Full details will be published elsewhere.

Organic Chemistry Laboratories, Indian Institute of Science, Bangalore, March 15, 1948.
A. C. Roy. B. H. Iyer. P. C. Guha.

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LIFE-HISTORY, BIONOMICS AND CONTROL OF JOWAR STEM-BORER (*CHILO ZONELLUS* SWINHOE)

Jowar (*Andropogon sorghum*) crop is usually attacked by stem-borers, such as *Chilozonellus*, *Sesamia inferens* and *Anthomyiad* flies, of which the first one is of considerable significance in the Bombay Province. The percentage of infestation at Poona varied from 57·7 to 79·4 in different varieties of *jowar* during 1945-46. Previous reports, however, indicate the maximum infestation going up to 86 per cent. in Surat during 1925-26.

The literature on this pest being very meagre, investigations were taken up with a view to studying the systematics of this species as well as its bionomics and other details.

An inquiry among entomologists showed that Rahman (Punjab) and Lal (U.P.) are of the opinion that *C. zonellus* is a synonym of *C. simplex*, whereas Hinton (London) and Cherian (Madras) differ from them in this respect.

Since considerable controversy existed about the presence of two species, namely, *C. zonellus* and *C. simplex*, detailed study was made in this respect, and all the characters were compared with the descriptions and diagrams collected from various countries like Japan, China and the British Museum, London. In India, species were collected from Poona, Padegaon and Delhi on different food plants, namely, *jowar*, maize sugarcane, rice, grasses, etc., and their characters noted.

Our investigations have shown that *C. simplex* and *C. zonellus* are two distinct species, and the species on *jowar* in India is exclusively *C. zonellus*. Its detailed life-history, seasonal history and the effect of different environmental factors on differentstages, have been thoroughly worked out. The nature and extent of damage has been studied and some control measures tried. Parasitization in nature was studied and the different species of parasites recorded.

There are 4 to 5 generations a year, and each life-history may occupy 29 to 210 days, depending upon temperature, overlapping of generations being not uncommon. The egg stage lasts for 4 to 9 days, caterpillar 18 to 193 days and the pupal 6 to 12 days. Hibernation during winter is in the caterpillar stage. Alternative host plants include many of the millets and other wild grasses. It is parasitized by *Dipterous* and *hymenopterous parasites*, the most important being a *tachnid* fly. Preventive methods of control, namely, destruction of "deadhearts" at the time of thinning, are of practical importance. Exposing the *jowar* stalks or stubbles to direct Sun's heat for 2 to 3 months, or burying the stubbles 5" below the earth for more than a month, kills all the hibernating caterpillars.

The detailed accounts of our findings are being published separately.

College of Agriculture, Poona 5, April 1, 1948.
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TRIALS WITH 666 AGAINST INSECTS AFFECTING GRAINS IN STORES

THE toxicity of Gammexane to the rice weevil, *Calandra oryzæ* L., the red flour beetle, *Tribolium castaneum*, and the saw-toothed beetle, *Silvanus surinamensis*, was determined by (1) mixing the insecticide with the grains, (2) dusting the inside of bags, (3) dusting the godowns and outside of the bags.

One lb. of wheat grain mixed with Gammexane, D 230, and 100 specimens of each of the three species of insects were introduced separately into 2 lb. jars. The insecticide at five different levels of concentration was tried as shown in Table I. The experiment together with control was replicated three times. Temperature and humidity were recorded daily.

TABLE I

Effect of Mixing D. 230 with Wheat

No.	% D 230 mixed with talc	Percentage mortality of insect at 2-day intervals. (Average of three replications)												% 666 on grain
		2			4			6			8			
		Percentage Mortality												
		C	T	S	C	T	S	C	T	S	C	T	S	
1	0·1	70	20	64	83	28	74	90	38	74	100	52	86	0·0002
2	0·3	76	40	67	92	52	75	9·	64	77	100	84	87	0·0006
3	0·4	82	60	68	96	64	74	96	70	80	100	84	90	0·0008
4	0·45	86	64	72	96	65	75	97	73	82	100	93	94	0·0009
5	0·5	86	68	74	98	70	78	100	76	86	··	95	97	0·001
6	0·5% Talc.	36	12	4	46	32	21	52	40	27	60	48	34	Nil
7	Control	18	0	8	27	16	17	36	25	25	48	34	33	Nil

C = Calandra oryzæ. T = Tribolium castaneum
S = Silvanus surinamensis

The above table shows that 0·5 per cent. D 230 gave a 100 per cent. kill of *Calandra oryzæ* in 6 days. Other strengths also gave a 100 per cent. kill of the same insect, but in 8 days. *Tribolium castaneum* and *Silvanus surinamensis* were less affected by the insecticide, and cent. per cent. mortality of these insects was not obtained in the same period required to kill *Calandra oryzæ*.

