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Miscellanea.

The Control of the Tobacco Cricket *(Brachytrupes membranaceus* Drury*)* in Southern Rhodesia.

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This is a compilation of the results obtained from various experiments carried out during 1948-1952 regarding the control of the Cricket *Brachytrupes membranaceus* Drury, which is the most widely spread cricket pest in Southern Rhodesia. It is, like all other representatives of the Gryllidae (Achetidae), a thick-set insect, bearing the anterior wings flat on the abdomen and partly overlapping each other (see figure). There is in addition a smaller species (*Macrogryllus consocius* W.) which occurs in young planted Tobacco, but its incidence is limited. The Mole Cricket *(Gryllotalpa africana)* is also to be found in Southern Rhodesia, but its economic significance, at least for Tobacco, is doubtful.

The genus *Brachytrupes* seems to occur in the tropical and subtropical belt of Asia and Africa and *B. membranaceus* is, as far as we know, reported as destructive of young cultivated plants in the following countries:

TABLE 1.

Crops damaged by *Brachytrupes membranaceus*	Country or area	Authority	
Tobacco	Southern Rhodesia	*Jack*	(1929)
(field and nurseries)	Union of S. Africa	*Smit*	(1952)
Cotton	Uganda	*Hargreaves*	(1921)
	Belgian Congo	*Monteil*	(1934)
	Nyasaland	*Ballard*	(1914)
	Nigeria	*Lamborn*	(1914)
	Tanganyika	*Harris*	(1937)
Sorghum	East Africa	*Morstatt*	(1920)
	Sudan	*Zacher*	(1921)
	South Africa	*Smit*	(1952)
Coffee	French West Africa	*Vayssière* and *Meunier*	(1925)
	Kenya	*Anderson*	(1923/24)
	Uganda	*Hancock*	(1925)
	Northern Rhodesia	*Allan*	(1929)
	Madagascar	*Frappa*	(1933/34)
Citrus	Sierra Leone	*Hargreaves*	(1929)
Oilpalms	Sierra Leone	*Hargreaves*	(1929)
Tree Nurseries	Uganda	*Hargreaves*	(1921)

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Fig. 1. Adult female of *B. membranaceus* Drury (slightly enlarged).

The common species of South and East Asia is *B. portentosus* (syn. *achatinus* Stoll). It is reported to cause damage to Coffee, Tea, Rubber, Tobacco, Sweet Potatoes, Chillies, Manioc, etc. (*Sen*, 1921).

Brachytrupes membranaceus is confined in Southern Rhodesia to the sandveld, granitic in origin, where it has assumed the status of a major pest. Sands and sandy soils have a poor water retaining capacity which is linked up with a free percolation. These conditions ensure a permanent fairly low subterranean water table throughout the seasons and swamping of the soil does not generally occur. Soils which superficially dry up quickly and with loose mechanical structure allow easy digging. These are the cardinal environmental characteristics of the cricket, subterranean in its habits, coming to the surface at night for feeding and harvesting. Shallow soils with rocks and heavy gravel underneath are not suitable habitats, but deep sandy soils with a well developed profile, at least three to four feet, are required.

The normal food of *B. membranaceus* consists, according to the season, of fresh or dried-up leaves, stalks, seeds of herbaceous and woody plants, as ascertained by their larders kept in the bottom or subsidiary chambers of their burrows. We found on many occasions leaves and stalks of *Brachystegia randii, Isoberlinia,* leaves, flowers and stems of *Helichrysum argyrosphaerum,* leaves and shoots of grasses and leaves and stalks of young planted Tobacco, Sunnhemp, Maize and Beans, in burrows in cultivated lands.

Incidence in Tobacco Fields.

It has been generally noticed that border strips, narrow belts, and fields which are much longer than broad usually show the most concentrated number of Cricket holes, sometimes up to five per square yard. In large areas of cultivated lands the number of Crickets is, as a rule, very much smaller. Contour ridges which split up such areas into partitions harbour more Crickets than adjacent areas. Mapping of Tobacco lands gave the information that the borders show higher incidence of Cricket population. The irregularity in the distribution over a field naturally is also controlled by the level of the surface, but it is anticipated that the time and depth of ploughing up virgin and reverted land for first year Tobacco are liable to control the general pattern of Cricket distribution and its density. Termite heaps are never prone to be inhabited by Crickets.

