

## Phytosanitary state of Plant citrus in irrigated area of the lower Moulouya (Morroco Oriental)

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### Abstract

In the Moulouya irrigated perimeter, citri-culture is one of the key sectors of the economy of the region. It is the main producing area in scope and ranks third nationally after the Gharb and Souss. Indeed, this is an important source of foreign currency because it generates an average of 300 million dirhams, or 20% of the total value of crop production; However, citrus plantations are likely to be attacked by many pests which cause massive damage especially to young citrus plantations. The survey conducted in the area is meant to collect information from citrus growers on crop production plant equipment and the most predating pests encountered in the farms..

**Keywords :**Citrus, pests of citrus, crop production, irrigated the lower Moulouya;

### 1. Introduction

The citrus farming sector holds an important place in the Moroccan economy. With an acreage 81500ha, it offers an average production of about 1.3 million tonnes per year. Exports are an important source of currency. 2.5 to 3 billion dh per year. In social terms, the sector is the main source of income for farmers as it provides, directly and indirectly, nearly 21 million days of work affecting 13,000 families (Anonyme, 2008).

The irrigated perimeter of Moulouya alone in the north-eastern Morocco, covers an of 16441ha, of citrus trees. Indeed, it creates nearly two million work-days annually. It is also a source of a gross annual income equivalent to 20% of a total income from irrigated crop production (about 300 million dirhams). Citrus production is estimated to be closer to 87% in the Province of Berkane. Indeed, there are about 11 varieties, dominated by two main ones: the Clementines of Berkane (Cadoux) and the Navel, which together account for 95% of the total production, against 5% for other new varieties (Anonyme, 2008).

Despite the crucial role of this sector, it has for some years, faced several constraints curving its development and production both quantitatively as well as qualitatively. Among these problems, we can state, in the first place, the phytosanitary problems, (therme reserved to aquatic which is related to damage caused by different

pests. The Mediterranean fruit fly or medfly *Ceratitis capitata* (Wiedemann, 1824) (*Name and date of first descriptor*) (Diptera) is another case, which is mostly a source of direct damage to many species and varieties of citrus. Some species of aphids can cause direct damage to citrus crops, but the major risk is constituted by the ability of some species (especially *Aphis gossypii* Glover, 1877 (*Name and date of first descriptor*) ) to transmit the *tristeza* virus. The Coccidae are important pests, including a number of species such as the Diaspinae but also some Lecanidae and Pseudococcinae. The appearance of the citrus leafminer, *Phyllocnistis citrella* Stainton,1856 (*Name and date of first descriptor*) (Lepidoptera) in many Mediterranean countries during the first half of the 1990s has led many studies on methods of chemical or biological control allowing to adapt previously established programs. These have generally contributed to a marked improvement in the situation and a limitation of the damage caused by the leafminer. In addition, various Acari Tetranychidae mites (*Tetranychus urticae*, *Panonychus citri*) and Eriophyidae (*Phyllocoptes oleivora*, *Aceria sheldoni*) are regular pests whose control Often requires occasional use of mineral oil or specific Acaridae

### 2. Materials and Methods

To determine the phytosanitary status of citrus in the lower Moulouya, we chose to proceed with an

investigation of a sample of 5,173 ha, equivalent to 37% of the total area of citrus of the perimeter. 54 farmers and landowners have been subjected to this study. The period of our investigation has extended between March and May, that is to say during the spring, period which is the right time for such a study given that the majority of pests attacking citrus appear at that time.

### 2.1. Field of investigation

Study site: Our study has been carried out in the irrigated perimeter of the lower Moulouya (Fig1), for the following reasons:

- The high agricultural potential that this perimeter offers;
- The great diversity of the cultures;
- The large number of farmers.

