USE OF TRAPS FOR PEST/VECTOR RESEARCH AND CONTROL

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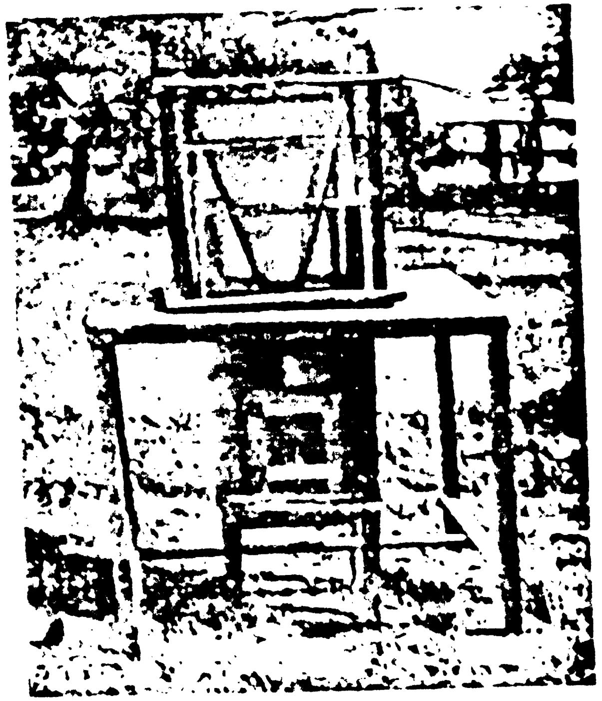

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USE AND DEVELOPMENT OF INSECT TRAPS AT ICRISAT

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ABSTRACT

Several types of insect traps are being used by entomologists at ICRISAT in their pest-management research on sorghum, millet, groundnut, pigeonpea, and chickpea. The various traps, most of which have been developed or adapted at ICRISAT, are described. The utility of these traps for monitoring and pest management is discussed.

Introduction

The use of traps for monitoring insect populations is increasing as more attractants are discovered. Although traps and attractants of various kinds are being produced commercially in both developed and developing countries, controversy persists over their value as a means of controlling or even monitoring insect populations. This paper does not attempt to examine the value of trapping *per se*, but provides information on the various traps tested at ICRISAT for monitoring the major insect pests of our mandate crops. Some of these traps were designed, and nearly all of them were constructed in our laboratories and workshops.

The traps described here may be classified into two main categories: (a) those that involve sources of attraction, "attractant traps"; (b) those that catch insects by obstructing their activities—"obstruction traps". Traps combining both these principles or involving more than one source of attraction are named after the major source.

ATTRACTANT TRAPS

Light Trap:

The use of light as a source of attraction for certain insects is well known. Light traps for catching insects have been in use for many years. Well-known designs of light traps include the Rothamsted trap, most important source of loss. A summary of the data recorded by the surveys from 1977 to 1982 is shown in Table 2. In addition, limited surveys were undertaken at the vegetative stage of crop growth in some areas. The data on plant mortality recorded from these surveys are also incorporated in Table 2.

The overall pod damage recorded from the survey was surprisingly low, less than 8%. Many fields had no pod damage. However, in some fields more than 50% of the pods were found to be damaged.

Estimation of avoidable loss

Although there are few reports of quantified yield loss caused by the insect pests on this crop there are many reports of pesticide trials on chickpea, particularly in India, from which it is possible to obtain estimates of avoidable loss.

Several insecticide trials have been directed towards the control of H armigera, but it is seldom, if ever, possible to control a single pest with a chemical pesticide and leave the rest of the fauna unaffected The trails normally record the percentage of damage in the pods sampled from protected and unprotected plots and the yields of seed from those plots. Published data from such trials are summarized in Table 3. It can be seen that all though the reduction in percentage pod damage ranged from 2-8 to 39.3 in India and from 0.7 to 11.6 in Syria, the avoidable loss (expressed as s percentage of the yield of the protected crop) were much greater in India, ranging from 9.0 to 60.0% in India and from 1.6 to 24.4% in Syria. This would indicate that the pesticide has not only led to a decrease in the percentage of pods that were damaged, but also to an increase in the number of pods that were carried by the crop. As most surveys only report the percentage of pods that are damaged. and not the total number of pods carried by the plants, it is clear that such survey data will generally tend to underestimate pest–caused losses.

