Chitwood. Considering the wide occurrence of the pest and the economic importance of the crop, 94 germplasm accessions obtained from IARI, New Delhi were screened for resistance.

Five or six surface sterilized seeds of each accession were separately sown in five 10 cm earthenware pots containing autoclaved sandy loam soil. At two weeks after sowing the seedlings were thinned to one per pot and 500 freshly hatched nematodes were introduced at three weeks by pouring the larval suspension into three to four holes in the soil around each seedling. Forty days after inoculation, the plants were uprooted and the numbers of galls and the egg masses produced on the root surface were counted.

Of 94 germplasm accessions screened, 38 received a grading of one with no galls and were considered immune (Table 1). Twenty were in the two grade (resistant); 15 were rated three (moderately resistant); 10 were rated four (susceptible) and 11 were rated five (highly susceptible). Further work is in progress to confirm the resistance of the 38 accessions which received a grading of one.

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Table 1. Response of certain cultivars of chickpea to root-knot nematode, *Meloidogyne incognita*.

Grade	Galls	Germplasm accessions
1	None	GL-604, JM-989, NEC-330, NEC-343, NEC-351, NEC-380, NEC-382, NEC-407, NEC-425, NEC-447, NEC-1519, NEC-1523, NEC-1578, NEC-1581, NEC-1584, NEC-2304, NEC-2572, NEC-2579, NEC-2580, NEC-5555, P-6, P-19, P-55, P-21-1, V-1, V-2, V-10, V-12, V-19, V-20, V-32, V-40, V-52, V-72, V-74, V-75, V-78, V-89
2	1-25	NEC-314, NEC-320, NEC-331, NEC-443, NEC-1575, NEC-1583, NEC-1585, NEC-1586, NEC-2552, NEC-2553, NEC-2571, NEC-2574, NEC-2593, P-23, P-9723, P-17-1, V-16, V-31, V-51, V-58
3	1-25	NEC-315, NEC-328, NEC-361, NEC-429, NEC-460, NEC-1606, NEC-2569, NEC-2584, NEC-5557, P-60, P-61, P-76, P-96913, P-84-1, V-6
4	26-50	NEC-333, NEC-356, NEC-363, NEC-385, NEC-2585, P-14, P-9075, V-21, V-39, V-57
5	50	JM-997, NEC-362, NEC-2566, P-28, P-63, P-9706, P-37-1, V-5, V-13, V-22, V-61

Entomology

Phenylacetaldehyde: An Attractant for *Heliothis armigera*

Recent research at ICRISAT and elsewhere has led to the development of pheromone traps that catch large numbers of male, *Heliothis armigera* moths. Although such traps may be useful for monitoring populations of the moths, they are unlikely to lead to any direct reduction of the populations of this pest. The *H. armigera* moths are so mobile that very many traps, or the use of the pheromone as a confusion agent, would probably be required over a very large area to produce significant reduction in mating with a consequent reduction of egg and larval populations. It would be much more useful if traps could be developed to attract female moths before they laid eggs.

It is well known that some insects are attracted to their host plants by volatile chemicals. There are reports that *Heliothis* spp moths, including females, are attracted by some chemicals (Cantelo and Jacobson, 1979a)[1]. Consequently, in 1981, we obtained samples of 15 chemicals that had previously been recorded as attractants for *Heliothis* spp, from Dr. M. Jacobson, Director of the USDA/ARS Biologically Active Natural Products Laboratory, Beltsville, USA, and tested these in traps in fields at ICRISAT Center. Several of these chemicals attracted a few female *H. armigera* moths and phenylacetaldehyde appeared to be the most promising. Previous studies (Cantelo and Jacobson, 1979b)[2] have also indicated that phenylacetaldehyde is particularly attractive to *Heliothis* spp.

Current work at ICRISAT is directed towards tests of different dispensers for the release of the chemical attractants and the use of antioxidants that may prolong the effectiveness of phenylacetaldehyde. Table 1 shows the catches of *H. armigera* moths in modified ICRISAT standard traps in a chickpea field on the Haryana Agricultural University Farm at Hissar. The traps were baited with rubber septa impregnated with phenylacetaldehyde (0.05 ml), with and without ascorbic acid (0.01 ml) as an antioxidant. The baits were renewed weekly. During the 8-week test several species of insects were caught in the traps including 484 *H. armigera* moths, of which 39% were females, and 146 *Diachrysia orichalcea*. The addition of ascorbic acid appeared to increase the catches but further, replicated, testing is required to confirm this.

Table 1. *Heliothis armigera* captured in traps baited with phenylacetaldehyde alone, and with ascorbic acid, Haryana Agricultural University Farm, Hissar, India, 1983.

Dates	Weekly catches of *H. armigera* moths: Phenylacetaldehyde (0.05 ml)		Phenylacetaldehyde (0.05 ml) + Ascorbic acid (0.01 ml)	
	Male	Female	Male	Female
05-11 March	21	34	19	38
12-18 March	17	13	9	8
19-25 March	21	11	31	13
26-01 April	0	2	10	3
02-08 April	2	1	0	4
09-15 April	21	9	30	17
16-22 April	45	13	57	22
23-29 April	4	0	8	1
Total	131	83	164	106

Although the catches appear to be encouraging they must be viewed in perspective. The traps were operated over a period when there were very many *H. armigera* moths in the vicinity, as shown by catches in nearby pheromone traps which averaged more than 900 male moths per trap during the third week of this study. Thus, the phenylacetaldehyde traps were catching a very small proportion of the moths present in the area. However, we regard these results as being encouraging enough for us to continue the search for effective attractants.

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[1]Cantelo, W.W. and Jacobson, M. 1979a. Journal of Environmental Science and Health A14(8):695-707.

[2]Cantelo, W.W. and Jacobson, M. 1979b. Environmental Entomology 8(3):444-447.

Pest Avoidance to Reduce *Heliothis* Damage in Chickpea

In Uttar Pradesh, 15.3 per cent of the chickpea crop, worth Rs. 462.5 million, is lost annually due to *Heliothis* (Lal *et al*.,

Table 1. Mean pupal periods of *Heliothis armigera* infesting chickpea at Kanpur (U.P.) from 1979/80 to 1981/82.

Date of pupation	1979/80 No. of larvae	1979/80 Mean pupal period	1980/81 No. of larvae	1980/81 Mean pupal period	1981/82 No. of larvae	1981/82 Mean pupal period
24-31 Dec	31	65.0	8	49.1	7	52.1
1-7 Jan	21	65.0	5	49.0	23	46.0
8-14 Jan	26	56.4	7	47.3	4	45.0
15-21 Jan	19	55.4	9	41.3	4	42.3
22-28 Jan	10	34.4	13	36.1	5	41.0
29 Jan-4 Feb	15	31.1	15	26.0	3	29.3
5-11 Feb	9	26.3	10	24.0	0	-
12-18 Feb	8	16.3	21	18.1	2	27.2
19-25 Feb	4	14.3	4	16.0	2	19.1
26 Feb-3 Mar	2	15.0	12	15.3	3	21.0
4-10 Mar	3	14.0	2	13.0	4	21.1
11-17 Mar	30	12.1	14	12.2	5	12.0
18-24 Mar	64	11.0	19	9.1	11	10.0
25-31 Mar	67	10.1	13	10.0	12	10.0
1-7 Apr	56	9.1	58	10.1	37	10.0
8-14 Apr	31	9.1	41	9.1	34	9.1