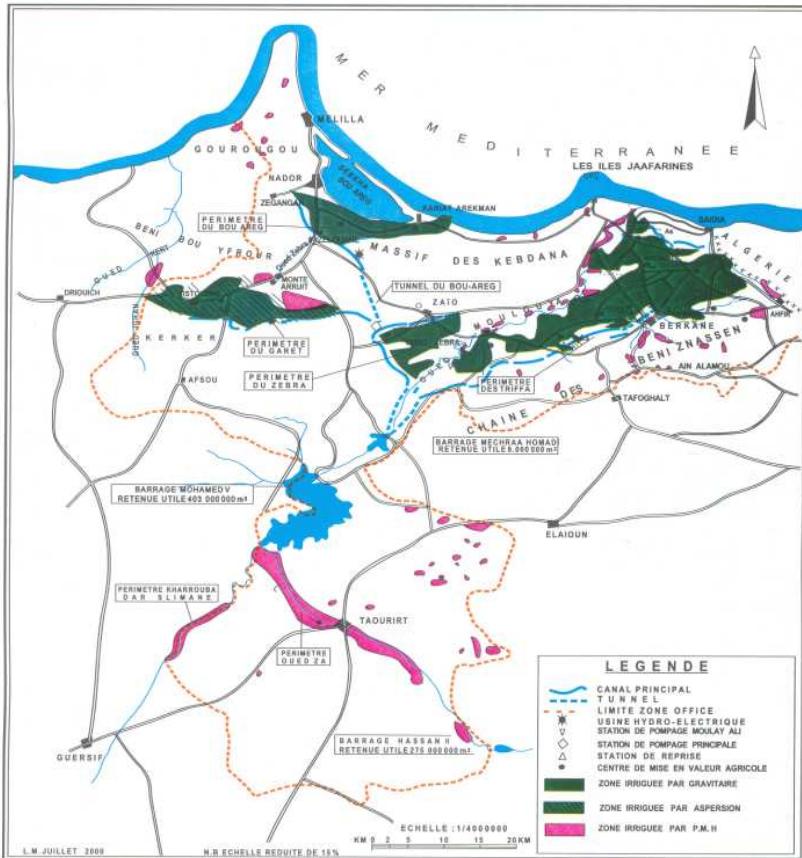


Fig 1. Irrigated area of the lower Moulouya (ORMVAM 2006).

We have opted to conduct this study with the assistance of technicians and farmers to gather information concerning: crop production, plant equipment, the inventory of the enemies of citrus. For this reason, a survey-form has been prepared and submitted to the farmers selected for this study.

### 2.2. Location of properties in the perimeter

Over 50% of the farms studied are located at Slimaniya Berkane, Jaara Zaist, Cafémour, Ragada, Bouchakour etc. ... 24% of properties are located in Aklim, 11% in Madagh, 5% in EL Atamna, the 7% remaining are distributed between Taourirt, Naima, Chouihiya, Saidia and Ain Zebda. The location of farms studied and the number of properties are summarized in Table 1.

Table 1  
Distribution of properties at the perimeter

Location	Number of farms
Madagh	6
Berkane (Slimaniya, Jaara, Cafémour, Ragada, Zaist, Bouchakour)	29
Aklim	13
Naima	1
Taourirt	1
Ain zebda	1
Chouihiya	1
Saidia	3
El atamna	1

## 3. Results and discussion

### 3.1. Agricultural areas

From the graphical presentation (Fig2), we can subdivide agricultural areas into three categories:

- Category 1: de 5 à 25 ha
- Category 2: de 25 à 100 ha
- Category 3: > à 100 ha

Of the 54 farmers surveyed, 70% are part of the first category, 16% of farmers are included in the second, while the class 3 (> 100 ha), represents only 13% of total

farms including two cooperatives (EL and EL IZDIHAR Wahda), SOFAK TAJ agricultural and Pro-agor domain.