Table 4 summarizes the estimates of avoidable loss that have been calculated from trials using dust formulations (A), spray formulations (B), and from large demonstration plots (C). The data were calculated from the reports of AICPIP trials conducted from 1974 to 1980, and the estimates are calculated from the differences in yield obtained from the untreated check plots and the highest-yielding pesticide treatment.

A word of caution is necessary when considering the data from such published reports. Most scientists tend to publish the data from trials when those trials are successful. If trials show little or no increase in yields from pesticide use then those trials are often considered to be of no interest and so are not published, Thus, the estimates of avoidable pest loss derived from published data of pesticide trials may tend to overestimate losses, also such data are usally from trials on research station farms where the pest populations may be very different to those in farmers fields.

Other estimates of pest-caused losses

There is only meagre information on pest-caused losses from trials where pest attacks were inflicted in a controlled manner by artificial infestation or by simulation of pest-caused damage.

In India, tests were reported from Jabalpur and Pantnagar on the effect of *Heliothis* larval density on pod damage and yield loss in chickpea. Infestation with a range of 1 to 10 larvae per meter row, resulted in 5 to 10% loss in grain yield per larva (AICPIP, 1977). In Syria, Hariri (1979) observed that if the numbers of leaf miner larvae exceeded 50 per plant, the crop damage would be severe. Such studies will be helpful in evoling 'economic thresholds' and it would be useful to conduct such studies for at least two seasons in the major chickpea growing areas.

Simulation of *Heliothis* damage to foliage and flowers has been attempted at ICRISAT. While defoliation up to 50% of the vegetative stage had no discernable effect on yield, 100% defoliation resulted in small reduction in yield, and a delay in maturity of about 2 weeks (ICRISAT, unpublished). Flower damage by *Heliothis* was found to be substantial at ICARDA and this damage is not included in the usual recording of pod damage at harvest (ICARDA, 1980). This is probably one of the reasons for the frequently-observed gap between pod damage percent and yield loss percent in such loss estimate studies.

Some attempts have also been made to account for the effects of seasonal pest activity and of agricultural practices on the extent of losses caused in chickpea. Trials on planting dates carried out in different parts of India, suggest that often pest damage was markedly affected by sowing time but the yields were not generally affected by the levels of pod damage recorded (Saxena, 1980). Plant density studies at ICRISAT and elsewhere have shown that with increasing plant density, more *Heliothis* larvae thrive per unit area, but have no direct influence on pod damage and/or yield. Irrigated crops gave higher yields in spite of higher percent pod damage as observed at ICRISAT (ICRISAT unpubl.). The role of intercropsis also being studied, and it appears that reduction in loss due to *Heliothis* may be possible by intercropping with wheat (AICPIP, 1977). The role of these and other promising agricultural practices on loss due to pests needs to be assessed more extensively across the crop growing regions.

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Table 1 : Insect pests of Chickpea

Scientific Name	Family	Nature of damage	Pest status	Reference
LEPIDOPTERA				
Agrotis ipsilon (Hfn)	Noctuidae	B	—	5
Agrotis segetum (Dennis & Schiff)	"	B	X	30
Agrotis spinifere (Hubn)	"	B	X	42
Agrotis spp.	"	B	X	4
Autographa nigrisigna (Wlk.)	"	B/F	—	26
Azazia rubricans B.	"	B/F	X	50
Chrysodeixis chalcites (Esp.)	"	B	X	**
Heliothis armigera (Hubn)	"	F	XXX	26
Heliothis assulta Gn.	"	F	X	31
Heliothis peltigera (Schiff)	"	F	X	52
Heliothis punctigera Wllgr.	"	—	XX	*s*
Heliothis virescens F.	"	F	X	53
Heliothis viriplaca (Hfn)	"	—	XXX	52
Ochropleura flammatra (Denis & Schiff)	"	B/F	—	11
Plusia spp.	"	F	XX	8
Plusa signata F.	"	B/F	X	**
Scotia *elegana*	"	—	—	*
Spodoptera exigua (Hb)	"	B	XXX	46
Spodoptera litura (F.)	"	B	X	**
? *Trichoplusia ni* (Hb)	"	B/F	—	17
Thysanoplusia (*Diachrysia*) *orichalcea* (F)	"	C	—	21
? *Etiella zinckenella* (Treitschke)	Phycitidae	F	—	45
Marasmarcha ehrenbergiana Zell	Pterophoridae	B/F	X	47
Laspeyresia nigricana (Steph.)	Olethreutidae	B	XX	17
DIPTERA				
Chromatomyia horticola (Goreau)	Agromyzidae	C	X	****
Liriomyza cicerina (Rond)	"	B/C	XXX	27
Liriomyza congesta (Backer)	"	B/C	—	23

Contd... Table 1.

