

## DISPERSAL OF MALE RED-WINGED BLACKBIRDS FROM TWO SPRING ROOSTS IN CENTRAL NORTH AMERICA

C. EDWARD KNITTLE

*Denver Wildlife Research Center, USDA  
Denver, Colorado 80225 USA*

GEORGE M. LINZ<sup>1</sup>

*Colorado Cooperative Fish and Wildlife Research Unit  
Colorado State University, Fort Collins, Colorado 80523 USA*

BRAD E. JOHNS, JOHN L. CUMMINGS, JAMES E. DAVIS, JR., AND  
MICHAEL M. JAEGER

*Denver Wildlife Research Center, USDA  
Denver, Colorado 80225 USA*

**Abstract.**—We determined the dispersal of male Red-winged Blackbirds (*Agelaius phoeniceus*) from spring roosts in northwestern Missouri and southeastern South Dakota by recovering 687 birds marked with an aerielly applied fluorescent pigment. Eighty-six percent of the marked birds migrated to breeding sites northwest of the spring roosts, many of these in sunflower-producing areas. Males dispersing from northwestern Missouri were found in western Minnesota, North Dakota, and eastern South Dakota, whereas males dispersing from southeastern South Dakota were found in southwestern Minnesota, the western three-fourths of North Dakota, and the northeastern two-thirds of South Dakota. Limited sampling in Canada indicated that some redwings emanating from spring roosts in central United States breed in Canada. Management of redwing populations in those spring roosts may reduce the number of birds that damage sunflower.

### DISPERSIÓN DE *AGELAIUS PHOENICEUS* DESDE DOS CENTROS DE PERNOCTACIÓN EN LA PARTE CENTRAL DE LOS ESTADOS UNIDOS

**Sinopsis.**—En un estudio que se llevó a cabo en el noroeste de Missouri y el sureste de Dakota del Sur, se determinó la dispersión de machos de *Agelaius phoeniceus* (desde sus lugares en donde pernoctan en la primavera) mediante el recobro de 687 aves que fueron marcadas con un pigmento fluorescente que se aplicó desde el aire. El 86% de las aves marcadas se movieron hacia sus áreas de anidamiento en el noroeste; muchas de estas través de áreas en donde se siembra girasol. Las aves que pernoctaron en Missouri se encontraron luego en el oeste de Minnesota, Dakota del Norte y la parte este de Dakota del Sur, mientras que las aves que fueron marcadas en Dakota del Sur se movieron hasta el suroeste de Minnesota, el oeste de Dakota del Norte y las dos terceras partes del noreste de Dakota del Sur. Un muestreo, aunque limitado, indicó que algunas de las aves que pernoctan durante la primavera en las partes centrales de los Estados Unidos se reproducen luego en Canadá. El manejo de estas aves en las áreas en donde pernoctan en la primavera pudiera reducir el daño que estas producen a los sembrados de girasol.

We used an aerielly applied fluorescent pigment to determine the distribution of male Red-winged Blackbirds (*Agelaius phoeniceus*) after dispersing from two spring roosts in northwestern Missouri in 1982 and southeastern South Dakota in 1983. We were primarily interested in the

<sup>1</sup> *Current address: Denver Wildlife Research Center, USDA, Denver, Colorado 80225 USA.*

percentage of marked redwings recovered in the major sunflower producing regions of Minnesota, North Dakota, and South Dakota.

Oilseed sunflower (*Helianthus annuus*) acreage in those states stabilized between 1.2 and 1.6 million ha in the early 1980s (McMullen 1985). From 0.9% to 2.0% of the sunflower crop is lost each year to foraging aggregations (flocks) of blackbirds (Icterinae) (Hothem et al., in press). Thus, there is a critical need to develop management strategies aimed at reducing the impact of blackbird feeding on sunflower.

Red-winged Blackbirds are the most numerous of the icterinae in the Dakotas and Minnesota (Besser 1985, Besser et al. 1984, Dolbeer and Stehn 1983) and probably cause the most damage to sunflower (Besser 1978). In late summer and autumn redwings gather in flocks and migrate to wintering areas in the southern United States. Because birds in winter roosts tend to emanate from a large geographic area (Dolbeer 1978, 1982), population control at these roosts probably would not effectively reduce breeding populations in specific areas (e.g., sunflower-growing region) (Dolbeer 1978).