### 3.2. Crops

Crop production in the Moulouya perimeter is varied and diversified. It mainly includes: Fruit, vegetables and

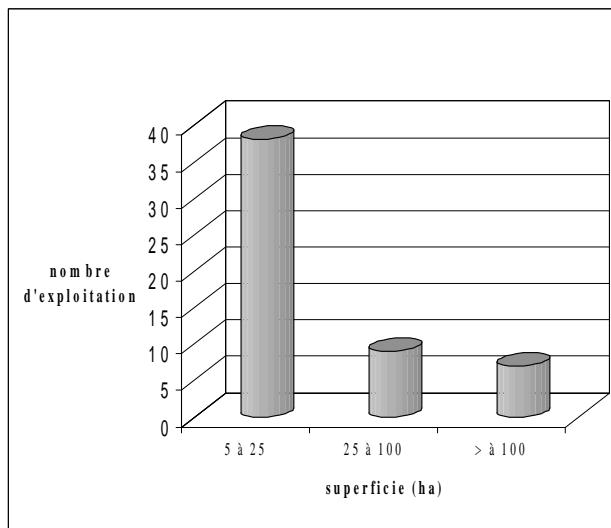


Fig 2: Distribution of agricultural land in orchards studied at the perimeter.

The majority of farmers are engaged in the culture of crops requiring intensive phytosanitary treatments as the case may be among others with potatoes, citrus and grapes. These indeed, require adequate equipment to deal with all phytosanitary problems (fungal diseases, insect attack, physiological disorders ...). The sprayer, remains the primary material used and the most ranging capacity which varies from 1500 l to 2000 l. This material is provided with one or two sticks supplied with a manometer essential for controlling the operation and adjusting the sprayer by indicating the pressure. 96% of the farmers surveyed have their own equipment, only two farmers, carry out service delivery.

### 3.3. Inventorying citrus predators

The citrus is subject to attacks of various predators; almost all citrus growers suffer the same pests in their farms. During the investigation it was found that the most serious pests are mainly: mealybugs (especially the Californian flea), the fruit fly, mites and leaf-miners. Other pests (the white fly, moth, and worm of the umbilicus) are negligible in terms of severity of the attack;

The attacks are scaled in the graph (Fig 4). They show that insects seem most important with 50%, followed by the fruit fly 20%, other pests (aphids, mites and leaf

industrial cereals. The majority of the surveyed farmers are exporting producers of citrus, especially the seedless Clementine. Over 50% of them engage exclusively in growing citrus fruit, 22% engage in cultures of citrus in addition to potatoes, 17% grow citrus fruits and vines, while 10% engage in other cultures in parallel (Fig 3).

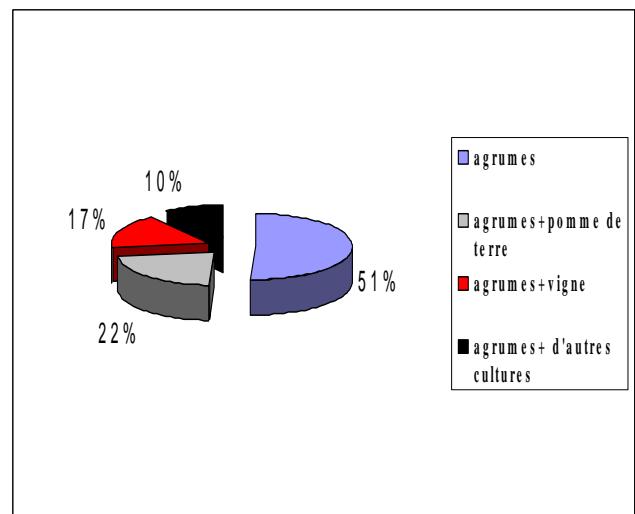


Fig 3: different crops at the perimeter Moulouya (campaign 2012).

miners) have almost similar proportions. The pressure of these pests include the fruit fly and the Californian flea. It is a major challenge for citrus growers, especially exporters. The great concern for producers is to obtain exportable fruit, which responds to quality of international standards measured at packing stations.

