

# Study on population dynamic of fruit fly species in the State of Ceará

## Estudo da dinâmica populacional de espécies de moscas das frutas no Estado do Ceará

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### ABSTRACT

Field and lab studies were undertaken aiming at surveying and monitoring fruit flies, genus *Anastrepha* and the species *Ceratitidis capitata* (Wied.), with emphasis on their population dynamics. The study involved six counties in the State of Ceará Brazil located at the zone called "Median Jaguaribe River Valley" between 5° and 7° southern latitude and 46° and 47° western longitude. It was used a highly accurate system for detection and monitoring of fruit fly pests. This system was composed by pheromone traps (McPhail and Jackson traps) baited with food attractants based on hydrolyzed protein and the pheromone TrimedLure. It was observed that the increasing acreage and host diversity of edible fruits highly preferable by fruit flies, especially *C. capitata* constitutes a threat to development of fruit production for export in these counties. The population of *C. capitata* and *Anastrepha* increases with the raining season. The Fly Trap Day (FTD) index in 2001 was 7 times higher than in the year 2000. Most fruit fly catches were from fruit orchards and urban areas rather than in melon fields. The hydrolyzed protein in McPhail traps played an important role in the capture of fruit flies. A problem is the amount of other insects attracted and captured in these traps, and also they are cumbersome to deploy.

**Index terms:** McPhail trap, *Ceratitidis capitata*, *Anastrepha* spp., hydrolyzed protein, TrimedLure, Fly Trap Day (FTD).

### RESUMO

Estudos em campo e laboratório foram desenvolvidos com o objetivo de levantar e monitorar moscas de frutas do gênero *Anastrepha* e da espécie *Ceratitidis capitata* (Wied.) com ênfase na sua dinâmica populacional. Este trabalho envolveu seis municípios no Estado do Ceará, localizados na região do Médio Jaguaribe entre 5° e 7° de latitude sul e 46° e 47° de longitude oeste. Foi usado um sistema altamente sensível para a detecção e monitoramento de moscas das frutas. Para tanto, foram usadas armadilhas dos tipos McPhail e Jackson com iscas atrativas à base de proteína hidrolizada e do paraferomônio TrimedLure. Observou-se que o aumento da área de fruteiras, hospedeiras importantes de moscas das frutas, principalmente a espécie *C. capitata*, constitui uma ameaça ao estabelecimento da área para produção de frutas para exportação. As populações de moscas das frutas aumentam durante o período chuvoso. O índice, Mosca Armadilha Dias (MAD), em 2001, foi sete vezes maior que o observado em 2000. O maior número de moscas capturadas foi oriundo de pomares de fruteiras e da área urbana e não de campos de melão. A proteína hidrolizada em armadilhas McPhail é muito importante na captura de moscas das frutas. O problema é o grande número de outros insetos atraídos e capturados e a dificuldade de manuseio.

**Termos para indexação:** Armadilhas McPhail, *Ceratitidis capitata*, *Anastrepha* spp., proteína hidrolizada, TrimedLure, Mosca Armadilha Dia (MAD).

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## Introduction

Among tephritid fruit flies, some species of the genus *Anastrepha* and the species *Ceratitis capitata* (Wied.) have been considered pests of quarantine importance for many countries. The genus *Anastrepha*, family Tephritidae, has been recognized as an economically important type of fruit fly, which infests over 100 plant species from northern to southern Brazil (Malavasi et al., 1980; Zucchi, 2000). Some important species such as *A. fraterculus* (Wiedemann), *A. obliqua* (Macquart), *A. sorocula* Zucchi (1979) and *A. grandis* are highly destructive pests of tropical and temperate fruits (Braga Sobrinho et al., 1999a; 1999b). The species *A. grandis* is easily distinguished from the others by its larger size. The others require a detail examination of the ovipositor morphology for an accurate identification (Steck, 1991; Zucchi, 1979).

The most recent catalogue of the *Anastrepha* sp. was published by Zucchi (1988), in which 77 species were listed. In the last twenty years only 17 *Anastrepha* new species were found in Brazil. From 92 *Anastrepha* species in Brazil, hosts have been recognized only for 41 species. Only one host has been recognized for 21 species of *Anastrepha*. The genus *Anastrepha* is most polyphagous species in Brazil with 58 species of host plants. The species *A. obliqua* is associated with 23 host species. However, *A. grandis* has been found only on hosts of the family Cucurbitaceae (Zucchi, 2000).