The damage done by *B. membranaceus* in Tobacco fields to the stand is estimated to run between 5% and 30%; usually other pests, like Cutworms (*Agrotis segetum*), White Grubs (*Anomala* and *Schizonycha* spp.) and/or False Wireworms (Tenebrionidae) were found associated, which brought up the accumulated losses to 10-60%. From observations made during the period 1949/1952 it appears that a sequence of two or more seasons with a short fall of rain are favourable for the propagation and spread of *B. membranaceus*. On the other hand, wet seasons, especially those with an early onset of rains, lead to high mortality. The areas occupied by Crickets are restricted then to well drained lands, such as ridges and contour strips.

Crickets may cut 6-10 young Tobacco plants each in the vicinity of their burrows. Medium and fully grown plants do not suffer under the attack and the damage is therefore confined to newly planted out Tobacco and refills. On the other hand, regrowth of cut stems, bottom leaves of old Tobacco plants and eventually weeds serve as food resources. Damage to Tobacco seed-beds does not occur, as a rule, and only on one occasion were we able to find another species of Cricket (*Acanthogryllus fortipes* W.) during late November whilst cutting young Tobacco plants in a seed-bed.

Control Measures.

During the season 1948/1949, *Ashby* (1949) initiated the study of the ecology and biology of *B. membranaceus*. The extended investigation of the authors of this report included Cricket Control by means of synthetic insecticides, potassium cyanide and miscellaneous baits.

Cricket control, so far, was restricted in Southern Rhodesia to digging out by hand. On one farm, which was suffering notoriously from Crickets, potassium cyanide gassing was resorted to, with spectacular results. Prior to planting, 2.5 grams of KCN were applied by the spoon method to the partially opened hole system and then closed by means of sand and stones.

Observations and experiments carried out in the field as well as in the laboratory during 1949/1952 opened the avenue for an effective control of Crickets in Southern Rhodesia.

Field Tests.

Test No. 1.

Hard surface soil, road sites and grass-bush veld. Entrance holes to burrows open.

Date of treatment: 19. 6. 1951. Insecticides poured into the holes by hand and the holes closed. For detailed results see Table 2.

TABLE 2.

% Reduction of Active Mounds (Crickets Alive).

Chemicals:		1st inspection 16 July	2nd inspection 16 August	3rd inspection 20 September
Dust (± 1 gm.):				
BHC 3% dust		98.0	96.1	94.1
Chlordane 3% dust		90.0	90.0	95.6
Parathion 2% dust		96.7	98.4	90.1
BHC 40% w.p.	used as dusts	89.9	93.2	91.6
Chlordane 50% w.p.	used as dusts	96.6	100.0	96.6
DDT 50 w.p.	used as dusts	82.2	82.2	85.5
Parathion 25% w.p.	used as dusts	85.0	96.5	96.5
Non-treated:		0.0	24.2	27.6
Suspensions (1 gm. in 20 c.c.):				
BHC 40% w.p.		82.7	90.4	90.4
Chlordane 50% w.p.		84.9	91.9	95.3
Parathion 25% w.p.		75.9	89.7	82.8
DDT 50% w.p.		63.5	61.5	63.4
Non-treated:		0.0	40.2	44.9
Emulsions (20-25 c.c.):				
Chlordane 0.1%		79.0	94.2	97.7
BHC 0.2%		88.8	86.3	82.3
Parathion 1.0%		95.0	97.5	95.0
DDT 1.0%		83.9	96.4	82.1
Non-treated: A		0.0	23.7	25.0
Non-treated: B		5.0	22.6	47.1
Fumigants (gun):				
EDB 4 c.c.		98.2	100.0	94.4
EDB 2 × 4 c.c.		100.0	100.0	96.5
EDB 4 c.c.		94.4	93.0	92.6
EDB 2 c.c.		91.3	96.3	87.3
Non-treated:		33.3	39.4	42.5
DD 4 c.c.		96.5	100.0	100.0
DD 2 × 4 c.c.		100.0	98.1	97.7
DD 3 × 4 c.c.		95.7	97.1	97.8
Non-treated:		46.8	55.3	44.6

Comments:

The experiments were carried out on 1,936 burrows (28 plots) of which 187 served for checking purposes (6 blocks). From the survey of the latter the average natural survival potential could be assessed for the experiment period 19th June to 20th September.