As migrating redwings near their breeding areas in late winter and early spring, they disperse into progressively smaller flocks. If an effective and environmentally safe technique can be developed for population control, spring roosts may offer an opportunity to affect large numbers of redwings (Greenwood and Weatherhead 1982, Weatherhead et al. 1980). However, management programs designed to reduce depredating redwing populations must address questions on the potential impact on the species in the targeted geographic region.

#### STUDY SITES AND METHODS

Using census techniques described by Meanley (1965), we estimated that in mid-March 1982 approximately 16 million blackbirds (92% male redwings) were roosting in cattails (*Typhus* sp.) in two semi-permanent wetlands (Class IV; classification of Stewart and Kantrud 1971) in north-western Missouri. One roost (9 ha), near Rushville, in Buchanan County, harbored about 3 million blackbirds. The other roost (285 ha) was located on the Squaw Creek National Wildlife Refuge (Squaw Creek), in Holt County, and contained about 13 million blackbirds. On 13 Mar., during a 20-min period following sunset, concentrations of blackbirds in the Rushville roost were sprayed by a helicopter at altitudes from 15 to 90 m, with a suspension of 5% boiled linseed oil, 2% fluorescent green pigment, in No. 1 diesel fuel. Similarly, on 16 Mar., birds were sprayed in the Squaw Creek roost with fire-orange pigment.

In mid-March 1983 about 3 million blackbirds (96% male redwings) were roosting in a 2835-ha semi-permanent wetland in Lake Thompson, near DeSmet, Kingsbury County, South Dakota. Although cattail was the predominant vegetation in this marsh, the birds roosted in about 405 ha of scattered patches of phragmites (*Phragmites* sp.). On 21 and 22 Mar. the birds were sprayed with gold pigment (mixture of fire-orange and Saturn yellow pigments) from a fixed-winged aircraft.

The marking liquid adheres to feathers and dries in 3–5 min. In a separate study, Knittle and Johns (unpubl. data) estimated that in 6 wks about 29% of the pigment is lost. Although some pigment is visible in daylight, it is best detected under ultraviolet light.

In May, June, and July 1982–1983, cooperators from United States and Canadian wildlife agencies collected territorial male redwings and mailed the wings to the Denver Wildlife Research Center for examination under ultraviolet light. In 1982 birds were collected in 19 states and three provinces, in 1983 in 11 states and three provinces. The location of each bird was designated as the latitude and longitude of the southeast corner of the degree block in which it was collected. Only birds collected during the periods 1 May–30 Jun. in the United States and 15 May–15 Jul. in Canada were included in the results.

In 1982, 307 redwings were collected from six states (Arkansas, Florida, Louisiana, Mississippi, Oklahoma, and Tennessee) that were considered out of the normal spring migratory path. Of those birds collected in Florida, 76% ( $n = 50$ ) had small orange particles on their feathers. Upon inquiry, the manufacturer of the pigments revealed that the fire-orange pigment was used for a variety of purposes (e.g., insecticide formulations, paint, and testing for water seepage). Hence, a criterion was established to separate contaminated birds from birds sprayed with the marking formulation. Since the marking suspension streaks when sprayed on birds, only birds with marks that were clearly streaked (“splashed”) were considered positively marked. This results in conservative estimates of birds marked. An improved formulation has since been developed that produces longer lasting and more readily distinguishable marks.

We were primarily interested in the number of marked birds found in the six major sunflower-growing regions: central North Dakota, western North Dakota, eastern North Dakota-northwestern Minnesota, central South Dakota, northeastern South Dakota-southwestern Minnesota, and northwestern South Dakota (Figs. 1, 2). The strata boundaries were determined by political boundaries and sunflower acreage.

#### RESULTS

*Northwestern Missouri (Rushville and Squaw Creek).*—We collected male redwings the day after each roost was sprayed. Of the 181 birds collected near the Rushville roost, 43.6% were marked; 58.5% of 41 birds collected near Squaw Creek were marked. Because of the proximity of these two roosts (40 km), it is likely that roost interchange was occurring (Heisterberg et al. 1984). Thus, for further analyses we treat the two northwestern Missouri roosts as a single roost, with 8.2 (SE =  $\pm 0.5$  million) million marked birds.

