

# **Population dynamics of *Corecoris dentiventris* Berg. 1884 (Hemiptera: Coreidae) at an experimental tobacco crop in Porto Alegre, RS – Brazil**

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Aceito para publicação em 09/4/2001

## **Resumo**

A dinâmica populacional de adultos de *Corecoris dentiventris* foi investigada em uma cultura experimental de fumo, localizada em Porto Alegre – RS, Brasil (30° 01'S 51° 13'W), através do método de marcação e recaptura. Foram plantadas 365 mudas de fumo do tipo Virgínia variedade K 326, em uma área de aproximadamente 300m<sup>2</sup>. Todas as plantas foram inspecionadas semanalmente durante o período de agosto/97 a fevereiro/98. Os indivíduos adultos foram capturados manualmente, marcados nos élitros com caneta de tinta permanente com base em um código de pontos e devolvidos à mesma planta. Para análise das estimativas populacionais foi utilizado o método de Fisher-Ford. Durante 45 ocasiões de amostragem foram marcados 273 adultos. A percentagem de recapturas foi extremamente alta, ficando em torno de 41% e

40% para fêmeas e machos, respectivamente. A taxa estimada de sobrevivência diária foi superior a 96%. O tamanho populacional na 1ª geração ficou em torno de 60 e na 2ª geração atingiu um patamar superior a 100 indivíduos. A longevidade mínima média estimada foi  $25,19 \pm 2,21$  e  $22,9 \pm 3,54$  para fêmeas e machos, respectivamente.

**Unitermos:** Coreidae, *Corecoris dentiventris*, marcação e recaptura, dinâmica populacional, fumo.

## Summary

The population dynamics of *Corecoris dentiventris* adults was studied at an experimental tobacco plot in Porto Alegre, Brazil (30° 01'S 51° 13'WGR), by the mark-release-recapture method. In an area of ca. 300 (3 are) m<sup>2</sup>, 365 tobacco plants were grown. From August/1997 to February/1998, all plants were inspected weekly. Adults were captured by hand, marked with coded dots on the elitra with a permanent ink pen and released back on the same plant. Data was analyzed by the Fisher-Ford method. Two hundred seventy three bugs were marked on 45 sampling occasions. Recapture rates were extremely high, about 41 and 40% for females and males respectively. Daily survival rate estimates were above 96%. Population size was about 60 individuals in the 1<sup>st</sup> generation, reaching a plateau higher than 100 in the 2<sup>nd</sup> generation. Estimated mean minimum longevity was  $25.19 \pm 2.21$  and  $22.9 \pm 3.54$  for females and males respectively.

**Key words:** Coreidae, *Corecoris dentiventris*, mark-recapture-release, population dynamics, tobacco.

## Introduction

Populations present fluctuations in their numbers. Density dependent and/or independent processes may bring about these



fluctuations (Sinclair, 1989; Cappuccino and Price, 1995). To understand these processes, it is necessary to investigate the seasonal and annual variations in population size, movements and survival rate of the population's individuals. Thus, one of the main attributes to be considered is the population density together with fundamental demographic parameters (Begon and Mortimer, 1986).

Insects are the group of animals most used in population studies, because they present, among other characteristics, relatively short lifecycles and small body size (Varley et al., 1980). Besides their theoretical interest, the population dynamics of insects is important for the monitoring and management of species which are considered as pests (Solomon, 1980).

Gray-tobacco-bug, *Corecoris dentiventris*, is cited as a pest of tobacco (*Nicotiana tabacum*) crops because it causes leaf wilting and twisting due to its sucker feeding habit (Costa, 1958; Bertels, 1962). According to Caldas et al. (2000), females lay their eggs on tobacco leaves, especially on the main vein of the abaxial surface, and the embryonic development is  $13.7 \pm 0.12$  days; the cumulative average length of the nymphal phase is  $34.9 \pm 0.12$  days; the sexual ratio is 0.49 (0.97 ♂ : 1 ♀). The main natural enemies are the predator *Cosmoclopius nigroannulatus* (Heteroptera: Reduviidae) and the parasitoids *Gryon gallardoi* (Hymenoptera: Scelionidae) and *Neorileya* Sp (Hymenoptera: Eurytomidae) (Santos, 1999).

Tobacco crop is very important throughout the world. Brazil is the leader in exportation and 90 % of the crop is grown in the southern states of the country (Neumann, 1998). It is a very profitable crop, but, due to the intensive use of pesticides, it is associated with serious environmental degradation and damage to the health of the farmers themselves. In addition to the economic importance of studies on the fauna associated with tobacco, the system *Nicotiana tabacum* – *Corecoris*



*dentiventris* presents itself as a very high potential as a tool for population ecology research.