Scientific Name	Family	Nature of damage	Pest status	Refe. rence
Liriomyza trifolii (Burgess)	"	B/C	—	23
Ophiomyia cicerivora Spencer	"	B	X	49
Delia platura (Wg.)	"	B/C	—	27
Hylemya cilicrura (Mg.)	Anthomyiidae	—	—	*
HOMOPTERA				
Acyrthosiphon pisum (Harris)	Aphididae	G	XX	15
Aphis fabae Scop.	"	D/G	XX	17
Aphis craccivora Koch	"	D/G	XX	17
Aulacorthum (Acyrthosiphon) solani (kalt)	"	G	—	13
? *Ferrisiana virgata* Ckll.	Coccidae	C	XX	10
HEMIPTERA				
Tettigometra atra	—	—	—	*
COLEOPTERA				
Subcoccinella vigintiquattour-punctata (L).	Coccinellidae	B	X	3
Diabrotica spp.	Chrysomel idea	A	XX	6
? *Luperodes* sp.	Chrysomelidea	E	—	**
Aulacophora foveicollis (Lucas)	"	B	X	29
Tanymecus indicus F.	Curculionidae	E	XXX	4
Sitona crinitus Hbst.	"	—	—	24
Holotrichia consanguinea Blanch.	Melolonthidae	—	—	43
ORTHOPTERA				
Acrotylus humbertianus S.	Acrididae	B	X	**
Ailopus simulatrix simulatrix Wlk.	"	B	X	**

Contd... Tab'e 1

Scientific Name	Family	Nature of damage	status status	Ref-rence
Attractomorpha crenulata F.	"	B	X	**
Cantotops erubescens Wlk.	"	B	X	**
Chrotogonus trachypterus K.	"	B	X	**
Cyrtacanthacris tartarica (L.)	"	B	X	**
Eyprepocnemis alacris S.	"	B	X	**
ISOPTERA				
? *Odontotermes* sp.	Termitidae	A	X	55

?= Association to be confirmed; A= Root damage; B= Shoot damage; C= Defoliation; D= Sap feeding; E= Seedling damage; F= Pod/seed damage (Field); G= Vector

XXX= Major pest; XX= Minor pest; X= Rare/Occasional pest; — = not assessed.

* = Cubero, I.J. (Pers. comm.); ** = ICRISAT (unpubl.); *** = Rogers, R.I. (pers. comm.)**** = Sehgal, V.K. (pers. comm.)

Table 2. Summary of ICRISAT pest damage surveys at maturity stage of chickpeas in India, during 1977–82

States	No. of fields surveyed (No. of years)	Mean % pods damaged by pests			Mean % plants killed by pests *
		Borer	Birds	Total	
Andhra Pradesh	14 (4)	15.1	0.0	15.1	0.7
Bihar	22 (1)	5.7	0.6	6.3	0.0
Gujarat	10 (2)	5.9	0.3	6.2	0.6
Haryana	47 (3)	1.2	1.4	2.6	2.6
Karnataka	25 (3)	3.1	0.0	3.1	0.1
Madhya Pradesh	105 (3)	13.2	0.5	13.7	3.6
Maharashtra	117 (4)	4.7	0.04	4.8	0.4
Orissa	4 (2)	5.4	0.0	5.4	0.0
Punjab	40 (3)	2.5	0.01	2.6	3.1
Rajasthan	63 (4)	8.2	1.1	9.3	1.9
Tamil Nadu	2 (1)	7.0	0.0	7.0	0.0
Uttar Pradesh	192 (5)	8.4	0.3	8.7	1.0
West Bengal	6 (1)	2.4	0.0	2.4	0.0
Overall	647	7.33	0.41	7.76	1.55

* Plants recorded to have been killed by cutworms, termites, whitegrubs etc.