Of the 5526 territorial male redwings collected between 40°N and 55°N, 10.2% were marked (Fig. 1, Table 1). None of 741 birds collected south of 40°N was marked. The percentage of marked birds increased with each degree of latitude north of Missouri. Although only 206 birds were collected between 49°N and 54°N (Canada), it is noteworthy that

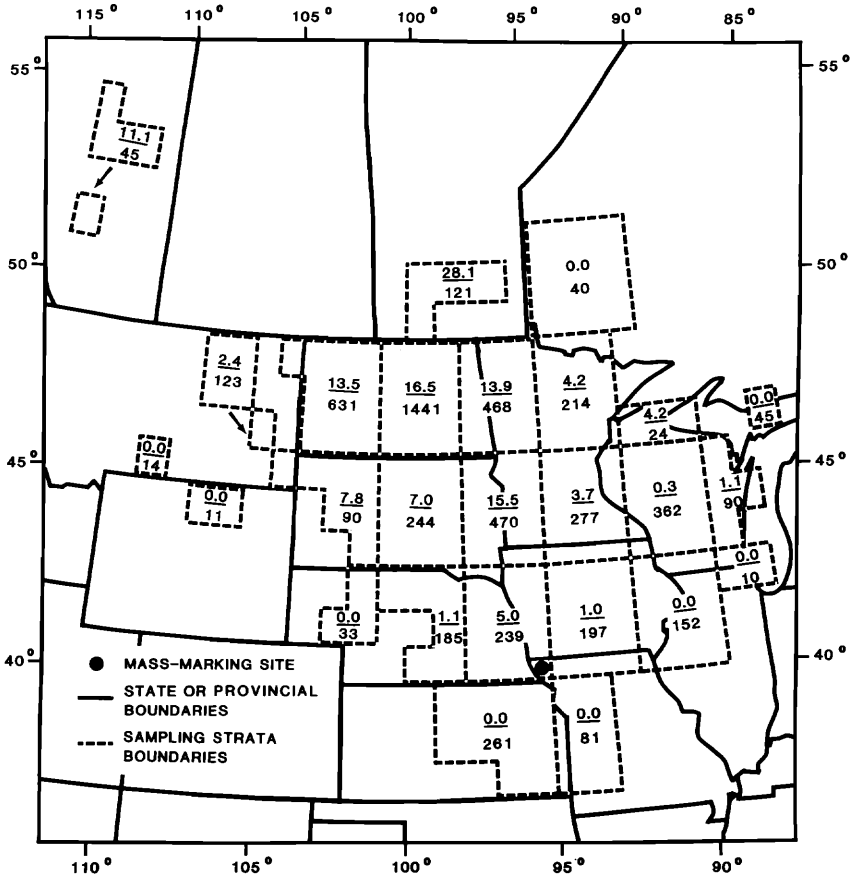


FIGURE 1. Number and percentage of marked (underlined) male Red-winged Blackbirds collected in designated strata in central United States and southern Canada, after dispersing from spring roosts in northwestern Missouri.

18.9% of those birds were marked. Only 1.7% of 1406 males collected northeast of Missouri (39°N, 95°W) were marked. In contrast, 13.0% of the 4120 birds collected northwest of Missouri were marked.

The sunflower-growing regions with the highest percentages of marked birds were central North Dakota (16.5%), eastern South Dakota-southwestern Minnesota (15.5%), eastern North Dakota-northwestern Minnesota (13.9%), and western North Dakota (13.5%) (Fig. 1).

*Southeastern South Dakota (Lake Thompson).*—We collected 219 male redwings the day after the roost was sprayed and found that 79.9% were marked or about 2.4 million (SE = ±79,000) were marked in the roost.

Of the 2425 birds collected between 44°N and 55°N, 5.0% were marked. The percentage of marked birds varied with latitude, peaking at 7.0% of