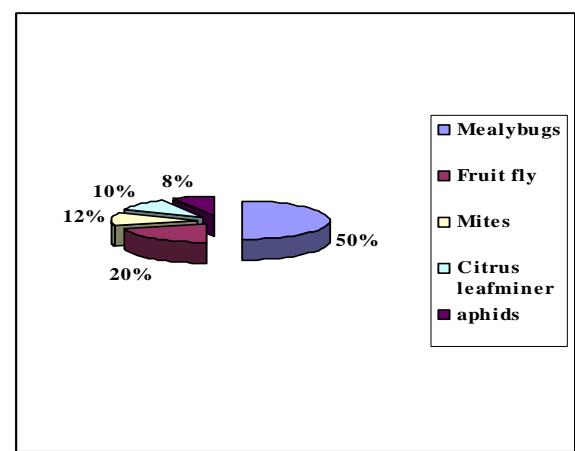


Fig 4: Major pests of citrus orchards level (campaign 2012).

**- Mealybugs:** Mealybugs are among the most serious pests of citrus because of their prodigious ease of propagation. They are mostly oviparous species but there are ovoviparous (the eggs are already fertilized), and

viviparous species (I. Foldi, 2003). The main species of the insects found in the citrus farms are: The California red scale (*Aonidiella aurantii*), (Fig 5). The citrus mussel scale (*Lepidosaphes beckii*) (Fig 6). Long mussel scale (*Lepidosaphes gloverii*). However, the California red scale remains the most destructive pest; the pest is not specific to citrus, it has several host plants: pear, olive, rose, acacia, fig, castor (Devaux, 1977; Delucchi, 1964; Parlauran 1971 ).

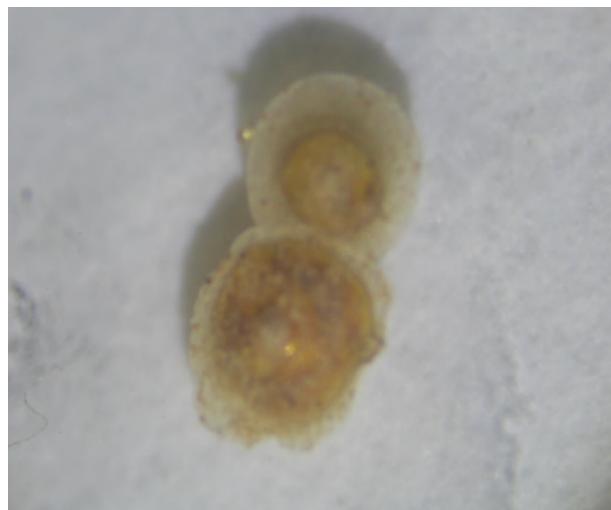


Fig 5: A: Male California red scale *Aonidiella aurantii* (x16), B: Female California red scale *Aonidiella aurantii* (x14).



Fig 6 : The citrus mussel scale (*Lepidosaphes beckii*) (x10).

**The fruit fly:** Fruit flies (Diptera: Tephritidae) are amongst the largest families of Diptera. In 1994, White and Elson-Harris listed 4000 species arranged into 500 types. The Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae), is one of the world's most damaging fruit pest (White and Elson, 2004) and may be the most predating pest of citrus (Talhouk, 1975; Garrido and Ventura, 1993). Among the polyphagous fruit flies, present in different regions of the world, only the Mediterranean fruit fly *Ceratitis capitata* known among farmers by the name "al Doubabate fawakih" exists in the Mediterranean region (Fimiani, 1989). It is of paramount importance since it affects more than 250 marketable fruit plants, (Fimiani, 1989) or more than 350 plants (Liquido et al, 1991). She lives fruits of many plants such as citrus, peach, pear, apple, apricot, fig, plum, quince, grape, cherry (sweet cherries), pomegranate (*Punica*), strawberry, etc.. The fruit fly causes enormous damage to citrus fruit production; it affects the fruit by depreciating its quality required for exportation. (Mazih, 1992). "The fruit fly is an obstacle in front of Morocco's exports to countries that are very important, such as Japan and the United States of America, which impose very strict measures prior to the opening of their markets for citrus and tomato from Morocco (quarantine measure residue levels)".