There is a great lack of detailed information on the population dynamics of coreid bugs in general and *C. dentiventris* in particular. Most works dealing with these bugs have focused on species associated with agroecosystems. Becker and Prato (1982) have studied birth and mortality rates at the egg stage of *Spartocera* (= *Corecoris*) *lativentris* in *Solanum sisymbriifolium*, in Brazil. Amaral Filho and Storti Filho (1976), Amaral Filho and Carpieiro (1977) and Amaral Filho (1981 and 1986) has studied aspects of the biology of several species of Brazilian coreids. Studies such as those of Bonjour et al. (1990) with *Anasa tristis* in the USA, Egwatu and Ajibola Taylor (1976) with *Acanthomia tomentosicollis* on *Cajanus cajan* in Africa, and Kainoh et al. (1980) with *Leptocoris chinensis* on rice in Japan, have dealt with the spatial distribution of the insects throughout the various stages of these crops. Recently, several studies on the biology and ecology of *C. dentiventris* have been carried out on the same area as the present work (Santos et al., 1997 and 1998; Salazar et al., 1998; Canto-Silva, 1999; Caldas et al., 1999 and 2000; Santos 1999). However, there is still a lack of high precision data on the density at the adult stage and its variation in time.

Thus, the present work aims to investigate the population dynamics of *C. dentiventris* adults in an experimental crop of tobacco by the mark-release-recapture method.

## Material and Methods

The work was carried out at the Experimental area of the Departamento de Fitossanidade da Faculdade de Agronomia da Universidade Federal do Rio Grande do Sul (UFRGS) in Porto Alegre (30° 01'S and 50° 13' W), Rio Grande do Sul, Brazil.



On 1 August 1997, 365 Virginia (variety K326) tobacco seedlings were planted in 13 rows spaced 0.8 within rows, 1.0 m between rows, in an area of approximately 300 m<sup>2</sup>. Plants were identified by alphanumeric coordinates, letters corresponding to rows, and numbers referring to plants in the row.

Samples were taken weekly from early August to late February, which is the period of duration of the tobacco culture. On each sampling occasion, all plants were inspected, and adult individuals were captured by hand, marked and released back on the same plant. Marks were made with a permanent ink marker and consisted of a system of code points based on a suggestion by Brussard (Southwood, 1978). Records were made on individual number, sex, plant location and plant coordinate for every capture event. The air temperature in the sampling area was registered daily.

The Fisher-Ford method was used for the analysis of population estimates, after its assumptions were tested (Fisher and Ford, 1947; Begon, 1979). Longevity was estimated from the time elapsed between the first and last capture of each individual. Thus, the values found are estimates of the minimum longevity of recaptured individuals.

## Results and Discussion

The colonization of the tobacco culture by *C. dentiventris* began on 26 August 1997 and was gradual, with the arrival of individuals throughout three weeks. The colonizing generation was composed of 26 individuals of each sex, and most of them arrived between 2 and 9 September 1997. In the year before the present work was conducted, Caldas et al. (2000) established a tobacco plot for the first time in the study area and registered the beginning of the colonization period about a month later in the season (8 October 1996). The earlier colonization here reported can be related to (i) the higher temperatures registered in August

and early September 1997 than in 1996, and (ii) the possibility that some individuals of *C. dentiventris* may have remained in the study area itself or in its surroundings during the period between the two studies, perhaps in diapause and/or alternative hosts. In fact, one individual was caught in 1997, which had been marked the year before and had managed to survive 31 days in the culture.

On 45 sampling dates, 273 adult individuals of *C. dentiventris* were marked, 165 females and 108 males. The average number of individuals captured per day was  $14.19 \pm 2.12$  for females and  $4.02 \pm 0.82$  for males, and the recapture percentage was markedly high, about 41% for females and 40% for males (Table 1). These levels of recapture rank well above those usually obtained in field studies with insects (eg., Dreyer and Baumgärtner, 1997) and even those considered in theoretical studies (Bishop and Sheppard, 1973; Roff, 1973 a and b; Brownie et al., 1986).

TABLE 1: Number of multiple recaptures for females and males. Experimental area of the Departamento de Fitossanidade da Faculdade de Agronomia/UFRGS. Porto Alegre – Brazil.

