

benefit of the Forestry Branch and the ranchers of the Nicola Valley. Without trespassing on the grounds of this memorandum, I may say that I found that the spread of these locusts commenced from the Minnie and Courtenay Lake Districts, and that they travelled north at least as far as Kamloops, and extended west as far as Merritt and east as far as Kelowna. These areas are merely arbitrary as representing the probable centre of the infestation. The investigation into the Nicola country was begun in the first week of November, 1914, a very unpropitious time to study the adults, for very few could be found, and those adults found were dead and mutilated in the stacks of hay. The eggs were easily found, and in some instances in extreme numbers, indicating clearly that no disease of the adults had destroyed the females before their eggs had been laid. Where eggs were found in concentrated area, blister-beetle larvæ were also numerous enough, no doubt, to effect a fair means of control by next spring. Eggs on the range were normal and apparently healthy; consequently there is every indication that we shall again be bothered by the adults next summer unless one of the usual periodical diseases intervenes. I gathered that the outbreaks occur every seven years or so, and that the years when the locusts were most numerous and did most damage were 1889, 1898, 1907, and 1914, and that great damage was effected for about three years surrounding these dates. It is interesting to note that in one of Dr. Fletcher's old reports for 1898 (late Dominion Entomologist), on the authority of Dr. Scudder, the following species were involved: "The great mass of material was *Trimerotropis*, probably *cineta*." Out of the balance he made out the following species: *Camnilla pellucida*, *Cercotettix verruculatus*, and *Melanoplus atlantis*. These species were named from specimens from the Nicola District.

The next paper is one written by Mr. Lionel E. Taylor on "Notes on Birds likely to be of Service in the Destruction of Locusts in the Nicola Valley," and will ask Mr. Anderson to read this paper.

#### NOTES ON BIRDS LIKELY TO BE OF SERVICE IN THE DESTRUCTION OF GRASSHOPPERS IN THE NICOLA VALLEY.

BY LIONEL E. TAYLOR, F.Z.S., M.B.O.U., ASSOC.MEM.A.O.U.

The following notes are based on the reports on economic ornithology issued by the United States Department of Agriculture and from other sources; they do not pretend to be in any way complete, as the literature at my disposal is limited. The species of birds mentioned are those which may with some certainty be presumed to occur in the Nicola Valley in considerable numbers. There are many other species which occur in small numbers or at infrequent intervals, but these have been omitted, as it is not thought that they could be of economic importance.

It must be pointed out that almost all birds will eat grasshoppers at certain times, and especially when they are feeding their young. It is also important to note all investigation points to the fact that grasshoppers are exceedingly palatable to birds, and that when an incursion of these insects occurs a great many species of birds will depart from their usual diet and live almost entirely on grasshoppers.

Unfortunately there are no birds in this country which exist in such numbers as to be able to seriously cope with a large outbreak of grasshoppers as is the case in many other countries, and notably in Africa, where such birds as storks, pratincoles, kestrels, and others are capable of destroying entirely enormous swarms of locusts by their own efforts. In case, however, any doubt may exist on this point, I may mention that these flocks of birds frequently contain tens of thousands of individuals, and that they follow the swarms of locusts sometimes for weeks on end.

It must not be presumed from this that because we have no such enormous flocks of birds very little good can result. In California, where grasshoppers are annually a plague in one part or another, often numbering twenty-five to the square yard, it is conceded that the birds are not able to cause an appreciable decrease in

the number of grasshoppers; but, at the same time, it was estimated that on a square mile in an infested area the birds accounted for 120,445 grasshoppers daily, which must mean an enormous saving of damage.

The following is a list of useful birds likely to occur in the Nicola Valley. The nomenclature is that of the A.O.U. Check-list, 3rd edition. It must be pointed out that the figures given as to the percentage of grasshoppers eaten does not always refer to the particular species or subspecies found here in the West, but to the Eastern form.

WESTERN MEADOW-LARK (*Sturnella neglecta*).

This will probably be found to be the greatest locust-destroyer, and being present in large numbers during the summer it is of great economic importance. The percentage of grasshoppers eaten is 29 per cent. for the year and 42 per cent. during August.

DESERT SPARROW-HAWK OR KITTY HAWK (*Falco sparverius phalæna*).

This bird ranks very high as a grasshopper-destroyer and is abundant everywhere during the summer. Of 410 stomachs examined, 314 contained insects mostly grasshoppers. I have seen a great number of these birds shot under the impression that they are destructive to poultry; this is a popular erroneous idea, and farmers should be warned against shooting them. It is very seldom that they take birds, especially chickens, and then only when they are very small.

ARKANSAS KINGBIRD (*Tyrannus verticalis*).

