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ABSTRACT: Attempts were made to investigate and account for some aspects of the present status of the black-breasted lark (Melanocorypha bimaculata) as a pest of sorghum in one of the rain-fed semi-desert areas of the Sudan. Also some observations were conducted to understand the behavior and the feeding habits of the pest in relation to crop damage phenology. Problems encountered in the application of some control techniques were discussed and evaluated in order to suggest sound control strategy.

## INTRODUCTION

The black-breasted or the Calandra lark (Melancorypha bimaculata) (Brehm) of the family Alaudidae is a winter migrant bird, noticeable for being a serious pest of sorghum in central Sudan from October to March. It is locally known as jaghiagha, an Arabic-Sudanese name derived from the loud cheery trill it constantly utters in flight.

Large flocks of this bird are common in the Gezira Province, yet it was overlooked and no attempts have been made to account for its pest status in relation to feeding behavior and crop damage phenology.

Butler (1911) has reported that it breeds in northern and central Asia and migrates in the winter to north Africa as far south as Ethiopia and the Blue Nile of Sudan. He has cited its abundance near Khartoum (Lat. 15°N & Long. 33°E) during the winters of 1909, 1910 and 1911. Mackworth-Poraed and Grant (1960) have reported that some of the 36 species of larks which occur in east Africa migrate from southern Europe, western Asia, and north Africa, and that this species migrates in its non-breeding season as far as latitude 14°N. Schmutterer (1969), however, has pointed out that it is a winter visitor from October to March during which it inflicts considerable damage to sorghum. Most describe the bird as a pest because it digs out sown grains.

This paper aims at describing and accounting for some aspects of the present status of the bird as a pest of sorghum in relation to its ecology, feeding habits, and crop damage phenology. Some bird control techniques were tested and evaluated in order to suggest a sound control strategy.

## THE STUDY AREA

### Location

Butana is a semi-desert area which lies approximately between Lat. 14° and 15°.30 N and Long. 33° -30 and 34°.30 E of the Blue Nile. The investigated area lies around Tundub village, northeast of Rufa a town (Lat. 14°-45 and 15.°15 N and Long. 33°.15 and 33.°45 E). This study area was visited twice; from 10 to 20 November, 1974 and from 17 to 27 November, 1975.

### Climate and Vegetation

The predominant vegetation in the Butana semi-desert area is the scattered Acacia tortilis alternated with wild grasses such as Cymbopogon nervatus. Climatic conditions are shown in Table 1.

Table 1. The average maximum and minimum temperatures, relative humidity and the total amount of rain from July to November for the years 1965-1975 that was recorded at Tambul Research Station, which is a few miles northwest of the study area (source = Sudan Meteorological Dept.).

| Reading | July | August | September | October | November |
|---|---|---|---|---|---|
| Av. Max. Temp. | - | - | 95 | 100 | 9 |
| Highest Max. | - | - | 106 | 105 | 106 |
| Lowest Max. | - | - | 78 | 82 | 85 |
| Av. Min. Temp. | - | - | 71 | 71 | 64 |
| Lowest Min. | - | - | 63 | 59 | 48 |
| R. Mat. 6 am | - | - | 72 % | 51 % | 35 % |
| Total R/F (mm) | 122 | 129 | 55 | 16 | 1 |
| Total R/F (inc) | 408 | 5 | 2.17 | 0.63 | 0.04 |

### Cropping System

Flood cultivation is the dominant agricultural practice where most of the flooding valleys (wadies) are fully utilized for growing sorghum during the rainy season from July to November. In the study area about 2600 feddans (1 feddan = 1.038 acres) of a local sorghum variety (Fetrita) was grown. The size of the cultivated area varies from year to year depending on the distribution and amount of rain flooding the semi-arid valleys.

## BIRD FLOCKING AND MOVEMENT

The black-breasted larks feed in groups of up to 200 birds; sometimes the flocks are larger but rarely exceed 400 to 500 birds -- possibly because the milky stage of sorghum is rarely abundant enough at any one locality to support more. Feeding is communal throughout the growing season but flocks are largest from mid September to mid October, when the sorghum heads are at either the milky and/or the dough stage. Flocks are not well integrated and birds continually join and leave. There is, in fact, a great deal of movements within the study area in response to changes in food supplies, and as a result larks occur in certain places at certain times of the day depending on the location of milky-stage sorghum and also the shift in harvest.

