Discussion: Whether the scutellum in the young embryo exercises any special physiological function for the promotion of growth in the young embryo or merely plays a physical role in providing the absorption surface necessary for the supply of nutritive elements to the embryo is a matter for more critical investigation. The large growth for the embryo whose scutellum is not removed, in this experiment, may be attributed either to the one or the other of the two possible functions of the scutellum stated above, or to both. The poor growth of the embryo in which the scutellum was removed may be partly due to the shock sustained by the embryo in the process of the removal of the scutellum. But this should not last long and the young growing embryo should be able to get over this shock and continue growth if the scutellum had no vital connection whatsoever with the growth promotion in the young embryo. Hence it seems that the scutellum does play a definitue role in the promotion of embryonic growth.

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Some Experiences with BHC (Gammexane) and DDT.

V. The Cotton and Bhindi Jassid, (Empoasca devastens, D)

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Jassids, popularly known as leaf-hoppers, belong to the category of bugs. These are tiny, active wedge-shaped creatures, infesting a variety of cultivated crops. The adults and nymphs are provided with a set of piercing and sucking mouth-parts with which they are able to puncture the tender portions of the plants and suck up the nutrition. The bugs usually occur by millions on their respective hosts and despite their minute size, they are capable of causing an enormous drain of the cell-sap. Over eight species of these jassids have been recorded as crop pests in South India, the more serious forms of which are (1) The paddy jassid (*Nephotettix bipunctatus*, F.), (2) the mango hoppers (*Idiocerus Atkinsoni*, L.) and (3) the cotton jassid (*Empoasca devastens*, D.). The present article is about the last mentioned species.

Previous History: This leaf-hopper has been recorded as a pest of exotic varieties of cotton for over 40 years and its ravages have since been progressively assuming more and more serious proportions. Considerable attention has been devoted to the study of this troublesome insect and a volume of information has since accrued, the bulk of which consists of data on the different species of jassids, their taxonomic characters, their life-history, habits, seasons of occurrence etc.

The more important line of work has, however, centred round breeding strains of cotton resistant to these jassids. The consensus of opinion appears to be that the hairiness of the plant has a direct relation to its resistance to the jassid. But this character itself is reported to be influenced by factors like rainfall, variations in the climatic conditions, soil fertility etc. Special mention has to be made of strain Nos. 2, 3 and 4 of Cambodia cotton evolved and distributed by the Cotton Specialist, Coimbatore, which possess a remarkable degree of resistance if sown in the proper season and followed by favourable weather conditions, adequate irrigation facilities etc. The major factor contributing to the resistance is reported to be the pronounced hairiness of the first four leaves which inhibits the initial infestation and consequently the further multiplication of the jassids. Even these strains, if sown out of season or grown under unfavourable conditions, do get the infestation and suffer, but recover soon after the virulence of the pest subsides, whereas the susceptible types invariably succumb. While it has to be admitted here that the evolution of the insect-resistant strains has gone a long way to solve the problem, the help of pesticides has necessarily to be called in to keep down the damage even in the resistant varieties (if they are unable to exhibit their inherent qualities due to environmental factors). The chemical treatment is indispensable in the case of strains which are not endowed with any degree of immunity.

Pesticides like Nicotine dust and spray, kerosene emulsion, sulphur, Bordeaux mixture, etc. have been given a fair trial. Of these, only the first mentioned two are reported to have given a certain amount of relief. The beneficial results should have been more against the younger stages, since the adults invariably escape the direct hit of the contact insecticides by virtue of their powers of quick flight. Even the little reduction, if any, should have obviously been made up by the subsequent quick breeding of the jassids. The indifferent results of these chemicals are perhaps more obvious from the fact that none of them have since been adopted for the control of these jassids on a field scale. More tangible results have recently been achieved in the Punjab (Rahman 1946). Application of DDT dust mixed with ash at 0·5, 1·0 and 2% concentrations is reported to have caused an entire mortality in the course of 24 hours.