**Aphids:** Aphids (Fig 7) (Homoptera: Aphididae: Aphidinae) are among the most abundant and destructive pests for agriculture, particularly in temperate regions, causing direct damage to arable and horticultural crops as well as serving as vectors for many important plant diseases (e.g., Basky and Nasser, 1989; Ng and Perry, 2004; Robert et al., 2000; Woodford et al., 1995).

In the Moulouya perimeter, the main aphid species on citrus are met:-The black aphid of the orange (*Toxoptera aurantii*), the orange aphid (*Aphis spiraecola*), the cotton aphid (*Aphis gossypii*) and the green peach aphid (*Myzus persicae*).



Fig 7: Different aphid species of the family Aphididae.



Fig 8: Damages caused by *P.citrella* in orange leaves.

**-Citrus leafminer:** The citrus leafminer (CLM), *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae) is a citrus pest native to southeastern Asia. It has spread to most citrus growing areas in the Mediterranean and the Americas during the last decade of the 20th century (Urbaneja et al., 2000). Studies carried out between 1996 and 1999 showed that in Mediterranean areas, CLM damaged only 5–15% of the annual new-leaf area of mature trees and therefore yield was not affected by the pest (Garcia-Mari et al., 2002). In Morocco, it is in the beginning of September 1994 that the first outbreaks of the leafminer were located in regions of eastern and northern areas of Larache (Abbasi et al 1995). The pest, then, extended in a surprising manner to other citrus-growing areas and in early summer 1995, almost all

regions were invaded. Since its appearance in the area of Moulouya around 1994, this pest attacked only the young plantation, young twigs (Fig 8) and sometimes fruit. Temperature is the factor determining the onset and outbreak of the leafminer,

**-Mites:** Several species of mites are recognized on citrus fruits and the most important are: European red mites: In fruit farming red spider mite *Panonychus citri*, is considered by most authors as specific to citrus (Benfatto and Lanza, 1980). It is most frequently found on lemon, orange, mandarin and grapefruit (Tuttle, Baker, 1968 AND Benfatto, 1982). The spider mite *Tetranychus urticae*; extremely polyphagous and be hosted by a variety of 200 plants: wild plants, vegetable plants, flowers, fruit species. It is particularly feared on the vine,

beans, cucumber, crops, cotton, clover, sunflower and fruit trees. According to Tessier (1985), spontaneous plants play an important role in the contamination of crops. Mites thrive in colonies generally favored by high temperatures and low humidity. Without control measures, outbreaks occur in spring and summer periods on field crops but for those under cover and dry atmosphere, almost round the year. In the farms studied, *Panonychus citri* is the dominant species. According SASMA (1992), this species was first detected in 1989 in the Berkane area, causing considerable damage in the region. Indeed mite damage results in impaired physiological processes and reduced growth of plant organs. The surface of infested leaves is reduced (Fig. 9). This probably results in a decrease in their growth rate or simply the number of leaves per plant (Avery 1962, Avery and Brigs, 1968a; Summers and Stocking, 1972): the number of flowers decreases, the diameter is reduced and the stem is shortened (Jestior, 1978a, 1978b).



Fig 9: Damages caused by mites in orange leaves.

#### 4. Conclusion

The citrus farming industry is in the lower Moulouya was and remains a mainstay of the regional economy. Its economic role is well established and should be given all necessary measures to preserve and develop it because it is a vital sector. The imperatives of food production now require to review agricultural practices including the adoption of more effective management of pests. Citrus fruit are concerned first by these imperatives.

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