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Assessment of Bird Damage to Early-Ripening Rice in Cuautla, Morelos State, Mexico

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Abstract: Blackbird damage to rice has become a major economic problem for growers in Morelos, Mexico. Blackbirds, specifically the red-winged blackbird (*Agelaius phoeniceus*), brown-headed cowbird (*Molothrus ater*), and the red-eyed cowbird (*M. aeneus*) caused approximately 3.68% damage per hectare during spring-summer 2000. Other species such as the blue grosbeak (*Passerina caerulea*) and the blue-black grassquit (*Volatinia jacarina*) damage rice crops too, but mostly in the field borders near secondary vegetation or other crops like sugar cane or maize.

Key Words: rice, bird damage, blackbirds, stomach contents, brown-headed cowbird, *Molothrus ater*, red-eyed cowbird, *Molothrus aeneus*, red-winged blackbird, *Agelaius phoeniceus*, Mexico

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INTRODUCTION

The state of Morelos has a particularly diverse faunal assemblage (Contreras and Urbina 1995). This characteristic is widely manifested with a high diversity of avian species (Davis and Russell 1953, Contreras and Urbina 1995). In Mexico, 970 species of which 750 are resident have been reported (Varela 1981). Of these, 269 species (from 35 families and 12 orders) occur in Morelos (Gaviño de la Torre 1995).

In Morelos, conditions are favorable for agricultural crops including sugar cane, sorghum, maize, rice, and others. Rice (*Oriza sativa*) is a particularly important crop. During the 1990-1991 annual cycle, 19,154 and 1,883 tons of rice were produced in spring/summer and autumn/winter, respectively. This represents approximately 7% of the national production of rice for that year (INEGI 1997). Rice is a preferred food source for birds that consume the rice at all stages of development and cause significant economic loss to growers. To establish cost-effective management programs for birds in rice, it is important to quantify their damage.

BACKGROUND

De Grazio (1989) reported crop losses due to birds in some countries of Latin America: more than 80% of rice is affected in Argentina; \$7 million in rice crop losses in the Dominican Republic; and \$250,000 damage to wheat crops in Uruguay. Dolbeer (1999) reported significant bird damage to crops in the United States and Canada. Red-winged blackbirds (*Agelaius phoeniceus*) and common grackles (*Quiscalus quiscula*) damage more than 360,000 tons of maize annually. Decker et al. (1990) reported annual damage to crops caused by blackbirds and other species in Texas to be greater than \$8 million.

Celaya (1983) suggested that in Morelos red-winged blackbirds feed mainly on cultivated grains like rice, maize, and sorghum during the cropping period and on

insects outside the season. Stomach content analysis showed that red-winged blackbirds had an average of 0.782 g of rice in their stomachs and caused approximately 40% crop damage. Red-winged blackbirds also fed mainly in the center of the crop. In Morelos in 1990, growers invested 420 Mexican pesos per hectare, representing 10% of the total rice production cost, for bird control (Hernández 1993).

METHODS

The study was conducted in "El Mirador" in areas bordering the urban zone of Cuautla, Morelos. It was part of a study to determine the effectiveness of a frightening device (propane cannon). Damage was evaluated in areas where the propane cannon was not operating.

Rice Cultivation

The variety of rice (*Oriza sativa*) sowed in the study area was Morelos A92. Some areas were sowed during the first 2 weeks of May 2000 and harvested at the end of September. Areas sowed at the end of May were harvested in October. The rice crop where damage was evaluated was sowed in late May and harvested in late October 2000.

Determination of Species and Stomach Contents

Eight mist nets (12 × 2.5 m) set on 24, 25, 29 and 30 August were used to sample birds utilizing the rice crop. Sixty-four birds were caught in 100.45 hours per net. The captured individuals were euthanized and species identified (Peterson and Chalif 1989, Howell and Webb 1995). Stomach contents were collected. Some birds were kept as specimens for the ornithological collection of the Unidad de Referencia en Roedores, Aves y Maleza.

Evaluation of Damages

A 4-hectare area covering different parcels was selected. This area was divided into 4, 1-ha quadrants for

bird counts. The study was conducted from 5 to 25 September, 2000. Damage was evaluated every 5 days (10, 15, 20 and 25 September). The evaluations were made using a simple random sampling approach (Cochran 1992). Each quadrant was divided into 100, 10 × 10-m cells (Besser 1973, DeHaven 1976). Ten plots were then selected at random. In the center of the plot we marked a 1.5 × 1.5-m (2.25 m²) subplot.

In each subplot we counted the total number of panicles to obtain an estimate of the total number of panicles per hectare. To minimize any effect of our presence on birds, we evaluated damage when bird activity within the crop was minimal. Damaged panicles with 10 cm of stem were clipped, deposited in bags, labeled with location, and transferred to the laboratory to obtain a dry weight. On the last day of sampling, we collected complete healthy plants of rice to estimate the expected yield of rice.

To obtain a better evaluation of damage due to blue-black grassquits and blue grosbeaks in the eastern and southern borders of the study site, we sampled 5 additional 1 × 10-m randomly-selected plots along the edge of each quadrant. Damage was evaluated in each of these plots using the same procedure described for the quadrant. Damage was sampled on 26 September.

