

# THE EVOLUTION OF THE JAPANESE BEETLE (*POPILLIA JAPONICA* NEWMAN - COLEOPTERA: SCARABAEIDAE) ON TERCEIRA ISLAND, AZORES

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With 4 figures and 3 tables

**ABSTRACT.** The introduction of the Japanese beetle in 1970, on Terceira Island made necessary the implementation of a net traps to survey the spread of this pest, allowing the study of the adults population evolution in real time conditions.

In this work the evolution of the pest in eight different locations during three years is presented.

The analysis of the collected data reveals the great variation in field captures amongst the different years of the study. Movements of the pest to new areas were detected and the traps' net proved to be a good tool to indicated the pest situation on Terceira Island in real time conditions.

## INTRODUCTION

The Japanese beetle (*Popillia japonica* Newman - Coleoptera: Scarabaeidae) was found in Terceira Island in the beginning of the 70's (GUIMARÃES, 1972). Since the insect was declared a quarantine pest several measures were implemented in order to isolate and eradicate this new organism from Terceira.

Unfortunately, the survey of it's populations with traps began only three years after the first identification of the insect on the island. These traps were Ellisco<sup>R</sup> and allowed the definition in 1973 of the first limit of infestation, and the subsequent three limits, the last one established in 1985 (Fig.1).

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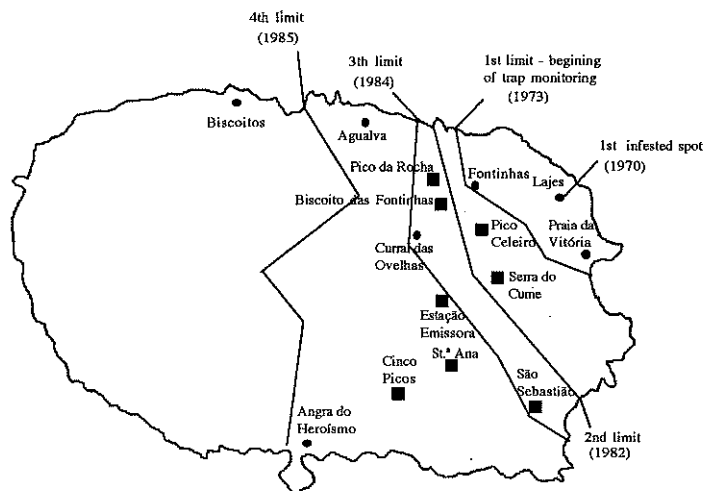


Figure 1 - Evolution of area occupied by Japanese beetle (*Popillia japonica*, Newman) on Terceira Island (LOPES, 1990).

The evolution of the Japanese beetle population was followed in all the island from 1989 until 1991, year when the Agricultural Services take over the job. But since 1987 the evolution of Japanese beetle captures were followed in a crescent number of selected locations, finishing with eight places, in the most populated areas using Ellisco<sup>R</sup> traps with a floral attractive and a pheromone.

## MATERIAL AND METHODS

This work was developed by the Plant Protection Section, Department of Agricultural Sciences of the Azores University, during the last four years (from 1990 to 1993) in eight of the most infested areas of Terceira Island: Cinco Picos (LX), St. Ana (SA), São Sebastião (SS), Serra do Cume (SC), Estação Emissora (EE), Pico Celeiro (PC), Biscoito das Fontinhas (BF) and Pico da Rocha (PR) (Fig. 1).

In each location four Ellisco<sup>R</sup> traps were used with their colour attraction reinforced by floral (PEP+ Eugenol / 3:7) and sexual (Japonilure) lures.

The traps were placed in the field from the beginning of June to the middle of September covering the period of emergence and appearance of the adults on Terceira Island.

Insects captured by these traps were collected every three days (two times per week) during all the study period.

## DISCUSSION

Total captures for each location obtained during the study period are presented in Fig. 2 and Table 1 while daily average captures for each location, are presented in Fig. 3 and Table 2.