Life-History and Habits: The jassids occur practically throughout the year, but assume serious proportions by December–January. The life-history of the bug is briefly as follows: The female inserts her eggs singly, generally inside leaves, leaf-stalks, veins, young shoots etc. The egg stage lasts from 5 to 15 days and the nymphal period from 10 to 12 days passing through 5 instars. Mating takes place 2 to 16 days after the last moult and the oviposition 2 to 7 days later. The maximum egg-laying capacity of a female is recorded as 29, but the eggs are laid in the course of a fortnight. While this is about the general rule, striking variations have been recorded in the duration of the nymphal stage and the longevity in the Punjab, where extremes of climate are more pronounced. The nymphal period extends to 7 days in autumn, and is prolonged to 21 days during the cold weather. Mated adults live up to 36 days in summer and 48 days during winter. Unmated adults survive for about three months when carefully fed. Certain colour variations also are said to occur during the different seasons, the winter broods being markedly reddish, while the summer ones are greenish yellow.

Host Plants: Exotic and indigenous cottons, brinjal (*Solanum melongena*), bhindi (*Hisbiscus esculentus*), sun-flower (*Helianthus annus*), Hollyhock (*Althea rosea*) and potatoes are the favourite hosts.

Nature and Extent of Damage: Cotton: A severe attack is first indicated by the presence of millions of the hoppers which fly about when the plants are disturbed. The infestation commences during the earlier stages of the crop and reaches the maximum by December-January. More obvious indications are exhibited by the yellowing or reddening of the lower leaves, while the younger leaves at the terminal ends present a crinkled appearance. The growth is retarded and the plants invariably succumb in the case of the susceptible varieties. In the few that survive, flowering is sparse, boll-formation poor and the quantity of the yield poorer.

Bhindi: Of late, these jassids appear to have developed a partiality for this vegetable. They occur almost throughout the year, but the infestation manifests itself to an alarming degree during February—March. The leaves turn yellow and more often get crinkled and cupped. The affected plants remain stunted in growth and ultimately wilt away. But these symptoms should not be confused with those of the virus disease which is altogether a different malady. This disease is transmitted by an *Aleurodid*, (*Bemisia gossypiperida*) and is characterised by the yellowing of the leaves with the peculiar reddish streaks on either side of the veins. With the progress of the disease, the discoloration spreads to all the leaves which eventually fade away. Strange as it may be, that while the complaint is so virulent and destructive, one finds very few of the vectors on the plants themselves. The redeeming feature of the jassid trouble is that the plants recover their normal growth soon after insect factor is eliminated, while those affected by the virus are definitely doomed and the only method of control would be to pull out and destroy the sick plants so as to prevent the spread of the infestation.

Brinjal: The symptoms of attack in this plant also are evinced by the crinkling and discoloration of the leaves and poor growth of the infested plants.

It has also to be mentioned in this connection, that all the host plants of this jassid are susceptible to virus diseases, transmitted by different insect vectors and that the bug itself even if it occurs on a pest form, is absolutely innocent of this more serious and incurable malady.

Work Done: A serious incidence of the pest almost threatening the wholesale ruin of some experimental work on bhindi, was reported during September 1948 from the Millet Breeding Station. Trials were undertaken with the recently available formulations DDT, BHC and and Hexa-ethyltetra-phosphate (H. E. T. P.) as sprays at 0·1, 0·1 and 0·05% strengths respectively. H. E. T. P. and DDT caused an appreciable mortality, while BHC was practically inert. Subsequent trials conducted more on an exploratory basis against the same pest on cotton during December 1948, confirmed the specific action of DDT as spray at 0·1%. The studies were pursued during 1949 on bhindi at the Central Farm, Coimbatore, the variants being DDT 3 and 5%, BHC 5% dust, DDT spray at 0·1% and of BHC at 0.05%. The data on the initial population, the percentage of reduction 24 hours after treatment as well as the yields were gathered and a gist of the same is furnished in statement No. 1.

The following are the broad conclusions available from these figures.

1. Between DDT and BHC, the former appears to have a specific action against the jassid both as dust and spray;
2. The spray at 0·1% is more economical and efficient, the cost being Rs. 5—8—0 per acre per treatment;
3. The yield of the treated plots appreciated by 28% as a result of the elimination of the jassid;
4. The pest being mild at the time of the observations, the difference in the yield has not been sufficiently striking. Exploratory trials conducted during the months of February to April when the jassid was more virulent, indicated additional yields ranging from 120 to 380% over the control for the same treatment.

Similar trials were conducted against the same leaf-hopper on brinjals and the percentages of reduction in the population are given in this case also.

