zaroug, Abbasher, A. Abbasher and Eldur B. Zahran *

Department of Plant Pathology, Faculty of Agriculture and Natural Resources Abu Haraz, University of Gezira. P. O. box 42 Wad Medani, Sudan

* Corresponding author, email: edurzahran@gmail.com.

**Abstract:** Mistletoes of the genus *Tapinanthus* (Loranthaceae) are stem hemiparasites comprising about 250 species in East and West Africa. Mistletoe (*Tapinanthus globiferus*) (A. Rich.) van Tieghan, which possess straight pentamerous colourful red flowers, causes severe damage to lime (*Citrus aurantifolia* Swingle) and guava (*Psidium guajava* M.) in orchards along the Blue Nile banks in central Sudan. The main purpose of this research was to find an environmentally friendly approach for the management of mistletoe in orchards fruit trees. Specific objectives were: to evaluate the presence, degree of damage caused by the parasite, and the awareness of farmers, and then use this information to assess possible control measures. A survey was conducted in 2009/2010 by interviewing 186 farmers in the study area (Wad Medani and Hisahisa Provinces) in the Gezira State, a major producer of fruits in the State. The survey results indicated that the incidence of the parasite was 73% in Wad Medani and 23% in Hisahisa. About 70% of the respondents were familiar with the parasite, and 64% of the interviewed farmers practiced traditional pruning by using logging axe, most of the farmers failed to control the parasite. Severely infected orchards were selected for assessment of potential preventive control methods using severe pruning, regular pruning using long handled shears and traditional pruning with logging axe. The results revealed that severe pruning reduced infection by 76% and severity index by 94% in guava. However, traditional pruning using axe reduced infection by only 2.2% and severity by 45%. Regular pruning in lime trees using long handled shears reduced infection by 50% and severity index by 80%. Using the traditional methods in lime orchards reduced severity by 18% with no effect on infection percentage. In conclusion, severe pruning and regular pruning using long handled shears were found to be effective in controlling the parasite in guava and lime trees. These methods were easy to accomplish, and not expensive.

**Keywords:** Pruning, long handled shears, logging axe

© 2013 Sudan University of Science and Technology. All rights reserved

---

### Introduction:

Mistletoes of the genus *Tapinanthus* (Loranthaceae) are stem hemiparasites of about 250 species in East and West Africa. The plant, which possess straight pentamerous colourful red flowers, inflict damage on coffee, citruses, guava other fruits and ornamental trees (Viccer, 1981). The nature of sticky seeds enhances the distribution by birds and other animals (DelRio *et al.*, 1996 and
Aukema, 2004). The mistletoe *Tapinanthus globiferus* (A. Rich.) van Tieghan, occurs in most citruses and guava producing areas along the Blue Nile banks in central Sudan (Zaroug et al., 2009). These plants have no root system and parasitize the host plants; they debilitate the tree and reduce the fruit-bearing area. Damage from mistletoes involves the death of branches distal to the infection. More serious damage occurs in poorly-managed orchards and/or under drought stress conditions, situations that often lead to the death of the host (Boussim, et al. 2004). Recently, mistletoes infection on orchard trees has rapidly increased in Sudan.

The primary control methods of mistletoes are pruning of infected branches and removing or eradicating severely infected trees (Hawksworth, 1983; Butin, 1995; Wood and Reilly, 2004). Removal of mistletoe plants from infected branches does not kill the parasite and resprouting from the haustorial system often occurs. Although chemical, biological and genetic controls have been and are still being investigated, particularly for dwarf mistletoe, these methods have not been shown to be practical or economical so far (Shamoun and Dewald, 2002).

Pruning is required for proper citrus care. It includes, regular removal of sprouts, elimination of dead and diseased branches, and the low-hanging branches (skirting) may need to be removed. Pruning is also practiced to control mistletoe, but the infected branches are cut irrespective of the point of attachment of the parasite to the host. In both lime and guava trees severe pruning is sometimes practiced to eliminate deadwood, and diseased limbs inorder to renew tree growth. However, complete destruction of severely infected guava trees is commonly practiced to control the mistletoe in Sudan.

The main purpose of this research was to find an environmentally friendly approach for managing mistletoe in orchards fruit trees. The specific objectives included: evaluating the presence, degree of damage caused by the parasite and farmers’ awareness. The information obtained is to be used to develop possible control measures.