RESULTS AND DISCUSSION

Determination of Species

Fifty-nine of the 64 birds caught were species considered to be pest species. We identified 9 species of birds from 3 orders and 6 families (Table 1) (González 1976, De Grazio and Besser 1970, Celaya 1983, Urbina et al. 1993, Del Villar 2000). In all quadrants, species of the family Icteridae fed mainly on rice and occurred in the center of the crop (Table 3). These observations agree

with those of Celaya (1983), who observed red-winged blackbirds mostly to feed in the center of crops. The species of the families Emberizidae and Cardinalidae displayed greater activity in the eastern border for the quadrants 2, 3 and 4, and in the eastern and southern borders of quadrant 1. This was probably due to the presence of secondary vegetation or other crops such as sugar cane and maize.

Stomach Contents

Stomach contents of the captured birds are summarized in Table 2. The analysis only involved separating and washing the seeds of rice from the rest of the particles found.

Evaluation of Damage

There was no significant difference in damage between quadrants (ANOVA; F=1.93; 3,12 d.f.; P=0.17). Rice yield per hectare in Cuautla, Morelos was equivalent to 9.4 tons. We estimated rice losses due to birds to be 0.85%. With rice valued at 2,250 Mexican pesos per ton, then losses are equivalent to 181.08 Mexican pesos per hectare.

Evaluation of Damage in Borders

Table 4 presents the results of damage assessment in the borders of the four quadrants. Losses were as high as 13.3 kg rice per 250 m² of sampling area. Considering that each border is 100 m long and should have yielded 94 kg rice, 2.83% of rice was lost. Total losses per hectare (crop center + border) was therefore 3.68%. This agrees with results of a study by Ing. Felipe de Jesus Osuna (Agrotecnia rice program, INIFAP Zacatepec, pers. comm.) that suggested that bird damage to rice in Cuatla varies between 3% and 4%.

Table 1. Species of birds caught in rice crops in Cuautla, Morelos.

Family	Species	No. of Individuals	Locality
Columbidae	<i>Columbina inca</i>	2	Ejido Mirador
Cuculidae	<i>Crotophaga sulcirostris</i>	1	Ejido Mirador
Cardinalidae	<i>Passerina caerulea</i> *	7	Casasano, Mirador
Emberizidae	<i>Volatinia jacarina</i> *	7	Ejido Casasano
Hirundinidae	<i>Hirundo rustica</i>	2	Ejido Casasano
Icteridae	<i>Agelaius phoeniceus</i> *	9	Ejido Mirador
Icteridae	<i>Quiscalus mexicanus</i> *	6	Ejido Mirador
Icteridae	<i>Molothrus aeneus</i> *	18	Ejido Mirador
Icteridae	<i>Molothrus ater</i> *	12	Ejido Mirador

*These species are considered in various studies as pests in rice crops in Mexico (González 1976, De Grazio and Besser 1979, Celaya 1983, Urbina et al. 1993, Del Villar G. 2000).

Table 2. Stomach contents of the different bird species captured.

Species	Rice material	Average weight (g)	No. of individuals	Other material found
<i>Molothrus aeneus</i>	seeds	0.58	18	stones, other seeds
<i>Molothrus ater</i>	seeds	0.32	12	stones, other seeds
<i>Quiscalus mexicanus</i>	seeds	0.26	6	stones, other seeds
<i>Agelaius phoeniceus</i>	seeds	0.26	9	stones, seeds, insects
<i>Passerina caerulea</i>	peel	0.21	7	other seeds, insects
<i>Volatinia jacarina</i>	seeds	0.10	7	other seeds
<i>Crotophaga sulcirostris</i>	--	--	1	stones, seeds, insects
<i>Columbina inca</i>	--	0.14	2	dust, peel of other seeds
<i>Hirundo rustica</i>	--	--	2	diverse seeds

Table 3. Damage caused by birds at each sampling date and for each quadrant (kg/ha).

Sampling date	Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4	Total
10 Sep	33.05	119.32	0	13.94	166.31
15 Sep	18.90	47.21	3.66	5.28	75.05
20 Sep	10.29	8.12	1.03	2.84	22.28
25 Sep	15.11	11.86	18.13	13.19	58.29
TOTAL	77.35	186.51	22.82	35.25	321.93
Average	19.33	46.62	5.70	8.80	80.48
Standard Deviation	9.79	51.56	8.42	5.58	61.3
Standard Error	4.89	25.78	4.21	2.79	30.65

Table 4. Damage caused by birds in the borders of each quadrant.

Date of sampling	No. of plots per quadrant	Quadrant 1 East border (g)	Quadrant 1 South border (g)	Quadrant 2 East border (g)	Quadrant 3 East border (g)	Quadrant 4 East border (g)	Total (kg)
26 Sep	5	5517.15	3275.6	3436.4	746.85	323.1	13.299

CONCLUSIONS

The stomach contents of brown-headed cowbirds, red-eyed cowbirds, red-winged blackbirds, blue grosbeaks, and blue-black grassquits indicate that these birds feed on the early-ripening rice. The species *Quiscalus mexicanus* also had rice seeds in stomach contents but was only observed feeding on rice remaining on the ground after harvest. Presumably rice panicles do not support the relatively greater weight of this species. Bird damage caused to rice was estimated at 3.68% of the crop yield.

Blackbirds will continue to be the predominant bird pests of crops in Mexico and North America, and we need to determine the vulnerability of their populations to control and the cost-benefit of control programs. Other bird species, such as some species of the families Cardinalidae and Emberizidae, may also cause significant

damage. The results of this study are conservative and more sampling is necessary. Although results do not suggest birds cause alarmingly high levels of damage, we need to take steps to ensure that these losses do not increase.

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