The Mediterranean fruit fly, *Ceratitis capitata* (Wied.) (Diptera:Tephritidae) is one of the most serious fruit pests in the world, infesting more than three hundred plant species (Liquidó et al., 1991). Several studies on population dynamic of *C. capitata* have been conducted in the tropics (Zucchi, 1988; Harris et al., 1993; Souza and Nascimento, 1999).

The northeastern part of the state of Ceará Brazil, situated in the zone called "Median Jaguaribe River Valley", located between 5° and 7° southern latitude and 46° and 47° western longitude, has become a melon and fruit producing zone. The objective of this work was to monitor, to detect and to study the population dynamic of Tephritidae, based on international standard protocols regarding its population dynamic.

## Materials and Methods

Surveying and monitoring studies in commercial fruit producing areas were undertaken from August 2000 to December 2001 involving six counties in the State of Ceará Brazil, located at the zone called "Median Jaguaribe River Valley", between 5° and 7° southern latitude and 46° and 47° western longitude. The counties involved were Aracati (1,276.0 km<sup>2</sup>), Icapuí (429.4 km<sup>2</sup>), Itaiçaba (240.2 km<sup>2</sup>), Jaguaruana (771.0 km<sup>2</sup>), Quixeré (746.4 km<sup>2</sup>) and Limoeiro do Norte (600.8 km<sup>2</sup>), with a total area of 4,063.8 km<sup>2</sup>.

In order to facilitate operational working, the area of the six counties was divided in two sectors based on methodology established by IPLANCE (State of Ceará Planning Institute). Sector A included the first three counties and Sector B with the other three.

In this study was used a highly accurate system for monitoring and detection fruit fly pests. This system was composed by pheromone traps (McPhail and Jackson traps) baited with food attractants and lures. The pheromone for Jackson trap was a polymeric dispenser containing 2.0 mg of TrimedLure. The food attractant for McPhail trap was hydrolyzed protein, (600 ml in each trap) at 5.0% with 3.0% of borax. In each Jackson trap was inserted a sticky carton panel to keep insect glued. Every week traps were inspected and the carton replaced. Every four weeks the pheromone dispenser was replaced. The hydrolyzed protein was replaced every week and the insects were collected and taken to laboratory for counting and identification.

Traps were installed in fruit areas like small orchards, backyards, and in strategic points like cross roads, packing houses of the above counties. In melon fields traps were placed under small wood hut at 50 centimeters above the soil level. In other places, traps were hung in the two third of fruit fly host trees. The McPhail trap density was one trap for each five hectares of melon. In fruit producing areas, one McPhail traps for each two square kilometers. In urban areas, one McPhail and one Jackson trap for each square kilometer. During the working period over fifty Jackson and thirteen hundred McPhail traps were placed in the two sectors.

Flytrap per day (FTD) is the population index that was used to estimate the average number of flies

captured in one trap in one day. Climatic data was recorded in strategic points in the working areas. Fruits were systematically collected and taken to laboratory for adult emergence. Adults collected from traps were taken to laboratory for sex separation and species identification.

## Results and Discussion

From August 2000 to December 2001, a total of 1,406 traps (1,334 McPhail and 72 Jackson) were installed in melon and fruit producing areas of the two sectors (A, B) of the six counties in the State of Ceará, Brazil. From that trap total, 54% of traps were placed in fruit trees and the remaining 46% were placed in melon fields. These traps captured during the period 1,689 adults of *Anastrepha* sp. and 14,790 *C. capitata*. The mean number of Medfly captured in 2001 was about ten times higher than in 2000 (Table 1).

**Table 1** -Yearly averages and total captures of *C. capitata* and *Anastrepha* sp. per county during years 2000 and 2001 in the Jaguaribe Valley State of Ceará, Brazil.