**Materials and Methods**

The study area lies along the Blue Nile banks in two provinces: Hisahisa (14° 44’ 47” N, 33° 17’ 43” E) and Wad Medani (14° 24’ 30.20” N, 33° 31’ 47.88” E), Gezira State, Central Sudan. The area is famous for growing guava, lime trees and vegetables.

In 2009 and 2010, 186 farmers, in two different provinces, Wad Medani (96) and Hisahisa (90) in the Gezira State, Central Sudan were interviewed with specific respect to their experiences and approaches to control mistletoe infection. The questionnaire form consisted of questions that assessed the awareness of farmers concerning mistletoe biology, occurrence of the parasite, and control methods used by farmers. The survey form and questionnaire form were prepared and then farmers were interviewed orally during field visits arranged by the Extension Service, Department of Agriculture, Gezira State Central Sudan. The data were analysed by SPSS Software version 11 to determine the frequency and confidence level of the questionnaire data.

Severely infected orchards were selected for the assessment of potential preventive control methods. Severe pruning of guava trees, regular pruning of lime trees using long handled shears were practiced in farmers’ orchard in Hisahisa province, Gezira State. These methods were compared with traditional pruning using logging axe.

Degree of infection was evaluated first in June 2009 and reevaluated in July 2010 to assess the effect of severe and regular pruning as compared to traditional pruning. The degree of infection was evaluated by two methods. One simply involved measuring percentage of infected trees. For the second method, severity of infection on each tree was rated on the scale 0-4 (0 = no infection, 1 = low infection
with 1-5 haustoria/tree, 2 = moderate infection
with 6-10 haustoria/tree, 3 = severe infection
with 11-15 haustoria/tree and 4 = very severe
infection with ≥16 haustoria /tree.

A severity index \( y \) for each sample was then calculated using the formula:

\[
y = \frac{(a \times o) + (b \times 1) + (c \times 2) + (d \times 3) + (e \times 4)}{a + b + c + d + e} \times \frac{100}{4}
\]

Where \( a, b, c, d, \) and \( e \) are number of trees
which fall into the increasing infection
categories 0-4 (Mathiasen et al., 2008).

Severe pruning in guava trees:
Severe pruning is sometimes practiced to
eliminate deadwood and diseased limbs in
order to renew tree growth. It is accomplished
by using logging axe to cut the whole branches
as appeared in Plate. 1 (a) and in this research
it was used to control mistletoe. For this
purpose a total of 300 guava trees were pruned
as explained above in an orchard in Hisahisa.
To evaluate the degree of infection 5 samples
each consisted of 20 trees were evaluated in
June 2009 before pruning and re-evaluated in
July 2010 after severe pruning.

Regular pruning in lime trees using long
handled shear:
Lime trees are widely grown in central Sudan
for its edible acid fruit. The tree seldom grows
more than 5m high and if not pruned becomes
shrub-like. Its branches spread and are
irregular, with short, stiff twigs, small leaves,
and many small, sharp thorns. A total of 300
lime trees were pruned using the long handled
shear with saw and cutter in an orchard in Hisahisa.
They were cut regularly at short
intervals with continuous inspection of the
orchard using long handled shears with cutter
and saw. It was accomplished by cutting the
infected branch at least 20-30 cm behind the
haustorium. The handle is about 3 meters long,
which enables the labour to cut mistletoe
infected branches at the tops of lime trees. To
evaluate the degree of infection 5 samples each
consisted of 20 trees were evaluated in June
2009 before regular pruning and re-evaluated in
July 2010 after pruning.

Finally, traditional pruning in guava and lime
trees:
Traditional pruning is required for regular
removal of sprouts, elimination of dead and
diseased branches. Also the bottom of the
canopy in lime trees may need to be removed
and it is sometimes used to control the
mistletoe.
The farmers use logging axe and cut the
infected branches irrespective of the point of
attachment. Since it was difficult to leave any
trees without pruning the traditional pruning
method was used as a control. The degree of
infection was evaluated using the same
procedure mentioned above. Moreover, the
infected trees were assessed twice once in June
2009, then reassessed after one year and
compared with the two methods mentioned
above using T-test

