

S31-5 Explosions of the eared dove: the unique case in southeast Brazil

Ronald D. RANVAUD¹, Enrique H. BUCHER²

1. BMB-Instituto de Ciências Biomédicas, Universidad de São Paulo, São Paulo 05508-900, Brazil; ranvaud@usp.br

2. Centro de Zoología Aplicada, Universidad Nacional de Córdoba, Córdoba 5000, Argentina; buchereh@uolsinectis.com.ar

Abstract The unique environmental conditions in which eared dove populations exploded in southeast Brazil recently has enabled verification of a general hypothesis that had been put forward to explain earlier dove explosions elsewhere in South America. Large-scale deforestation followed by a sequence of land use developments in different parts of the State of São Paulo, southeast Brazil, produced landscapes that favored, in varying degrees, the presence of doves in high densities. Applying knowledge of dove biology gained from prior experience, it was possible to predict, at least approximately, where and when dove populations might be expected to explode or implode. Observed patterns were surprisingly consistent with predictions after a key feature of local adaptation was taken into account, namely the novel adoption of sugarcane plantations for colonial breeding. Previously, breeding had only been recorded in semiarid natural woodland and forest patches, habitats unavailable in the new area of outbreak.

Key words Soybeans, Deforestation, Agricultural expansion, Colonial breeding

1 Introduction

At the time of European settlement, the forested habitat of the State of São Paulo, Brazil, was unsuitable for eared doves (*Zenaida auriculata*). Early in the 20th century, the human population started to spread and forest clearing began in earnest (Victor, 1975), mostly for pasture, coffee groves and subsistence farming. The new landscape favored eared doves, and by the 1940s their numbers had grown sufficiently for some grain farmers to become alarmed. The problem was not serious, however, and the doves still bred separately in dispersed pairs, mostly in trees.

Real change, however, came about in the late 1960s and early 1970s when generous government policies favored the mechanization of agriculture and fostered a switch to large-scale planting of grain crops valuable on the international market. As a result, the size of fields increased and rotation was introduced for a second annual crop. Under these conditions, eared dove populations exploded, the birds becoming a real nuisance in soybean fields at seedling emergence and wheat and rice fields at harvest. This coincided with the establishment of several vast breeding colonies, covering areas of between 40 and 1 000 ha, with up to 5–10 million breeding birds, all located in sugarcane fields.

Earlier agricultural development in the Argentinean Chaco had also resulted in eared dove outbreaks and colonial breeding (Bucher and Ranvaud, this symposium), so the events in southeast Brazil, a humid tropical environment, offered an opportunity to test whether ideas developed to explain prior outbreaks had wider applicability. In spite of several differences (climate, grain crops and crop rotation practices, number of harvests per year, type of vegetation

present), several key factors were common to the situations in both Brazil and Argentina. Principal among them was the waste from mechanical harvesting, providing grain food for most of the year, and a mosaic landscape with large homogeneous patches of dense vegetation (sugarcane) suitable for colonial breeding not far from the crop fields.

2 Materials and methods

The information here reported was obtained through a combination of literature search, questionnaires and oral history from local informants, and personal surveying of three active colonies in the State of São Paulo. In addition, the largest and most persistent of the breeding colonies, near Tarumã (50°30' W, 23°15' S) was the focus of a quantitative study of diet in which more than 6 000 crop contents were analyzed between 1994 and 2002.

3 Results

Information from literature, questionnaires and oral history, together with our own records, enabled the following reconstruction. As dove numbers increased gradually through the late 20th century in southeast Brazil, solitary nesting in trees gave way to colonial breeding in sugarcane. Evidence was obtained of a total of ten breeding colonies in sugarcane fields in the States of São Paulo and Paraná then, most no longer active.

The first colony was established in the early 1970s, near Tarumã SP. This was also the largest, reaching 1 000 ha on occasion, and the most persistent; it still survives. The time of its establishment coincided with a ten-fold increase in the area devoted to soybeans and wheat in the surround-

ing region. Around that time farmers adopted the practice of two harvests per year, providing abundant food for the birds year round, both through waste at harvest times and from weeds in the fields. Weed seeds were found to be important in the diet of the birds, especially at times when grain crops were ripening prior to harvest and unavailable. Land use has been relatively stable in the region, and, unlike plantings in the rest of the state, the area under sugarcane did not increase after the 1980s. About equal areas are devoted to sugarcane and to soybean-maize production on yearly rotation.

The other colonies were established within about a decade of the first, but all but one had disappeared by the late 1990s. In the region around the town of Ribeirão Preto, which was studied in some detail, the appearance of the colonies correlated with increased areas dedicated to maize (+50%) and to a lesser extent rice (+30%). The extinction of these breeding colonies correlated with a crash in the crops to levels lower than before the colonies had formed. During this time sugarcane continued to expand there, almost doubling from the late 1970s to the mid 1990s, and occupying more land than all other crops combined.

The sizes of the two active colonies in São Paulo today, at Tatumã and Penápolis about 170 km further north, are more than an order of magnitude different from each other, 1 000 ha versus 60 ha respectively. This correlates well with the area dedicated to annual crops within a radius of 50 km of the two colonies. Fifty kilometers is a distance that the birds are known to cover to feeding grounds each day

Dove diet at Tatumã over 8 years of study was entirely of grain and seeds from agricultural lands, consisting almost exclusively of waste grain, mainly wheat and maize, and weed seeds (Ranvaud et al., 2001; De Freitas, 2002). Mean dry weight of dove crops correlates with estimated grain availability, obtained through the monthly summaries of cooperative accounts. Dry weight also correlates with breeding and its intensity. Crop weights pass through a minimum in December and January, 2–3 g compared to 5–7 g at other times (Ranvaud et al., 2001; De Freitas, 2002); and these are months in which breeding, if any, is much reduced.

4 Discussion

Once sugarcane is recognized as a substitute for colonial breeding habitat, the recent natural history of eared doves in southeast Brazil is consistent with the hypothesis put forward by Bucher and Ranvaud (this symposium) to explain population explosions elsewhere in South America.

Establishment, survival and extinction of the breeding colonies together correlate with food available from ag-

ricultural activities. Colony size also correlates with food from the same sources. Diet was found to be entirely dependent on agriculture, especially waste grain and associated weeds. The mean weight of dove crops was found to go through a minimum at times of vegetative growth in grain crops, when agriculture provides little food; these are also times when breeding all but stops. Food is thus the key factor in dove demography.

The picture that emerges is one of growing dove populations as soon as food becomes easily available in open country, a common situation under the regime of expanding agriculture and improved mechanization through the 20th century in South America. Quantity of food available is increased by inefficiency in agricultural mechanical harvesting and by extended asynchronous or double cropping made possible by climatic conditions. At some threshold in population density, solitary nesting gives way to colonial breeding in dense, uniform patches of vegetation of particular size, if these are available. It is then that the populations explode. For this, the ideal ratio of areas dedicated to sugarcane and annual crops appears to be around 1:1, with patches of sugarcane above a regional minimum of 20 000 ha for breeding and roosting. When these conditions change or desynchronize, the doves appear to respond accordingly, dropping in numbers and reverting to solitary nesting.

Acknowledgements This research is the result of a long term project supported by Centro de Desenvolvimento do Vale do Paranapanema (CDVale), in collaboration with its technical Director, Hugo de Souza Dias. Grants were provided by the National Fund for the Environment, Brazilian Ministry of the Environment (FNMA). Data gathering for the largest breeding colony was made possible by the full cooperation of the Director of the Companhia Agrícola Nova America (C.A.N.A.), José Eugênio de Rezende Barbosa.

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