TABLE 3.

% Reduction of Active Mounds.

Chemicals:	1st	2nd	3rd inspection
	16 August	8 September	20 September 1951
Dusts:			
BHC 5%	92.6	91.6	88.6
DDT 5%	93.9	84.0	87.8
Chlordane 5%	96.0	91.8	87.8
Toxaphene 5%	89.1	77.2	87.2
Non-treated:	35.0	38.5	57.7
Fumigants:			
EDB 4 c.c. (diluted)	73.7	88.3	90.1
DD 4 c.c.	59.8	97.2	95.4
Non-treated:	26.7	28.4	28.4
Ca-Cyanide (1.75 gm.)	78.3	80.0	82.5
Non-treated:	29.7	30.3	31.5

% Reduction of June Populations in Check Plots.

Date:	19. 6.	16. 7.	16. 8.	20. 9.
	—	4.2	31.9	*38.6*

The reduction is considerable in view of the fact that ample and normal food supplies were available.

20th September. Chemical control. June treatments:

Dust: BHC, Chlordane and Parathion respectively yielded 90-96% control. DDT lagged behind with 85.5%.

Suspensions: Chlordane and BHC: 90-95% control. Parathion and DDT were much less effective.

Emulsions: Parathion 1.0 and Chlordane 0.1%: 95-97% control. BHC 0.2% and DDT 1%: 82% control.

Fumigants: DD (mixture of 1,2-dichloropropane and 1,3-dichloropropylene) and E.D.B. (ethylene dibromide) (4 c.c. each): 92-100% control.

Conclusions:

The experiments indicate that the expensive fumigants, as well as the suspension and emulsion forms of insecticides, can be replaced by dusts of Chlordane, BHC, Parathion and DDT respectively, in the combat of Crickets during the off-season.

Test No. 2.

A second series of experiments laid out later, 18th July 1951, on the same farm, comprised 1,110 burrows of which 253 served as checks; the insecticidal dusts (approx. 3 grams per hole) were not applied by little spoons as in the first test, but by hand-blower pump, to which a suitable tube was attached.

Comments (3rd inspection):

The *quick* application of insecticidal *dusts*, containing 5% a.i. with the hand-blower, inevitably linked up with wastage, produced, when applied in July, results somewhat inferior to those obtained in the first set of experiments, not exceeding the 90% mark.

The fumigants again proved to be very satisfactory (90-95% kill).

Calcium cyanide, applied to the holes in compacted soil, failed to give a 90% control.

The assessment of the Natural Mortality in the three non-treated plots, yielded, on an average, the following results:

% Reduction of the July population.

18. 7.	16. 8.	8. 9.[2]	20. 9.
—	30.1	32.4	39.2

Test No. 3.

Old land under veld-grass, to be taken under Tobacco, 20 lb. and 30 lb. respectively per acre.

Treatment: *Poisoned bait;* applied by broadcasting. Time required: 25-30 minutes per acre.

Experiment set up: 23rd August 1951. Size of plots: 1 acre each.

Inspection: 1st September 1951.

Composition of Bait	*% Reduction of Active Mounds*
20 lb. (18 lb. Bran and 2 lb. 5% BHC)	18-20%
30 lb. (27 lb. Bran and 3 lb. 5% BHC)	25-30%
20 lb. (18 lb. Bran and 2 lb. 10% BHC)	25-30%
30 lb. (27 lb. Bran and 3 lb. 10% BHC)	30-40%

Check plots. Initial populations per acre varying between 462-2,684.

Average: 1,570 per acre reduced to 1,399 = 10.9%.

Comments:

The original plan to have the trials replicated on half the field burnt prior to application, thus eliminating the natural food resources, had to be abandoned because no proper fire could be obtained as there was no continuity of the vegetation cover.

The trials produced results very inferior to those obtained in certain baiting experiments carried out in the last season. The local brand of wheaten bran available for the making up for the bait proved to be too fine and fluffy to be attractive to the Crickets whilst an abundance of normal food resources was present.