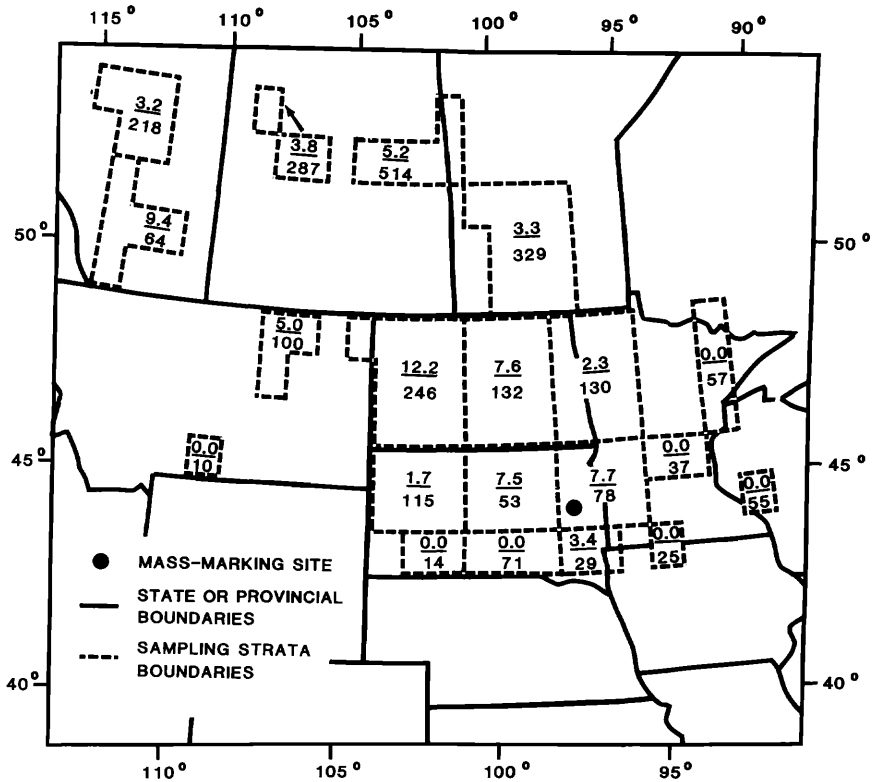


FIGURE 2. Number and percentage of marked (underlined) male Red-winged Blackbirds collected in designated strata in central United States and southern Canada, after dispersing from a spring roost in southeastern South Dakota.

665 between 46°N and 49°N (Table 2). One of the 188 birds collected south of latitude 44°N was marked.

Only 2.0% of 346 birds collected northeast of Lake Thompson (44°N, 97°W) were marked, whereas 5.4% of 2079 birds collected northwest of

TABLE 1. Percentage of marked male Red-winged Blackbirds found in various latitudes after dispersing from spring roosts in northwestern Missouri.

Latitude	Number of male Red-winged Blackbirds collected	Percentage marked
Less than 40°N	741	0.0%
40°N to 43°N	816	2.0%
43°N to 46°N	1558	7.0%
46°N to 49°N	2946	13.6%
49°N to 54°N	206	18.9%
Total	6267	10.2%

TABLE 2. Percentage of marked male Red-winged Blackbirds found in various latitudes after dispersing from a spring roost in southeastern South Dakota.

Latitude	Number of male Red-winged Blackbirds collected	Percentage marked
Less than 44°N	188	0.5%
44°N to 46°N	348	3.4%
46°N to 49°N	665	7.0%
49°N to 55°N	1412	4.4%
Total	2613	5.0%

Lake Thompson were marked. Peak numbers of marked birds were found between 99°W and 105°W longitude (6.8%,  $n = 1133$ ).

The sunflower-growing regions with the highest percentage of marked birds were western North Dakota (12.2%,  $n = 246$ ), northeastern South Dakota-southwestern Minnesota (7.7%,  $n = 78$ ), central North Dakota (7.6%,  $n = 132$ ), and northcentral South Dakota (7.5%,  $n = 53$ ) (Fig. 2). Of the 245 redwings collected in the other two major sunflower regions (eastern North Dakota-northwestern Minnesota and northwestern South Dakota), 2.0% were marked.

#### DISCUSSION

In the past, the seasonal distribution of migratory blackbird populations was determined by analysis of banding data (Besser et al. 1983; Dolbeer 1978, 1980; Gammell et al. 1986; Royall et al. 1980). Banding blackbirds to obtain information on seasonal distribution is a laborious task and recovering sufficient numbers of birds for a meaningful analysis takes many years. We marked about 10.6 million male redwings in 4 h and recovered 687 marked birds in two 10-wk sampling periods. Hence, aerial mass-marking is ideal for determining seasonal distribution in a relatively short time.