Results
The survey results showed that the incidence of
the parasite was 73% in Wad Medani and 23% in
Hisahisa. Seventy percent of the respondents
were familiar with the parasite and about 64%
of the interviewed farmers practiced traditional
pruning by using logging axe (Table 1).
The results revealed that severe pruning in
guava significantly reduced infection of
mistletoe by 76% and severity index by 94%
(Table 2, Plate 1). However, traditional pruning
using logging axe reduced infection of
mistletoe in guava trees by only 2.2% and
severity by 45%. Regular pruning using long
handled shears in lime fruit trees also
significantly reduced infection of mistletoe by
50% and severity index by 80% (Table 3).
Using the traditional methods in lime orchards
had no effect on infection percentage,
however, it reduced severity index by 18%
(Table 3).
Table 1: Mistletoe incidence, awareness among interviewed farmers and the current status of control in two provinces in the Gezira State, Sudan

<table>
<thead>
<tr>
<th>Variables</th>
<th>Wad Medani (%)</th>
<th>Hisahisa (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>73.0</td>
<td>23.0</td>
</tr>
<tr>
<td>Farmers Awareness</td>
<td>70.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Control using traditional pruning</td>
<td>64.0</td>
<td>65.0</td>
</tr>
<tr>
<td>Number of interviewed farmers</td>
<td>96.0</td>
<td>90.0</td>
</tr>
</tbody>
</table>

Table 2: Effects of severe and traditional pruning methods in controlling mistletoe on guava trees

<table>
<thead>
<tr>
<th>Treatment</th>
<th>June 2009</th>
<th>July 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Infected tree</td>
<td>Severity index</td>
</tr>
<tr>
<td>Severe pruning</td>
<td>91.7**</td>
<td>83.5**</td>
</tr>
<tr>
<td>Reduction %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional pruning</td>
<td>90.0</td>
<td>66.1</td>
</tr>
<tr>
<td>Reduction %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at p≤0.05 using T test.
** Significant at p≤0.01 using T test.

Table 3: Effects of regular pruning using long handled shear and traditional pruning methods in controlling mistletoe on lime trees

<table>
<thead>
<tr>
<th>Treatment</th>
<th>June 2009</th>
<th>July 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Infected trees</td>
<td>Severity index</td>
</tr>
<tr>
<td>Regular pruning with Long handled shears</td>
<td>92.5**</td>
<td>54.4**</td>
</tr>
<tr>
<td>Reduction %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional pruning</td>
<td>79.7</td>
<td>56.9</td>
</tr>
<tr>
<td>Reduction %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at p≤0.05 using T test.
** Significant at p≤0.01 using T test.

Discussion

The results of the survey indicated that farmers consider mistletoe to be a major pest on lime and guava trees in the two provinces surveyed. Although 70% of the respondents were familiar with the parasite and about 64% of the interviewed farmers practiced traditional pruning by using logging axe, however, most of them failed to control the parasite (Table 1). This was indicated after assessment of the degree of infection where the percentage of infected trees was reduced by only 2.2% in guava and no reduction was observed in infected lime trees after traditional pruning (Table 2 and 3). The same genus was reported to cause severe damage on coffee, citruses and guava trees in East and West Africa (Viccer, 1981). In addition, the
A parasite was reported to cause drastic damage in citruses and Guava in Sinar State, Sudan (Zaroug et al., 2009).

Pruning is the simplest curative and most affordable method to control mistletoes, at least in guava. It is efficient only if the host branch is cut at several-centimetres below the level of attachment of the parasite to eliminate the haustorial system entirely (Parker and Riches, 1993). However, this method is time-consuming and dangerous for people who are removing the parasite especially in lime trees. The available methods of control in Sudan are pruning, which could be preventive if it was done properly and regularly, or the removal of the infected trees, a destructive method. Unfortunately, pruning is not done properly: since the farmers remove only the haustorium of the parasite which leads to vigorous resprouting of the parasite. As mentioned, the accurate method is to cut the infected branch at least 20-30 cm behind the haustorium (Parker and Riches, 1993). In addition, the removal of infected branches should be done regularly at short intervals with continuous inspection of the orchard. According to the results the use of long handled shear reduced the incidence and severity of mistletoe infection in lime trees significantly as compared to the traditional pruning. It also, allowed the farmer to prune lime trees easily and effectively. In addition to controlling mistletoe, pruning is also required for proper care of lime trees to remove sprouts, deadwood, diseased limbs and skirting i.e. the removal of low-hanging branches. However, the spreading and irregular growth of branches with stiff twigs and many small sharp thorns make the traditional pruning very difficult. In this research the usage of severe pruning reduced the incidence of mistletoe in guava trees by more than 76% and severity index by more than 79%, compared to traditional pruning which reduced infection of mistletoe in guava trees by only 2.2% and severity by 45%. Although, severe pruning is effective in controlling the parasite, even so, the farmer will lose one season’s fruit crop. However, subsequent new growth and the resultant increase in the production with improved quality will compensate for the loss.

