Effectiveness of Sustainable Home-Made McPhail Traps in Mass Capturing of Longicorn Beetle, *Trichoferus griseus* (Fabricius) Adults under the Rain-Fed Conditions of Matrouh Governorate – Egypt

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**Abstract**

Longicorn beetle, *Trichoferus griseus* (Fabricius, 1792) (Coleoptera, Cerambycidae) is one of the most damaging fig tree pests at the Egyptian Northwestern Coast (ENC). The current paper discusses the first experience in mass-trapping of *T. griseus* adults by McPhail traps made with re-used PET water bottles. Traps were lured by unmarketable fig fruits immersed in a small amount of water with a bit of any insecticide. This kind of trap is considered competitive for low cost, easily handled and the re-use of PET bottles lowers the wasted plastic that may have good environmental impacts. Also the use of non-tradable fig-fruits as lure advantages the management of wastes. This study confirms the knowledge on *T. griseus* bionomics in ENC. Sixty traps were installed at a rate of 15 traps/site and 1 trap/tree. The traps were succeeded to catch 714 adults throughout the whole study period. The mean catches/trap recorded its highest value at Barrani site and the lowest at Marsa Matrouh. Throughout the whole study period, July month showed the highest capture. Seasonal fluctuation of *T. griseus* adults showed the peaked range from June till October. Although the present findings suggest the efficacy of the traps in mass-trapping of adult borer, we consider the need of further studies and insights to improve trap performance. All the studies will concur to demonstrate the mass-trapping effectiveness in the proposed fig IPM strategy. Finally, local growers, after short training period, enjoyed and disseminated among them how to manage the traps independently.

**Keywords**: Cerambycidae; *Trichoferus griseus*, Fig tree borer; Mass trapping; Rain-fed agriculture; Matrouh Governorate; Egypt

**Introduction**

Egyptian Northwestern Coast (ENC) considers as a unique site in terms of the agricultural practices in Egypt. Both prevailing environmental conditions (about 100 mm. annual precipitation rate with irregular events and rain-fed conditions, soil salinity, hot and drought summer season) and the natural northward slope inspired local Bedouins for unique cultivation style, which is the cultivation of fig and olive trees at the rehabilitated wadis in order to exploit the soil-infiltrated rain water to barely provide the trees with their water requirements (rain-fed irrigation). The full description regarding the climate, geomorphology and tableland of this area were mentioned at Yousif et al. [1]. The removal of large areas of indigenous wild vegetation to be replaced by fig and olive trees beside the non-environmental agricultural practice, facilitate biodiversity deterioration, elicit the outbreak of more than one pest and induce invasive infestation on domestic plants with sensible yield reduction as the final output. Such theme was the domain for the data of Shinji et al. [2] that concerned the replacement of natural forests by invasive alien trees in isolated oceanic islands, which was the main reason for deteriorating the biodiversity of many indigenous organisms.

In the current study longicorn fig tree borer, *Trichoferus griseus* (Fabricius, 1792) (Coleoptera Cerambycidae) is one of the most dangerous pest of fig tree trunks. The drought stress that fig tree is subjected to constitute a crucial pre-requisite for *T. griseus* outbreak as stated by Hanks et al. [3] for *Phoracantha semipunctata* F. The larval wood boring life style of *T. griseus* also makes its control practices quite difficult (Gul-Zumroegli) [4], Hoskovec et al. [5] and Imam and Rabah [6]. In practice, most Bedouin farmers are unlikely forced to cut back the main tree branches of their fig trees due to their inability to manage this pest.

and burn infested twigs and branches in winter as control measure. Later on Balachowsky [13] discussed again the species as a fig tree pest, and focused on the differences in phenology between the populations in France and in North Africa where the elision occurs in full summer. In the meantime Villiers [14] detailed several findings in Morocco, Algeria and Tunisia and reported that adults mate and lay eggs during night. Avidov and Harpaz [15] reported the presence of *T. griseus* in Israel infesting fig and Carob mainly on hills. Hegyessy and Kutas [16] found *T. griseus* in Hungary, a comparatively very cold country.

Accordingly, sustainable and integrated management program should be precisely scheduled to target different life forms of this borer depending on its bionomics. Although, the capture of Cerambycid species adults using light traps is generally recommended as an effective tool either for monitoring or control practices Amitava et al. [17] the difficulty for regular distribution of light traps to cover the intended fig tree area (s) under Matrouh Governorate conditions (due to the scattered pattern of fig orchard cultivation and the lack of power supply sources in most localities) was the main challenge that motivated us to find an effective alternative way to make such treatment practically possible. Accordingly, the current study aimed to evaluate the efficacy of fig fruit trap in the mass collection of fig tree borer adults. The innovative idea of the proposed study is the availability of trap components, environmental friendly, easily handled, cost-competitive and sustainable. We share this first approach as a starting point for further studies to improve the effectiveness of the proposed trap to demonstrate the possibility of their engagement in *Trichoferus griseus* IPM.