Our data show that 86% of the male redwings dispersing from spring roosts in northwestern Missouri and southeastern South Dakota migrate to breeding areas in a northwesterly direction. Spring migration appears to be strongly directional, with few males undergoing a reverse migration to establish breeding territories.

Individual redwings dispersing to breeding areas from northwestern Missouri move along a broad corridor that extends from eastern Montana to eastern Wisconsin in the U.S.A., a distance of about 3000 km. Birds marked in Missouri were found concentrated in breeding areas in western Minnesota, North Dakota, and eastern South Dakota, which are all sunflower production areas. Although sampling was limited in Canada to east-central Alberta, southern Manitoba, and southwestern Ontario, the number of marked birds found in those areas shows that Canada contains breeding areas for many redwings that pass through northwestern

Missouri in the spring. Thus, male redwings migrating through northwestern Missouri disperse over an area of at least 1.8 million km<sup>2</sup>. Because few birds established territories within 480 km of the roost, we speculate that northwestern Missouri serves largely as a staging area for migrating redwings and that local breeding birds disperse to their breeding territories soon after arriving at the roost.

In comparison, males marked in southeastern South Dakota (Lake Thompson) were largely found in southwestern Minnesota, in the western three-quarters of North Dakota, and the northeastern two-thirds of South Dakota. Thus, Lake Thompson also harbors redwings that nest in sunflower production areas. Those redwings, however, dispersed over an area in the central U.S.A. 70% smaller (405,000 km<sup>2</sup>) than those birds emanating from northwestern Missouri. Marked birds collected in east-central Alberta, central Saskatchewan, and southern Manitoba indicate that a substantial number of redwings using the Lake Thompson roost breed in Canada. Unlike the redwings marked in Missouri, more birds marked at Lake Thompson nested locally. This suggests that as male redwings move northward and form progressively smaller roosts, a larger percentage breed locally.

As evidenced by banding returns and morphological data, redwings breeding in central North America migrate in a southeasterly or southerly direction to their winter roosts (Dolbeer 1978, James *et al.* 1984, Meanley and Dolbeer 1978). Besser *et al.* (1983) and Gammell *et al.* (1986) reported on the seasonal movements of redwings banded in northeastern South Dakota (Brown County) and northwestern North Dakota (Ward County), respectively. They found that in late summer and autumn, males breeding northwest of those banding sites migrated through northeastern South Dakota. From there they followed a narrow corridor south to wintering areas in eastern Texas, eastern Oklahoma, and western Louisiana and returned in the spring by the same route. This corridor includes the Lake Thompson and northwestern Missouri roosts. Thus, roosts in northwestern Missouri probably harbor redwings that also use the Lake Thompson roost.

In the six sunflower-producing regions there are an estimated 3.2 million male redwings (R. A. Stehn, unpubl. data), of which 14.5% were marked in Missouri (1982) and 7.2% in South Dakota (1983). There are at least four possible explanations for the high percentage of unmarked birds. First, some marked birds may have lost the marker before being collected. Second, many birds probably passed through these roosts before or after the roost was sprayed (roost turnover). Otis *et al.* (1986) showed that turnover did occur in the Lake Thompson roost in 1985. The rate of turnover probably varies from year to year depending on environmental conditions. Third, some birds undoubtedly used other roosts before dispersing to their breeding areas. Biologists of the Denver Wildlife Research Center have found other roosts in eastern Nebraska, west-central Minnesota, and southeastern South Dakota that may have contributed birds to the sunflower regions (J. F. Besser and J. L. Cummings, unpubl.

data). Finally, there may have been fewer marked birds in those roosts than was estimated.

We conclude that northwestern Missouri and southeastern South Dakota provide spring roosting sites for some of the male redwings that damage sunflower. Research is needed to (1) determine the timing and dispersal patterns of female redwings, (2) delineate further the distribution of redwings dispersing from various spring roosts in central U.S., (3) determine the total number of birds using those roosts during spring migration, and (4) determine the proportion of the birds using those spring roosts that are causing damage to sunflower. Those data should enable scientists to predict the cost-effectiveness of any management scheme designed to reduce populations of redwings.