Test No. 4.

In view of the poor results obtained, another trial was set up in a field on the same farm with *Fumigants* applied by injection gun on the 5th September 1951.

Inspection: 22nd September.

[2] Some erratic rains occurred at the beginning of September.

	Initial population	Residual population	% Reduction
DD 5 c.c. per hole	1,228	208	83.1
EDB 1.5 c.c.	1,270	266	79.1
EDB 2 × 1.5 c.c.	1,190	215	82.0
Non-treated:	1,316	840	36.2

Comments:

The results obtained on plots ranging in size between 0.57 and 0.63 acres, demonstrate that with increasing age of the Crickets, combined with more voluminous and complicated architecture of the burrows, the fumigants do not reach a 90% efficiency. It is necessary to have the survivors re-treated.

The comparatively high natural reduction of the number of active Crickets within 17 days is of particularly practical importance.

Test No. 5.

In an already planted up Tobacco field, the usual method of digging out the Crickets was adhered to: on the 12th November, for instance, 15 labourers collected during the day 1,691 specimens. The pest could not be brought under control within a reasonable time.

On the 19th November, Lucerne available on this farm was cut and soaked with 1% Chlordane-emulsion and scattered over the ridges of a marked out infested plot.

On the 21st November, four labourers dug out from this plot 480 Crickets, of which 384 (80%) were dead.

On the 9th December, only very few apparently active mounds remained. The digging up of four of these burrows produced three dead Crickets, the fourth burrow was found to be empty.

Test No. 6.

Tobacco land, 1st year, bare fallow.

The very encouraging results obtained in Test No. 5 called for more baiting experiments.

Bait: Old Tobacco seedlings from seed-beds, chopped up, dipped in a 0.2% a.i. Chlordane-emulsion and applied to the field on the 11th December 1951.

1st inspection: 18. 12.

Bait applied to:	Crickets in burrow		Burrows empty	% Efficiency
	Dead	Alive		
1. Mounds only	36.4%	6.0%	57.6%	94.0%
2. Broadcast all over the infested area	27.0%	8.0%	65.0%	92.0%
3. No bait	—	100.0%	—	0

Nine days after the 1st inspection a control of 98% and 96% respectively was obtained.

Test No. 7.

Few Crickets, approximately 80 per acre, had to be eliminated in order to ensure reliable results with respect to other pests under experimental test.

Treatment: 18. 12. 1951 with old Tobacco seedlings chopped up and dipped into *0.2%* Chlordane-emulsion for 15 minutes.

Results: 4 days after treatment, all Crickets dead or burrows found empty.

Biological Control.

The following is a list of the entomophagous arthropods more or less regularly found preying on or parasitising *B. membranaceus* in Southern Rhodesia.

Insecta:

Hymenoptera:

Various species of *Doryline ants*. Predators. Only occasionally of practical importance.

Sphex (Psammophila) egregia Mocs. race *transvaalensis* Cameron (Sphegidae): not very frequent.

S. spp., indet., not frequent.

Chlorion xanthocerum Illig. var. *kigonserona* Strand (Sphegidae): wide range of distribution, very common and most frequent of the Sphegides capturing *B. membranaceus* in Southern Rhodesia. November to March.

Ch. xanthocerum Illig., three varieties not identified: fairly frequent.

Notogonidea bembesiana Bischoff (Sphegidae): widespread, fairly frequent, preying on young generation of *B. membranaceus*. April to June.

Larra spec. indet., (Sphegidae): apparently rare; January; strongly suspected to prey on *B. membranaceus*.

Coleoptera:

Scarites natalensis Boh. (Carabidae): Predator. In some instances found to be fairly numerous and effective.

Mantichora scraba Klug. (Cicindelidae): Only occasional predator. Widespread, fairly common.

Arachnoidea:

Solifugae:

Solpuga rhodesiana ? n.sp. Predator of young Crickets only; not common.

Araneidae:

Ocyale atalanta. Predator of young Crickets only; not common.

In addition we found that the entomophagous fungus, *Beauveria bassiana* Bals., occasionally attacks *B. membranaceus*, especially under increased moisture conditions of the soil.

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