### Materials and Methods

#### Study sites

Study sites are administratively followed Matrouh Governorate at the north-western corner of Egypt parallel to the Mediterranean Seashore line (Figure 1). The current study had been conducted from March, 2015 till January, 2016 and the selected sites were chosen to cover the main fig tree cultivation districts throughout the ENC area. Table 1 showed the selected sites and their GPS coordinates.

![Figure 1: Location map of the study area.](image)

#### Experimental design

At each selected site, 15 fig trees similar in their height and DBH (diameter at breast height) had been selected for trap installation and evaluation. Each trap consisted of 1.5 L. clear plastic bottles (PET) with four circular holes of about 2 cm. diameters at its upper part. Each trap was lured by one ripe fig fruit soaked in a little bit amount of water. Each trap is hanged on the tree by a piece of plastic cord or iron thin wire at the upper middle portion of the tree canopy. That is to say the 4 sites under evaluation have 60 fig trees (15 trees/site). Traps were weekly checked for counting and evacuating the caught insects and biweekly recharged by new fig fruit.

<table>
<thead>
<tr>
<th>Study sites</th>
<th>Coordinates</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Latitude</td>
</tr>
<tr>
<td>Ras El-Hekma</td>
<td>31° 9′ 58.57″</td>
</tr>
<tr>
<td>“Sidi Henash”</td>
<td>31° 9′ 58.57″</td>
</tr>
<tr>
<td>Matrouh</td>
<td>31° 11′ 54.06″</td>
</tr>
<tr>
<td>“Wadi Retam”</td>
<td>31° 11′ 54.06″</td>
</tr>
<tr>
<td>El-Nigala</td>
<td>31° 26′ 54.12″</td>
</tr>
<tr>
<td>“Wadi Gebali”</td>
<td>31° 26′ 54.12″</td>
</tr>
<tr>
<td>Barrani</td>
<td>31° 35′ 0.12″</td>
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<tr>
<td>“Abo Melad”</td>
<td>31° 35′ 0.12″</td>
</tr>
</tbody>
</table>

#### Trap catchment evaluation

To evaluate the efficacy of fig fruits as *T. griseus* adult attractor, the following parameters had been measured:

- The monthly catch per each site.
- The total and mean catch per site throughout the season.
- The mean catch per trap at each site (total caught insects at each site/165 traps (15 traps X 11 months)).
- The total and mean catch per month at all sites under evaluation.
- The mean catch per trap at each month (total monthly caught insects/60 traps).

At each site trap evaluation had been done under the ordinary practices implemented by the Bedouin farmers.

The ANOVA analysis was run using SPSS PASW Statistics ver. 18.

### Results

Data at Table 2 represented the monthly catch of fig tree borer adults. The total caught insects at the all study sites were represented by 714 adults. At the current study, trapping effectiveness that expressed as the mean catch per trap at each site (total caught insects/165 traps) could be ranked in an ascending manner as 0.38, 0.82, 1.47 and 1.65 adults at Marsa Matrouh, El-Nigala, Ras El-Hekma and Barrani, respectively. From statistical viewpoint, the sites were different (F=99.04 and P<0.05). Moreover, catching dynamic as mean catch per trap/month (total monthly caught insects/60 traps) was fluctuated among the minor catch at January (about 0.05) and the maximum at...
July (about 2.30) with in-between fluctuation throughout the whole study period (Table 2).

<table>
<thead>
<tr>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>Total catch</th>
<th>Mean catch/site</th>
<th>Mean catch/trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ras El-Hekma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14</td>
<td>0.73 ± 0.88*</td>
<td>13</td>
<td>0.87 ± 0.74</td>
</tr>
<tr>
<td>Marsa Matrouh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0.07 ± 0.25**</td>
<td>3</td>
<td>0.20 ± 0.41</td>
</tr>
<tr>
<td>El-Nigala</td>
<td>4</td>
<td>0.27 ± 0.45</td>
<td>5</td>
<td>0.33 ± 0.61</td>
<td>11</td>
<td>0.73 ± 0.88</td>
<td>24</td>
<td>1.60 ± 1.12</td>
<td>38</td>
<td>2.53 ± 0.91</td>
<td>15</td>
<td>1.00 ± 0.75</td>
<td>15</td>
</tr>
<tr>
<td>Barrani</td>
<td>9</td>
<td>0.60 ± 0.73</td>
<td>13</td>
<td>0.87 ± 0.83</td>
<td>22</td>
<td>1.47 ± 1.06</td>
<td>35</td>
<td>2.33 ± 1.71</td>
<td>42</td>
<td>2.80 ± 1.14</td>
<td>46</td>
<td>3.07 ± 0.88</td>
<td>55</td>
</tr>
<tr>
<td>Mean catch/ month</td>
<td>3.50</td>
<td>4.76</td>
<td>6.58</td>
<td>11.90</td>
<td>19.33</td>
<td>14.71</td>
<td>16.95</td>
<td>13.59</td>
<td>6.30</td>
<td>1.96</td>
<td>0.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean catch/ trap</td>
<td>0.42g</td>
<td>0.57e</td>
<td>0.78a</td>
<td>1.42d</td>
<td>2.30a</td>
<td>1.75bc</td>
<td>2.02e</td>
<td>1.62cd</td>
<td>0.75a</td>
<td>0.23gh</td>
<td>0.05h</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*: data represents the monthly catch **: data represents the mean ± SD.