The experiments were continued with DDT 2% and 5% dusts and sprays at 0·1% and 0·05% against the same jassid on cotton at the Cotton Breeding Station during December 1949 and a gist of the results is furnished in statement III.

The data indicate the very high mortality caused by the DDT dust and spray and the latter being quite efficient even at 0·05%. The cost of the treatment works to Rs. 4-2-0 per acre.

The results of Hexa-ethyl-tetra-phosphate (H. E. T. P.) are equally promising and it is proposed to develop the use of this chemical further.

Residual Effects: Small plots severely attacked and situated in the middle of a badly infested field were treated with the dusts and sprays mentioned above and the progress of the jassids observed. The treated plants were free for 10 days, after which an appreciable number of the jassids were found breeding on these plants. This gives us a broad indication that the residual effects of DDT last for about 10 days in the field.

It has to be mentioned here that though the availability of DDT and BHC has been a blessing by itself, certain untoward effects are likely to be experienced in the actual use of these chemicals on a field scale. The treated plants invariably get a heavy infestation of mites and sometimes of aphids as well. The secondary infestation can be attributed to the probable lethal action of the insecticides on the parasites and predators, which usually exert a natural check on the undue multiplication of these pests. The control of these insects is a simple affair, but a note of warning has to be sounded against the indiscriminate use of the chemicals, especially on crops, which are susceptible to infestation by mites, aphids etc.

The kind help and facilities rendered by the Cotton Specialist, Superintendent, Central Farm and the Millet Specialist are gratefully acknowledged.

STATEMENT—I.

Results of trials against the Jassid (Empoasca devastens) on Bhindi.

Locality: Central Farm, Coimbatore
Lay-out: Randomised plots replicated four times
Number of treatments: Six
Size of plot: 0·6 cents per replication per treatment

Treatments	Jassid population on 5 leaves			Yield per acre in lbs.	% increase of yield over control	Cost of treatment per acre		
	Before treatment.	24 hours after treatment	% reduction in population			Rs.	A.	P.
DDT 3% dust ...	44	7	84	1,043	29	17	8	0
DDT 5% dust ...	55	6	89	898	10	21	14	0
DDT 0·1% spray ...	42	3	93	1,038	28	5	8	0
BHC 5% dust ...	51	23	55	818	nil	10	5	0
BHC 0·5% spray ...	45	48	nil	895	10	12	11	0
Control ...	60	40	33	813	...		...	

STATEMENT—II.

Results of trials against the Jassid (Empoasca devastens) on Brinjal.

Locality : Ryots' field at Tudiyalur
Layout : Randomised plots replicated four times
Size of plot : 2 cents per replication per treatment

Treatment	Jassid population on 20 leaves				Cost of treatment per acre		
	Before treatment	24 hrs. after treatment	% reduction in population	72 hrs. after treatment	Rs.	A.	P.
DDT 5% dust ...	177	45	74·5	15	15	0	0
DDT 0·1% spray ...	436	62	85·7	45	6	0	0
BHC 5% dust ...	328	162	50·6	198	9	0	0
BHC 0·1% spray ...	334	225	32·6	120	17	0	0
Control ...	541	576	nil	334		...	

STATEMENT—III.

Results of trials against the Jassid (Empoasca devastens) on Cotton

Locality : Cotton Breeding Station, Coimbatore
Lay-out : Randomised plots replicated two times
Number of treatments : Six
Size of plot : 2½ cents per replication per treatment

Jassid population on 10 leaves.

Treatments	Initial counts		24 hours after treatment		48 hours after treatment		% reduction in population after 48 hours.		5 days after treatment		10 days after treatment		Cost of treatment per acre		
	A.	N.	A.	N.	A.	N.	A.	N.	A.	N.	A.	N.	Rs.	A.	P.
DDT 2% dust ...	62	62	2	7	2	4	96	93	4	...	28	10	17	8	0
,, ·5% ,, ...	51	90	...	4	...	4	100	96	...	3	20	...	25	0	0
,, ·1% spray ...	51	86	...	6	1	3	98	96	1	...	15	...	8	4	0
,, ·05% spray ...	49	93	...	4	1	3	99	97	1	...	28	...	4	2	0
HETP ·1% spray ...	20	34	1	1	1	2	95	94	2	...	18	14	7	8	0
Control ...	32	17	35	16	83	19	...	...	40	31	42	18		...	

A. Adult ; N. Nymph.