Gunny bags of five lb. capacity were dusted on the inside with D 230, two lbs. of infested wheat was then introduced into each bag. The percentage mortality of *Calandra oryzæ* is shown in Table II.

Dusting of bags at 1 per cent. D 230 kills all the insects after about 7 weeks, and the effect of the treatment lasts even after 11 weeks.

Three godowns, each of 1,200 cft. capacity, containing 108, 105 and 210 bags of both rice and wheat were dusted with the insecticide at the different levels as shown in Table III. A fourth godown containing 100 bags was left untreated as control. The percentage mortality of *Calandra oryzæ* is given below.

TABLE II
Effect of dusting bags with D 230 on Insect Mortality

No.	% D 230 with talc.	Percentage mortality of *Calandra oryzæ*		
		20 days	51 days	81 days
1	0·25	14	50	35
2	0·5	46	75	100
3	1	50	100	100
4	Control	5	8	28

TABLE III
Percentage mortality of Calandra oryzæ *in treated godowns in a period of four days*

No.	% D 230 with talc	Room No.	Percentage mortality of rice weevil before dusting	Percentage mortality of *Calandra oryzæ*— days after dusting		
				2nd	3rd	4th
1	0·24	1	6·24	35·9	27·3	27·1
2	0·5	2	2·8	40	62·5	54·1
3	1	3	8·3	100	100	100
4	Control	4	3·1	7·2	6·1	8·4

The table shows that 1 per cent. D 230 gives cent. per cent. mortality on the second day.

All these data show that if all these treatments are applied simultaneously large quantities of grains can be saved from insect pests, especially from *Calandra oryzæ* which is the chief and serious pest of grains in stores.

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March 23, 1948.

INSECT PESTS OF STORED GRAINS IN BOMBAY GODOWNS

BEFORE war, Bombay didn't feel the necessity to import the grain from abroad, and whatever was imported from other provinces, was not stored for any considerable period, but it was disposed off immediately. Since 1944, however, the foodstuff was imported from outside and the introduction of rations resulted in stocking the food grains in godowns.

Before 1944, about thirteen species of store pests were recorded of which only five were of major importance. After 1944, however, the number of insects infesting stored grains went on increasing a list of which is given below.

TABLE I
Insect Pests in Stored Grains in Bombay

Scientific name	Food grains infested	Status	Remarks
Insects recorded up to 1944			
1 *Sitophilus oryza* L. (Small strain) ..	Wheat, Maize, *Jowar*, Bajri, Rice and Barley	Major	
2 *Rhizopertha dominica* O. ..	Wheat, *Jowar*, *Bajri* and Split pulses Barley	Major	
3 *Pachymeres chinensis* F. ..	Gram, Moong, Tur, Soya bean and *Urid*	Major	
4 *Pachymeres analis* F. ..	do.	Major	
5 *Sitotroga cerealella* O. ..	Wheat, *Jowar* and paddy	Major	
6 *Corcyra cephalonica* St. ..	Rice, *Bajri*, Wheat and Split pulses	Minor	
7 *Tribolium castaneum* H. ..	Damaged grains and milled products	Minor	
8 *Lætheticus oryzæ* Wat. ..	do.	Minor	
9 *Oryzæphilus surinamensis L.*	do.	Minor	
10 *Læmophlœus minutus* O. ..	Rice and Wheat	Minor	
11 *Alphitobius picous* O. ..	Wheat, Rice, *Jowar*, Bajri, *Barley* and Pulses	Minor	
12 *Tenebroides mauritanicus* L.	Wheat and Rice	Minor	
13 *Periplanata americana L.* ..	Wheat *Jowar* and Rice	Minor	
14 *Trogoderma granaria* E. ..	Wheat, *Bajri*, Barley, Rice, *Jowar* and Pulses	Major	Introduced from the Punjab, C.P. and Sind with Wheat and Rice
15 *Plodia interpunctella* H. ..	Canadian Wheat	Major	With American Wheat, in 1945
16 *Ephestia cautella* Wlk. ..	Australian and Canadian Wheat	Major	With Australian Wheat, in 1945
17 *Sitophilus granarius* L. ..	Wheat, *Jowar* Barley and Maize	Major	With American Wheat, in 1944
18 *Sitophilus oryza* L. (bigger strain) ..	Wheat, Maize, *Jowar* and Barley	Major	With American Wheat in 1946
19 *Tribolium confusum* J.Du.	Damaged grains and milled Products	Minor	With American Wheat
20 *Bruchus phaseolus* L. ..	Gram	Minor	On Gram from other provinces
21 *Pyroderces rileyi* W. ..	Maize	Minor	On Maize from Argentina in 1946

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