County	2000			2001		
	Monthly average			Monthly average		
	<i>Ceratitis</i>	<i>Anastrepha</i>	Total	<i>Ceratitis</i>	<i>Anastrepha</i>	Total
Icapuí	0.0	0.0	0.0	54.6	5.6	621.1
Itaíba	0.0	0.0	0.0	16.2	13.8	68.4
Aracati	0.4	0.0	0.4	615.5	15.3	31.5
Quixeré	98.4	140.2	238.6	228.0	21.7	249.7
L. do Norte	12.8	0.2	13.0	189.3	16.3	93.6
Jaguaruana	6.8	0.0	6.8	77.3	10.2	199.5
Total	118.4	140.4	258.8	1,180.9	82.9	1,263.8

This explains the progressive population increasing of *C. capitata* in this fruit producing counties. The

highest catches of Medfly in Icapuí is due to the proximity of Mossoró county in the State Rio Grande do Norte where the population of Medfly has been very high due to large acreage of Barbados' cherry. From that total of capture of *Anastrepha* and *C. capitata* adults, 88.8% came from traps placed in other crops and 11.2% in melon fields, respectively (Table 2). In the sector A monitored melon area reached 1,637 hectares involving 13 melon production districts. In the sector B monitored melon area reached 1,261 hectares involving 15 melon producing districts.

In 2000 the counties Icapuí and Itaíba presented zero capture of fruit flies. In that year the number of traps place in crops other than melon was very low. It was observed that the capture is higher in traps placed in fruit trees outside of the melon field. For this reason in the year 2001, the proportion of traps placed in melon fields was much lower.

Climatic conditions in the whole study area presented little variation with average maximum and minimum temperatures of 32.8°C and 22.5°C, respectively. Relative humidity presented an average maximum and minimum of 95.4% to 47.7%, respectively. The raining season is quite concentrated and uniform. It usually starts in January goes up to May with an average annual precipitation less than 600 mm. During the raining season most of growers do not produce melon due to damage by rain itself and because high humidity causes high incidence of diseases.

The number of Medflies captured in Aracati, Quixeré and Limoeiro do Norte (sector A) was very high, especially during the rain

**Table 2** - Trap installed in other fruit crops and in melon fields, fruit fly captures and flytrap day index (FTD) during 2000 and 2001 in the Jaguaribe Valley State of Ceará, Brazil.

Year	Trap placement				Yearly fruit fly captures				FTD
	No. Traps								
	Other crops		Melon		<i>Anastreph</i>		<i>Ceratitis cc</i>		
McPhail	Jackson	McPhail	Jackson						
2000	17	11	228	0.0	2	700	120	492	0.2295
2001	671	61	418	0.0	591	405	13,939	239	1.6532

season, from January to June. Spot areas of guava, Barbados cherry and Spondias are spread out in these three counties. Traps placed in these hosts have shown very high captures of *C. capitata* that are significantly higher when is compared to the amount captured of *Anastrepha*. The predominance of capture of Medfly in 2001 was in traps placed in other crops rather than in melon fields. In March and June there were the highest captures of Medfly that coincided with the raining period.

The concentration of capture of *Anastrepha* followed almost the same distribution for Medfly, i.e., it coincided with the raining period. Again, Aracati, Quixeré and Limoeiro do Norte presented the highest captures. The fly trap day (FTD) indices were 0.22 and 1.65 for the years 2000 and 2001, respectively.

## Conclusions

- The population of Medfly in this region has been increasing since the last ten years due to the increasing acreage of host fruits like Barbados' cherry and guava. Even though Indian almond is a highly preferable host for Medfly the distribution of this host in the counties is very little and its presence as a shade plant in streets and villages is very scarce.
- The increasing acreage and host diversity of edible fruits highly preferable by fruit flies, especially Medfly, without any population reduction measure, constitutes a threat to development of fruit production for export in these counties.
- The population of Medfly and *Anastrepha* increases with the raining season.
- The Fly Trap Day (FTD) in 2001 was 7 times higher than in the year 2000.
- Most Medfly catches were from fruit orchards and urban areas rather than in melon fields.
- The hydrolyzed protein and the Brazilian McPhail trap have played an important role in the capture of fruit flies. A problem is the amount of other insects attracted and captured in these traps, and they are also cumbersome to deploy.

## Acknowledgments

Fund for this research was provided in part by the Northeast Bank (BN). We thank Ms. Ana Carina Fernandes Ometto and Mr. Carlos Teixeira Braga for helping field data collect.

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