## FEEDING HABITS

Larks prefer to feed either by nipping out the grains from low heads, by collecting the fallen seeds, or by perching on large sorghum heads. When food becomes scarce they move progressively into open areas where the crop is gathered after harvest. They have difficulty in clinging to crop heads and do not feed by hovering. The first flocks appear in the fields about 10 minutes after sunrise.

The black-breasted lark, like Quelea quelea, has a short and rounded bill, presumably an adaptation for nipping out seeds from sorghum heads.

## BIRD-WATER RELATIONS

Water for living organisms must be maintained in certain concentrations for the proper metabolic functioning of the body. The question is how much water can be obtained by drinking and how much can be derived from the food? Amount of water obtained from succulent grain food must be much more than that from a diet of dry seeds. External conditions such as temperature, humidity, and the degree of activity of the bird are among other factors that affect the varying requirements for water.

The black-breasted larks have been closely observed from sunrise to sunset in the study area and around it to detect their drinking behavior. The only source of water, an irrigation canal, 10 miles from the nearest fields has been regularly watched throughout the day. For 4 days not a single bird was observed drinking. There is, therefore, strong evidence that larks in this area can either go for long periods without water or they are not obligatory drinkers.

If this is the case, then water as a physiological need is entirely derived from sorghum seeds. It may also be argued that drinking at very isolated water places in semi-desert areas like the Butana has several disadvantages to the bird. These are the great risk of predation, the larger expenditure of energy in flying for water, and the loss in foraging or feeding efficacy because of the gradual depletion of food as harvest approaches.

## DAY AND NIGHT ROOSTING BEHAVIOR

### Day Roosting

During the hot hours of the day, the birds roost twice, from about 10 to 11 a.m. and again from 1 to 2 p.m. For this behavior each bird rests on a flat hole dug from under a sorghum plant. Average plant density was 60/100 sq. meters (2520/feddan) and almost any area underneath a plant that was examined had one flat hole with fairly fresh droppings in it. Adequate shade depends on the length of the stem and the size and number of leaves. The bird uses its legs to dig out a flat hole about 4 cm deep so it can comfortably sit in it under the shade. The day-roosting behavior could be an avoidance of heat stress under semi-desert conditions.

### Night Roosting

After sunset all the birds move to an open desert area 5 miles from the fields and stay overnight. Similar flat holes were also prepared. One roosting site (2 miles x 1 mile) was found to occupy an average hole density of about 230/100 sq. meters. The average distance between holes was 20 to 50 meters, and the area was dominated by scattered bushes of a wild grass, Cymbopogon nervatus.

## CROP DAMAGE PHENOLOGY

An area of about 2600 feddans of a local sorghum variety (Fetrita) was visited to determine crop damage phenology. Sorghum is usually sown after the first rains, about the third week of July, and the crop reaches its milky stage about the third week of September, and matures about the second week of November.

Distribution and magnitude of damage depends largely on the feeding pressure of birds in relation to the progress of the varying degrees of crop maturity; with damage being heavy from milky to dough stages and moderate to light towards maturity (Table 2).

Table 2. Intensity of damage to sorghum in relation to length of plant, stage of crop maturity, and feeding behavior of birds.

| Length of Plant | Intensity of Damage | Stage of Crop | Feeding Behavior |
|---|---|---|---|
| 60- 99 cm. | Heavy | Milky | Nipping out |
| 100-119 cm. | Heavy | Milky to Dough | Nipping out |
| 120-139 cm. | Heavy to moderate | Dough | Perching |
| 140-159 cm. | Moderate | Dough to ripening | Perching |
| 160 cm. | Light | Ripening | Perching |

A crude visual-damage assessment was carried out at random in an area of about 100 feddans. From each feddan, 10 groups each of 10 sorghum heads were examined closely. The average bird damage varied from 15 to 40 percent. Due to variations in sowing dates, all stages of crop maturity were present in a field at any particular location.

## THREE CONTROL TECHNIQUES

### Poisoning of Artificial Drinking Waters

In this method, empty 44-gal. drums were longitudinally cut into two halves, buried in the ground inside the fields within close vicinity of day roosts, and each was filled with water treated with 0.5% fenthion (60% a/i) in water (Schmutterer, 1969). Each container was distributed at the rate of 1/100 feddans over a total area of about 1000 feddans. Each water location was visited 4 times a day for 4 days, but not a single bird was found dead or poisoned. However, 35 golden sparrows, Auripasser luteus (Licht), which are also pests of sorghum, were found dead. The failure of this method to control larks confirms the assumption that this species is not an obligatory drinker.