In conclusion regular pruning using long handled shears was found to be effective in controlling mistletoe in lime trees, easy to accomplish and not expensive. On the other hand, severe pruning was effective to control mistletoe in guava trees and to remove old dry branches and diseased limbs to renew tree growth. At present, these two methods could be strongly recommended for the protective control of mistletoe (T. globiferus) parasitizing lime and guava in Sudan. Other methods should be investigated particularly biological control since chemical control on fruit trees is hazardous. It is noteworthy that proper understanding of the parasite biology and ecology is imperative for development of effective control methods.

Acknowledgments
Authors kindly appreciated financial support provided by Ministry of Higher Education and Scientific Research, Sudan. Thanks are also extended to Mr. Aboud A. Head of the Extension Service, Department of Agriculture, Gezira State, and farmers at Hisahisa & Wad Medani, Sudan with especial regards to Mr. Yosif Siddig.

References


Plate 1. Control of mistletoe in guava using severe pruning method:

a: Guava trees after severe pruning in June 2009, b: Early stages of recovery of guava tree canopy, resprouting of host branches, c: Guava tree canopy recovered, and started to bear fruit one year after severe pruning in July 2010
حقوق وشدة الإصابة بطفيل القلع (Tapinanthus globiferus) على أشجار الجوافة والليمون

محمد سعيد أحمد زروق وأبشر عوض أبو وأحمد زهران
قسم أمراض النبات، كلية الزراعة والموارد الطبيعية – إبها، جامعة الجزيرة، صب 42 ودمنئي – السودان
*المؤلف الرئيسي، عنوان إلكتروني
edurzahran@gmail.com

المستخلص:

الف중 أو العنبة نبات زهري غير كاملي التلف ينتمي على سوق النبات العائلة وتتبع الجنس (Tapinanthus) والعائلة (Loranthaceae). يتميز الفئل بالأزهار الحمراء الطويلة ويبعض نافذ كبير من أشجار اللويح والمروعة في المصري المنتشر على ضفتي النيل الأزرق في وسط السودان. هدفت هذه الدراسة لإعداد طريقة صيدية للتحكيم والحد من انتشار الفئل في الصناديق، الأهداف الخاصة للدراسة شملت تقييم انتشار الفئل، شدة الإصابة، ومدى معرفة المزارعين بهذا الفئل، والاستعانة بهذه المعلومات لتقييم طرق الكفاحية الممكنة. أجريت المسحات في العام 2009/2010 بمعاينة 186 مزارع في موقع الدراسة (محافظة ودمنئي والحصادصا) في ولاية الجزيرة والتي تعتبر منتقلة رئيس للمواقع والأخوك في الولاية، أوضحت النتائج أن نسبة الإصابة في ودمنئي 73% وفي الحصادصا حوالي 23%. حوالي 70% من المزارعين الذين شملهم البحث على معرفة بالفئل وحوالي 64% منهم يمارسون مكافحة الفئل بالتقليدي بالتقليم التقليدي باستخدام القأس، لا أن معظمهم فشلو في مكافحة الفئل. تم اختيار بساتين ذات إصابة عالية بغرض تقييم طريقة فعالة لمكافحة الفئل مستخدمين: طريقة القطع الجائر، التقليم المنظم باستخدام معص ذو ذراع طويل، والتقليم التقليدي باستخدام القأس. أوضح التناول أن استخدام التقليم الجائر في أشجار الجوافة قلل الإصابة بنسبة 76% وشدة الإصابة حوالي 92% مقارنة بالتقليم التقليدي حيث كانت نسبة الإصابة 2.2% فقط وشدة الإصابة 45%. أما التقليم المنظم باستخدام المعص ذو ذراع طويل في أشجار اللويح قلل الإصابة بنسبة 50% وشدة الإصابة بنسبة 80%. في حين أن استخدام الرياح التقليدية في أشجار اللويح قلل الإصابة بنسبة 18% دون حدوث تغير في شدة الإصابة. خلصت الدراسة إلى أن طريقة التقليم الجائر والمنظوم باستخدام المعص ذو ذراع طويل في أشجار الجوافة والليمون ذات فعالية في مكافحة الفئل هذا بالإضافة إلى سهولة تطبيقها وقلة التكافة.