Nº of recaptures	Nº of females	%	Nº of males	%
0	53	32	70	64
1	59	36	21	19
2	27	16	8	7
3	13	8	6	6
4	8	5	2	2
5	4	2	0	0
6	0	0	1	1
7	0	0	0	0
8	1	1	0	0
Total	165	100	108	100



The pattern of variation in the number of adults captured along the season was similar for females and males (Figure 1 a and b). Two adult generations were identified during the culture cycle in the area: the first was from the end of August to December 1997 when 45 females and 42 males were registered; the second generation began at the end in December and lasted up to 17 February 1998, when the culture cycle ended, and was represented by 120 females and 67 males.

The number of individuals in the first generation, around 60 (Figure 1c), was relatively low, possibly due to the occurrence of an intense rain period in September and October 1997, and relatively low temperatures from the end of September onwards.

A marked peak in the population size was estimated, for females and males, on 9 January 1998 (Figure 1). This may be an overestimate, due to the sudden change in the proportion of marked and non-marked insects, which can be accounted for the second generation adult recruitment. Taking the estimates for both females and males together, it seems reasonable to consider that the population size had risen to more than 100 adult individuals.

The sudden fluctuations in estimates in consecutive samples may have been caused by random variations in the proportion of captures and recaptures of adults of *C. dentiventris* due to samplings and/or weather conditions.

Average estimates of recruitment to the adult phase in the first generation for females was  $14.87 \pm 3.87$  and for males  $6.52 \pm 1.76$  individuals / sample date; in the second generation, an average of  $55.61 \pm 29.56$  and  $15.19 \pm 4.9$  individuals / sample date was obtained for females and for males, respectively.

Daily survival rate estimates were high and relatively constant throughout the period, (0.979 for females, 0.963 for males and considering both sexes, 0.979). *Corecoris dentiventris* adult mortality was low and approximately constant, being about 0.3 individuals/day.