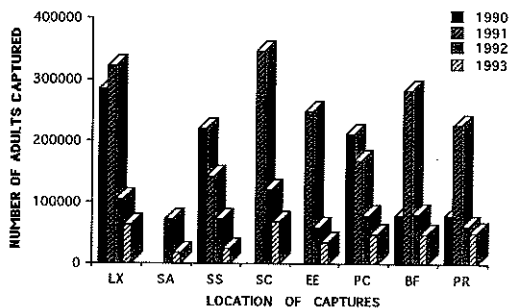


Figure 2 - Total captures during the four years of the study in the eight locations.

In the year of 1991 two new locations were found with great densities of adults and as a consequence, with a high potential for dispersion, justifying their inclusion in the study areas as new places, Serra do Cume (SC) and Estação Emissora (EE) (LOPES, 1991a). The amount of Japanese beetle captured in 1991 at Serra do Cume (SC) was, indeed, the biggest captured performed during all the study period (346.424) (Table 1). In 1992 a new location (St. Ana) between the two others (Cinco Picos e São Sebastião) was included in our study for the same reason.

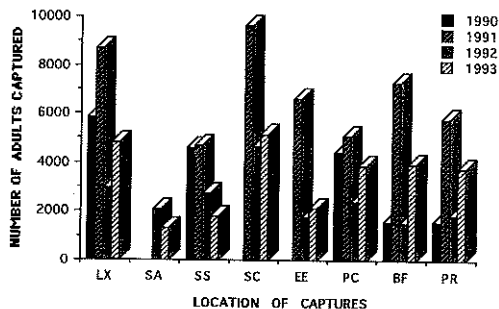


Figure 3 - Daily mean of captures for the four years of the study in the eight locations

In 1990 the greatest number of captures was registered in two locations between the second and third limits of infestation (Fig.1) pointing out the appearance of a new focus in Cinco Picos (LX), where captures reached almost 300.000 adults but in two other places of study, Pico Celeiro (PC) and São Sebastião (SS) the captures through out the season reached more than 200.000 adults (Table 1).

Furthermore, it deserves mention the fact of total and daily captures being at least three times bigger in the most recent focus (LX, PC and SS) than in older infested areas (BF and PR) (Table 1 and 2) showing the movement of the pest to southern areas (Fig. 1).

**TABLE 1** - Number of total captures in the eight locations during the four years of this study

Year LOCATION	1990	1991	1992	1993**
LX	285818	322168	103940	62684
SA	*	*	72284	16899
SS	219877	141187	70851	49241
SC	*	346400	120582	23161
EE	*	248403	59136	20427
PC	211757	167590	79031	33111
BF	77416	283481	79477	47052
PR	77334	226419	61677	46667

\* - locations without traps

\*\* - collected until the 16 of September

**TABLE 2** - The daily mean of the captures in the eight locations during the four years of the study

Year LOCATION	1990	1991	1992	1993**
LX	5833.0	8707.2	2969.7	4819,5
SA	*	*	2065.3	1299.9
SS	4580.8	4706.2	2725.0	1795,1
SC	*	9622.2	4637.8	5124,1
EE	*	6536.9	1739.3	2118,6
PC	4411.0	5078.5	2394.9	3898,7
BF	1580,0	7268.7	1546.2	3925,3
PR	1578,0	5805.6	1869.0	3796,8

\* - locations without traps

\*\* - collected until the 16 of September

The year of 1991 presented good climatic conditions to the registration of large numbers of adults of this pest captured in three of the five locations already studied in the year before (Table 3).

An indicator of such good conditions was the increase in captures in two of the five places by 65.8% and 72.9% (Table 3).

However, in two locations (São Sebastião - SS and Pico Celeiro - PC) a negative variation in adult captures was recorded from 1990 to 1991. These places were among those areas intensively sprayed with aerial insecticide treatments during that year (1991) as an attempt to reduce the pest populations levels. On the contrary the two places mentioned above with high increases in captures (Biscoito das Fontinhas - BF and Pico da Rocha - PR) were located in areas submitted to low insecticide pressure during the same year (1991) (Table 3). But the results of the aerial spraying were not consistent with an increase of 11.3% in adult captures registered in Cinco Picos (LX) one of the areas with biggest insecticide pressure.

**TABLE 3** - Evolution of the total captures of Japanese beetle (*Popillia japonica* Newman) in the eight locations comparing the results of each year with the previous one.