Table 2: Efficacy of fig fruit traps in the mass capturing of adult stages of fig tree borer, Trichoferous griseus, under the Egyptian NWC conditions (2015/2016 season).

**Figure 2**: Mean catch per trap at the investigated sites.

**Figure 3**: Mean catch per trap at the inspected months.
As different types of traps are dedicated for insect borer studies Amitava et al. [17] and Serdar and Peyman [21], the current data behaved similar trend with highlighting on the possibility of using such trap model as an effective IPM component through attracting T. griseus adults and consequently participating in the breaking of its life cycle. Moreover, this mass trapping technique is of fully sustainable with positive impact over the environmental habitat management [22,23].

Rain-fed agriculture at the Egyptian Northwestern Coast characterizes by scattered patterns of fig orchards with large bare areas between each neighboring plantation. Such agriculture style could impede or minimize the continuous flow of the borer adult stages among fig plantations, i.e., these abandoned areas may act as physical barriers for longicorn beetle migration. Accordingly, under this situation trapped beetles will not be compensated or replaced by others from the adjacent orchards. This argument could underpin the suggested hypothesis that mention to the possibility of employing this mass trapping technique as an effective tool in the IPM programs dedicated for fig longicorn beetle.

The point that drawn the attention was the significant variation in the number of captured beetles among the different study sites. The practices that implemented by the farmers may be the interpretation key. Marsa Matrouh site is located at the flood stream, which means that fig trees have adequate humidity that may adversely affect the larval growth of the borer Hanks et al. [3]. Furthermore, during the annual plant cares that include appropriate winter sanitary pruning of the infested branches, the farmers burned the pruned branches and applied prevention (sulphur dusting or copper oxo-chloride spraying) treatment at the injured spots. Comparable situation was noticed at El-Nigala with an exception that the farm workers didn’t apply the prevention practice after pruning, which may be the reason for the observed higher borer catch in the farm. At the remainder sites, installed fig fruit traps showed higher borer capture than the former sites. As Ras El-Hekma and Barrani sites are far-away from the flood stream, their fig trees are under water shortage stress that may act as good habitat for the larval stage of the borer. Also, this drought conditions especially during the hot summer season are coincided with the flight activity period of the adult borer stages Hanks et al. [3]. In this concern, Larsen mentioned the use of live traps, traps baited with attractive attractant. The current data also illustrated the flight activity of the intended borer that exhibited its peak during the summer season (June till September). Similar pattern of Monochamus galloprovincialis (Coleoptera, Cerambycidae) flight activity was noticed by Pedro et al.

During the course of this study, there are some practical points that should be highlighted to serve as a technical IPM guideline against this pest under the rain-fed agriculture. First of all, although borer adult capture technique is an effective tool in hindering the borer counts in the farm, it doesn’t reflect a real infestation percentage. But the role of mass capture can by maximized through involving this tool in a good designed IPM program.

Other important issue was the capability of this tool to monitor the flight scenario of T. griseus borer under Matrouh rain-fed conditions. This finding could be exploited not only as an actual guide for the commencement of the IPM program but also to detect the suitable time of the proposed interventions that meet the targeted stages.

The core concept is to prevent or at least diminish the new infestation through implementing effective practices for killing or
keeping the adult borer females away from the trees and consequently decrease the chance of egg deposition. Also, as adult flight period is correlated with egg deposition so ovicidal treatment(s) should be applied in synchronization with the flight period to affect the laid eggs. Other effective treatments are to target *T. griseus* larval stage through trunk injection process and apply, if possible, supplemental irrigation for the purpose of rising up the internal humidity of the tree trunks to a level that could hindering the larval growth. Such suggested points need further studies. Finally, it is of an urgently important to state that IPM program of this Cerambycid beetle is a long-term program that needs more patience and studies to attain acceptable results.

**Conclusion**

This study highlights the possible use of mass trapping to manage the population and damages of *Trichoferus griseus* on fig orchards in dry lands. We stress the need to investigate the efficacy of McPhtail traps prepared and serviced on site by local growers using otherwise wasted plastic and non-tradable and discarded fig fruits and avoiding the use of any insecticide formulate. The background or our proposal lies on the respect for a delicate ecosystem and the search for equilibrate, sounded and sustainable pest control action. Starting from this first approach we need to design series of studies to tune and improve crucial trap use details as: placement, elevation, numbers per tree/ha, orientation and more. Our target is the opportunity to enrol the proposed trapping technique as a principal component for *Trichoferus griseus* IPM in fig orchards.

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**References**