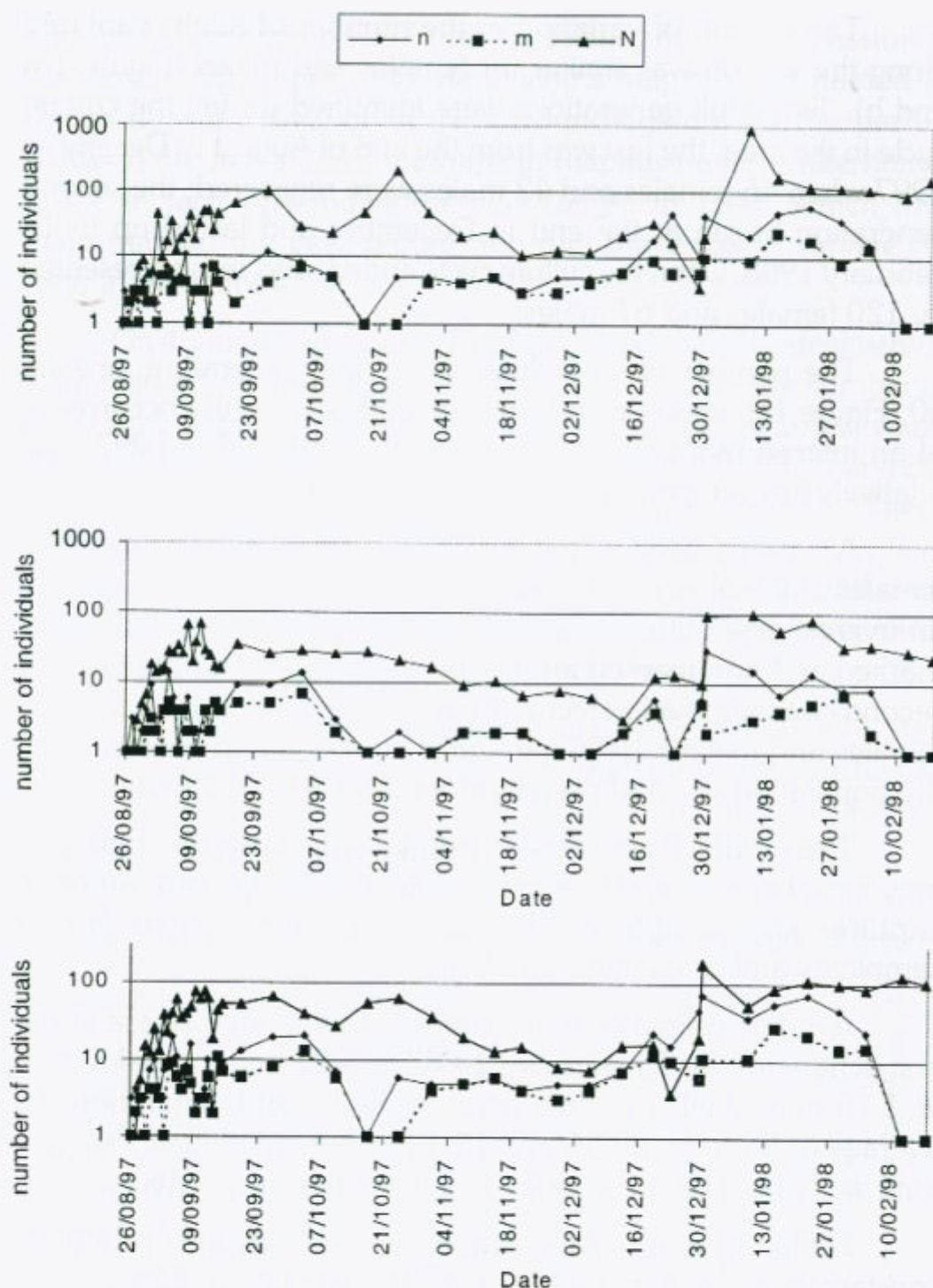


FIGURE 1: Number of captures ( $n$ ), recaptures ( $m$ ) and estimate of population size ( $N$ ) obtained through the Fisher-Ford method for (a) females, (b) males, and (c) males and females. Experimental area of the Departamento de Fitossanidade da Faculdade de Agronomia /UFRGS. Porto Alegre – Brazil.



The average minimum longevity estimated from recaptured individuals was  $25.19 \pm 2.21$  days and  $22.9 \pm 3.54$  days for females and males, respectively. There was no significant difference among the sexes ( $z = 0.1945$ ;  $gl = 152$ ;  $P = 0.8457$ ). Maximum longevity registered was 110 days for females and 107 for males. This high longevity corroborates the high survival rates estimated. The values are very close to those registered by Canto-Silva (1999) in 1996/1997 (female average =  $22.02 \pm 1.35$  days, maximum = 83 days; male average =  $17.84 \pm 1.91$  days, maximum = 84 days). Caldas et al. (1999), in their field study with the exclusion of predators, recorded an average longevity for adults of *C. dentiventris* of  $66.1 \pm 4.17$  for females and  $62.6 \pm 3.91$  for males.

The method of estimating adult longevity used in the present work – average period between the first and last adult captures – has two possible limitations. On one hand, the values can be underestimated, because individuals that were not recaptured had not necessarily died. On the other hand, it is possible that individuals which were not recaptured had died in fact, which would make the estimate exaggerated for the population as a whole. It is suggested, however, that these two possible sources of bias, being opposed, minimize the net error and that the very high recapture rate obtained reinforces its reliability. Given that Caldas' (1999) estimates were obtained with the exclusion of predators and that his values for average longevity were both higher than the ones estimated for minimum average longevity and lower than the maximum values registered in the present study, we consider the values presented here a good indication of the longevity of *C. dentiventris* adults for the population studied.

Differences in the population estimates between males and females may have occurred because males possibly move more within the culture and, thus, present a lower chance of being captured. Sampling intensities, although high for both sexes, were



lower for males (35.8%) than for females (67.9%). The sex ratio was 0.39 (0.79♂: 1 ♀).

Results obtained by Dreyer and Baumgärtner (1997), studying the population dynamics of coreid *Clavigralla tomentosicollis* in chickpea crops in Benin in Africa, using the mark-recapture-release method, contrast with those obtained for *C. dentiventris*. They registered a rapid colonization of the area by immigration of adults of neighboring areas, coinciding with the phase of bean formation in the plants. In their study, the colonizing generation was composed by ca. 3.5 individuals per 2m of planted row, and the number of recaptures varied between 4% and 6%. The higher daily survival rate estimated through the Fisher-Ford method by these authors was nearly 0.8 individuals/day and the estimate of daily mortality (emigration) was lower than 5%.

Based on the results – particularly on the high sampling intensity – it is possible to infer that *C. dentiventris* is an organism very well suited for studies on population dynamics. Results here presented, added to those of other studies carried out at the same place, provide evidence on how population size, colonization time and period of permanence in the culture may vary from year to year in the tobacco culture. Fluctuations in population levels seem to be affected considerably by weather variations from one year to another. When conditions were favorable, few individuals of the first generation originated a numerous subsequent generation, highlighting the high population growth potential of *C. dentiventris* (Canto-Silva, 1999).

The species is not generally referred as a major pest of tobacco, because high (and dangerous) levels of pesticides are routinely applied to these culture. However, as handling practices less harmful to the environment and producers are sought, knowledge on population fluctuations of *C. dentiventris* (and insects, in general), the mechanisms that govern them, and the



population levels that represent significant damages to the culture, are fundamental.

## Acknowledgements

We thank the CNPq for the Scholarship No 130098/00-0.

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