YEAR LOCATION	1990/1991		1991/1992		1992/1993	
	LX	(+)36350	(+) 11.3%	(-)218228	(-)67.7%	(-)41286
SA	*	*	*	*	(-)55385	(-)76.6%
SS	(-)78690	(-) 35.8%	(-)70336	(-)49.8%	(-)47515	(-)67.0%
SC	*	*	(-)225818	(-)65.2%	(-)53908	(-)44.8%
EE	*	*	(-)189287	(-)76.2%	(-)25238	(-)42.7%
PC	(-) 44167	(-) 20.9%	(-)88559	(-)52.8%	(-)32347	(-)40.8%
BF	(+)206065	(+) 72.9%	(-)204004	(-)72.0%	(-)32374	(-)40.7%
PR	(+)149085	(+) 65.8%	(-)164742	(-)72.8%	(-)12319	(-)20.0%

\* - places without traps

From 1991 to the current year of 1993 a general pattern of pest population decrease was observed (Table 3), which can result from several different reasons. On one hand, based on a better knowledge of the real field situation insecticide treatments were performed only over black currants' plants located on the edges of the pastures, depending on the evolution of the captures in the traps (LOPES, 1992b).

## CONCLUSIONS

The analysis of the collected data reveals that exists a great variation in field captures between the different years for the same location (demonstrated by data from Pico Celeiro (PC) (Fig. 4)).

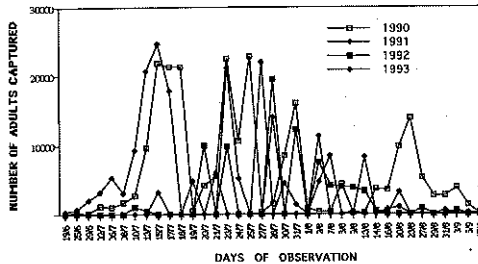


Figure 4 - Number of adults captured in the last four years on Pico Celeiro.

The appearance of Japanese beetle new focus was also demonstrated, showing the dissemination ability of the pest, in spite of the great insecticide pressure adopted for pest control, represented by positive population growth in areas with intensive treatments like Cinco Picos (LX).

While these limits of infestation must be carefully monitored, it seems also important continue the monitoring and control effort near the initial limits of infestation, such as Pico Celeiro (PC) (Fig.1), since those areas have been selected for biological control programs related with releases of parasitoids, entomopathogenic nematodes and fungi applications.

This work permitted a real knowledge of the field situation in Terceira Island posed by this pest, concerning the prediction of its appearance (LOPES, 1991b; 1992a). The methodology adopted also permits to define with precision the best time of intervention for Japanese beetle control by integration of several control measures such as the most convenient choice of insecticides with low secondary effects on beneficial insects, naturally occurring or released to fight the Japanese beetle.

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## REFERENCES

GUIMARÃES, J. M.:

1972. *Relatório sobre a prospecção da ocorrência e da expansão do escaravelho japonês na Ilha Terceira*. Dir. Geral Serv. Agríc. Rep. Serv. Fitopatol. Lisboa, 6 pp. (Ciclostilado).

LOPES, D. J. H.:

1990. O escaravelho japonês (*Popillia japonica* Newm.) na Ilha Terceira. *Agros*, 73 (1): 20-27.
- 1991a. *Relatório do progresso de trabalhos do Projecto de Investigação "Estudo do desenvolvimento do escaravelho japonês face aos parâmetros climáticos a que está sujeito na Ilha Terceira"*. Dept. Ciências Agrárias, Univ. dos Açores, Terra-chã, 12 pp. (Ciclostilado).
- 1991b. Previsão do aparecimento de adultos de escaravelho japonês (*Popillia japonica* Newman). *Actas II Jorn. Agrónom. Açoreanas*, Ponta Delgada, 15 pp. (em publicação).
- 1992a. *Relatório final do Projecto de Investigação "Estudo do desenvolvimento do escaravelho japonês face aos parâmetros climáticos a que está sujeito na Ilha Terceira"*. Dept. Ciências Agrárias, Univer. Açores, Terra-chã, 23 pp. (Ciclostilado).
- 1992b. *Contributo para o estudo do desenvolvimento do escaravelho japonês (Popillia japonica Newman: Coleoptera - Scarabaeidae) na ilha Terceira*. Dissert. Curso Mestrado Prot. Integrada, ISA, 272 pp.