#### ACKNOWLEDGMENTS

C. E. Knittle was responsible for the development and implementation of the project. G. M. Linz analyzed the data and prepared the manuscript. B. E. Johns was instrumental in developing the marking methodology. J. L. Cummings, J. E. Davis, Jr., and M. M. Jaeger participated in the laboratory and field phases of the project. Davis also entered the data into the computer and prepared the graphics. We thank the many cooperators from the United States and Canadian wildlife agencies for collecting birds in a timely fashion. J. L. Guarino provided helpful suggestions during the planning stages of the project. D. Anderson, J. Besser, G. Neuchterlein, and D. Otis reviewed earlier drafts.

#### LITERATURE CITED

- BESSER, J. F. 1978. Birds and sunflower. Pp. 263-278, in J. F. Carter, ed. *Sunflower science and technology*. American Society of Agronomy, Madison, Wisconsin.
- . 1985. Changes in breeding blackbird numbers in North Dakota from 1967 to 1981-82. *Prairie Nat.* 17:133-142.
- , J. W. DEGRAZIO, AND J. L. GUARINO. 1983. Seasonal movements of Red-winged Blackbirds banded in Brown County, South Dakota 1961-74. *N. Am. Bird Bander* 8: 140-143.
- , ———, ———, D. F. MOTT, D. L. OTIS, B. R. BESSER, AND C. E. KNITTLE. 1984. Decline in breeding Red-winged Blackbirds in the Dakotas 1965-1981. *J. Field Ornithol.* 55:435-443.
- DOLBEER, R. A. 1978. Movement and migration patterns of Red-winged Blackbirds: a continental overview. *Bird-Banding* 49:17-34.
- . 1982. Migration patterns for age and sex classes of blackbirds and starling. *J. Field Ornithol.* 53:28-46.
- , AND R. A. STEHN. 1983. Population status of blackbirds and starlings in North America, 1966-81. *Proc. East. Wildl. Damage Conf., Cornell Univ., Ithaca, New York* 1:51-61.
- GAMMELL, A., R. GAMMELL, AND J. F. BESSER. 1986. Seasonal movements of Red-winged Blackbirds banded near Kenmare, North Dakota. *Prairie Nat.* 18:123-127.
- GREENWOOD, H., AND P. J. WEATHERHEAD. 1982. Spring roosting dynamics of Red-winged Blackbirds: biological and management implications. *Can. J. Zool.* 60:750-753.
- HEISTERBERG, J. F., C. E. KNITTLE, O. E. BRAY, D. F. MOTT, AND J. F. BESSER. 1984. Movements of radio-instrumented blackbirds and European Starlings among winter roosts. *J. Wildl. Manage.* 48:203-209.
- HOTHAM, R. S., R. W. DEHAVEN, AND S. D. FAIRAIZL. Bird damage to sunflower in North Dakota, South Dakota, and Minnesota, 1979-1981. U.S. Fish & Wildl. Serv. Spec. Sci. Rep. Wildl. (in press).



- JAMES, F. C., R. T. ENGSTROM, C. NESMITH, AND R. LAYBOURNE. 1984. Inferences about population movements of Red-winged Blackbirds from morphological data. *Am. Midl. Nat.* 111:319-331.
- McMULLEN, M. P., ed. 1985. Sunflower production and pest management. North Dakota Ag. Exp. Sta. and North Dakota Coop. Ext. Service. North Dakota State University, Fargo, North Dakota.
- MEANLEY, B. 1965. The roosting behavior of the Red-winged Blackbird in the southern United States. *Wilson Bull.* 77:217-228.
- , AND R. DOLBEER. 1978. The source of Common Grackles and Red-winged Blackbirds wintering in Tennessee. *Migrant* 49:25-28.
- OTIS, D. L., C. E. KNITTLE, AND G. M. LINZ. 1986. A method for estimating turnover in spring blackbird roosts. *J. Wildl. Manage.* 50:567-571.
- ROYALL, W. C., JR., J. L. GUARINO, AND A. W. SPENCER. 1980. Seasonal dispersal of Red-winged Blackbirds banded in four western states. *N. Am. Bird Bander* 5:91-96.
- STEWART, R. E., AND H. A. KANTRUD. 1971. Classification of natural ponds and lakes in the glaciated prairie region. *Bur. Sport Fisheries and Wildl. Resour. Publ.* 92.
- WEATHERHEAD, P. J., J. R. BIDER, AND R. G. CLARK. 1980. Surfactants and the management of Red-winged Blackbirds in Quebec. *Phytoprotection* 61:65-71.

Received 10 Nov. 1986; accepted 19 May 1987.