A very abundant species, with a great liking for grasshoppers; percentage for year, 20 per cent.

KINGBIRD (*Tyrannus tyrannus*).

Similar habits to the above.

WESTERN BLUEBIRD (*Sialia mexicana occidentalis*).

MOUNTAIN BLUEBIRD (*Sialia currucoides*).

Although it might not be expected that so small a bird as the bluebird would be capable of consuming many grasshoppers, yet these insects form 22 per cent. of its diet throughout the year and 60 per cent. during August and September.

WESTERN ROBIN (*Planesticus migratorius caurinus* Grinnell).

This bird, which is particularly common during the late summer, feeds on grasshoppers to the extent of 10 per cent for the year and 30 per cent. for August.

NORTHWESTERN CROW (*Corvus caurinus*).

Grasshoppers form the leading diet of this bird during August.

BLACK-HEADED JAY (*Cyanocitta stelleri annectens*).

Grasshoppers form 5 per cent. of the diet for the year, 14 per cent. for July, 18 per cent. for August, and 10 per cent. for September. They are not found in any numbers except in the wooded regions.

BREWER'S BLACKBIRD (*Euphagus cyanocephalus*).

In California this bird ranks with the meadow-lark in being the most useful grasshopper-destroyer.

COLUMBIA SHARP-TAILED GROUSE (*Pedioecetes phasianellus columbianus*).

Although this species is said not to be of such value as the true prairie-chicken, yet it is probable that they consume large quantities of grasshoppers late in the summer. From nine stomachs examined, six contained 174 grasshoppers.

BLUE GROUSE (*Dendragapus obscurus richardsoni*).

The young of this species is fed largely on grasshoppers; the stomach of one examined contained twenty.

NORTHERN SHRIKE (*Lanius borealis*).

This bird is only mentioned as it is one of the greatest grasshopper-destroyers, but unfortunately is not plentiful enough to be of any importance here.

KILDEER (*Oxyechus vociferus*).

This bird, which is plentiful here in summer, is of considerable value as a locust-destroyer.

Sparrows of various species are of considerable importance; in June, when the larger species of grasshoppers are young, they form 36 per cent. of their diet.

BATCHELDER'S WOODPECKER (*Dryobates pubescens homorous*).

Grasshoppers' eggs are said to be freely eaten by this species.

It is perhaps superfluous to add that domestic fowls and turkeys are amongst the greatest destroyers of grasshoppers, a fact which should not be overlooked when dealing with small areas.

The meeting adjourned until 8 p.m.

In the evening Dr. S. Hadwen, Veterinary Pathologist, gave a lantern-slide lecture on the Cestridæ. The lecture was well attended and an enthusiastic discussion took place.

The meeting adjourned at 10 p.m.

### THE KANSAS REMEDY FOR THE CONTROL OF LOCUSTS.

BY ARTHUR GIBSON, IN CHARGE OF FIELD-CROP INSECT INVESTIGATIONS, ENTOMOLOGICAL BRANCH, OTTAWA.

In Entomological Circular No. 5 of the Dominion Department of Agriculture, which is now in press, and which is entitled "The Control of Locusts in Eastern Canada," I have given briefly the results in Eastern Canada following the use of the recently devised Kansas formula for the control of destructive locusts. Whenever opportunity occurs, we should be glad if farmers or others in British Columbia would try out this remedy and report to us, after the mixture has been given a fair trial.

The formula consists of: Bran, 20 lb.; Paris green, 1 lb.; molasses, 2 quarts; lemons, 3 fruits; water, 3½ gallons. The bran and Paris green are mixed thoroughly while dry. This may be done in a wash-tub or on a cement floor. The juice of the lemons is squeezed into the water, and to this is also added the pulp and peel after cutting into fine bits. The molasses should then be added, and when dissolved the mixture should be poured on to the dry bran and poison, stirring the whole constantly so as to dampen the bran thoroughly. When required for use, the bran-mash is sown broadcast in the infested locust areas early in the morning. The above quantity is sufficient to treat 5 acres. By scattering the mixture thinly a large number of locusts are killed, and when thus applied there is no danger of birds, poultry, or live stock securing a sufficient amount of the poison to kill them.

In our experiments near Ottawa, counts of dead locusts were made four days after the mixture had been broadcasted, and these gave from 50 to 414 to the square yard. In Quebec Province, however, from 900 to 1,200 dead per square yard were counted.

The Entomological Branch will be glad to correspond with farmers or others in British Columbia who may be troubled with locusts, or, as they are more commonly called, "grasshoppers." Specimens of the destructive species are desired. The circular above referred to will be sent to any one on request.