Table 3. Summary of reported estimates of avoidable loss due to different pests in chickpea

Target pests	Location (season-expts)	% pods lost due to non-protection	Avoidable loss			Ref.
			% grain	Grain yield kg/ha	Value* (Rs./ha)	
H armigera	Ludhiana (1970-72; 3 expts)	3.6	49.1	251	803	44
		7.0	10.7	39	125	
		39.3	60.9	277	886	
H. armigera	Hardoi (1974-75; 2 expts)	23.7	40.3	1343	4298	1
H. armigera	Sumerpur (Rajasthan (1968-71; 4 expts)	14.3	43.7	1035	3312	12
H. armigera	Raichur Karnataka (1957-56; 2 eeptc)	13.1	43.5	670	2144	40
H. armigera	Varanasi (1974-75; 1 expt)	—	20.6	713	2282	33
H. armigera	Coimbatore (1) (1971-72; 2 expts)	12.4	23.9	68	218	16
	(2)	2.8	16.7	67	214	
*H. aimiger**	Ludhiana (1972-76; 4 expts)	—	32.7	310	992	7
H. armigera	Coimbatore (1) (1974-75; 4 expts)	12.4	9.0	60	192	37
	(2)	12.3	58.8	570	1824	

Contd... Table 3.

Target pests	Location (season-expts)	% pods lost due to non-protection	Avoidable loss % grain	Grain yield kg/ha	Value* (Rs./ha)	Ref
H. armigera	Coimbatore (1971-74; 3 expts)	5.6	18.1	128	410	51
H. armigera	New Delhi (1980-81; 1 expt)	25.3	32.1	1982	6342	28
H. armigera	Hissar	27.6	86.4	500	1600	8
Plusia spp.	(1976-78; 2 expts)	7.1				
H. armigera *Plusia* spp.	Hissar (1977-78; 2 expts)	26.2 5.0	105 3	820	2624	9
H. armigera	- do -	75.5 4.3	155.5	110.7	3542	9
Heliothis spp. *Liriomyza*	ICARDA (Syria) (2 expts. 1979-81 spring sown)	1.4 2.0**	17.0	137	438	48
Heliothis spp. *Liriomyza*	ICARDA (Syria) (2 expts. 1979-81 winter sown)	6.9 1.3**	9.4	123	394	48
Agrotis ipsilon	Jabalpur (1) (1975-78; 3 exvpts)	—	62.6	821	2627	54
	(2)	—	92.6	756	2419	
Termite	Hissar (1974-77; 3 expts)	90.0	—	551	1763	55

* — Value estimated at the current price of Rs. 3.20/kg

** — Rating scale for incidence on 1-9 scale.

Table 4 : Summary of 'avoidable loss' estimates in AICPIP trials in India, 1974-80

AICPIP Centre	Avoidable loss (%) Method of estimation* A	B	C
Akola	14.0 (1)	40.9 (2)	—
Badnapur	17.9 (2)	23.1 (3)	—
Bangalore	73.4 (1)	72.1 (1)	—
Bikaner	32.0 (1)	16.7 (1)	—
Coimbatore	32.0 (2)	34 9 (4)	5.5 (1)
Dantiwada	36 8 (1)	—	20 0 (1)
Delhi	—	74.1 (1)	59.1 (2)
Dholi	28 3 (3)	46.4 (4)	20 2 (3)
Gulbarga	25.9 (1)	19.2 (2)	22.7 (1)
Hanumangarh	—	12.3 (1)	—
Hissar	24.6 (2)	33 2 (2)	36.0 (1)
Hyderabad	21.0 (2)	28.1 (4)	40.0 (1)
Jabalpur	36.1 (4)	29.0 (4)	35.7 (2)
Jaipur	39.1 (1)	45.2 (1)	23.9
Junagadh	17.0 (2)	33.7 (2)	2.0 (1)
Kanpur	60.8 (1)	67.9 (1)	22.7 (1)
Ludhiana	—	44.0 (1)	20.9 (1)
Pantnagar	—	71.8 (3)	12.7 (1)
Varanasi	40.2 (1)	12.7 (1)	—

* A= Dust formulations ; B= Spray formulations ; C= Demonstrations (Figures in parenthesis represent the no. of years observed).

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