### Aerial Application of Fenthion

In this technique, a piper supercub fitted with boom and nozzles was used to spray a mixture of fenthion (60% a/i) with diesel oil at the ratio of 2 to 3 (24% a.i.).

The pilot was instructed to make three non-spraying runs over the treated fields; the first and the second to enable 3 observers using binoculars to visually count the total number of birds flushed from underneath the sorghum plants, and the third run was so the birds would be a good target for an air-to-air control operation.

The trial was conducted at midday in a selected area of about 100 feddans where the crop was a failure. Because of poor navigational tactics, possibly adverse weather conditions, and the quick landing of the birds, a mortality of only about 10% was achieved. The average number of birds counted prior to treatment (200,000 birds) was fairly close to the number measured by the average number of 2500 flat holes or birds per feddan multiplied by the 100 feddan of the treated area (250,000 holes or birds). All dead birds were collected daily for 4 days and counted, both from the trial area and the surrounding area.

### Poison Baits

In this method 1 kg. of Fenthion (60% a.i.) was thoroughly mixed with 12 kg. of sorghum seeds to insure good seed coverage. The poison bait was then broadcasted by hand at the rate of about 12 kg/ feddan under sorghum plants in a trial area of about 1/4 of a feddan. About 5 gm. of poisoned seeds were placed in front of each flat hole and a total of about 625 holes, where the birds roost during parts of the day, were treated in this manner. All of the sorghum plants in the treated 1/4 feddan area had no heads, which minimized the effect of food preference over the poisoned bait. Each flat hole was examined twice a day for 3 days. Again, not a single bird was found dead or poisoned. This result has been confirmed by collecting and reweighing the amount of bait remaining after 3 days.

## DISCUSSION

The problem of the black-breasted lark has been recorded as a serious pest of sorghum about 68 years ago (Butter, 1911); yet, it has since been overlooked and no attempt was made to account for its impact on crops or to suggest a sound control strategy.

Larks are winter visitors from October to March and they time their arrival when most of the sorghum is at the milky and/or dough stage. They feed and roost communally throughout the growing season. They may feed by nipping out the grains from low heads or by collecting them from the ground or by perching on large heads. The birds have never been observed digging out freshly sown seeds as pointed out by Schmutterer (1969), probably because sorghum is sown as early as July, three months before the arrival of birds.

Visual damage assessments carried out at random have shown that this species can inflict damage to sorghum ranging an average from about 15 to 40%, much greater than that of Quelea quelea, a well known pest of sorghum in semi-arid savannah areas of the Sudan.

Attempts were made to apply the knowledge of their feeding, drinking and roosting behavior on devising effective control techniques. The aerial application of an avicide (Fenthion 60% a.i.) which is usually used for the control of Quelea birds in Africa, the poisoning of artificial drinking waters, and the use of a poisoned bait treated with the same chemical have all failed to control the larks.

The failure of the first method was largely attributed to the unpredictable day-roosting behavior under the shade of sorghum plants. If the birds were disturbed to make them become a good target for aerial spraying, they quickly land and hide under the plants to escape chemical contamination.

The failure of the second technique was entirely due to the birds being non-obligatory drinkers, and they probably derive their water requirements from the sorghum seeds. However, the failure of the third method was attributed to considerable preference of sorghum as food over the poisoned bait. Although in this treated area, there was almost nothing to feed on; yet, the birds ignored the poison bait, presumably flying to other areas for food.

It seems from what has been explained that a sound control strategy should be based on an integrated approach whereby cultural methods and effective direct crop protection methods could be applied. Farmers should be urged to grow early maturing varieties of sorghum in order to escape bird damage in late September to early October, when the birds arrive. Because of variations in sowing dates of the present crop, timing of harvest should be precisely scheduled to deprive the birds from attacking maturing grains, particularly when there is high feeding pressure as a result of food scarcity. Other direct crop protection methods, i.e., the use of repellents, frightening agents, and noise-making devices should also be tested and evaluated under the semi-arid conditions of the Butana against a winter visitor like the black-breasted lark.

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