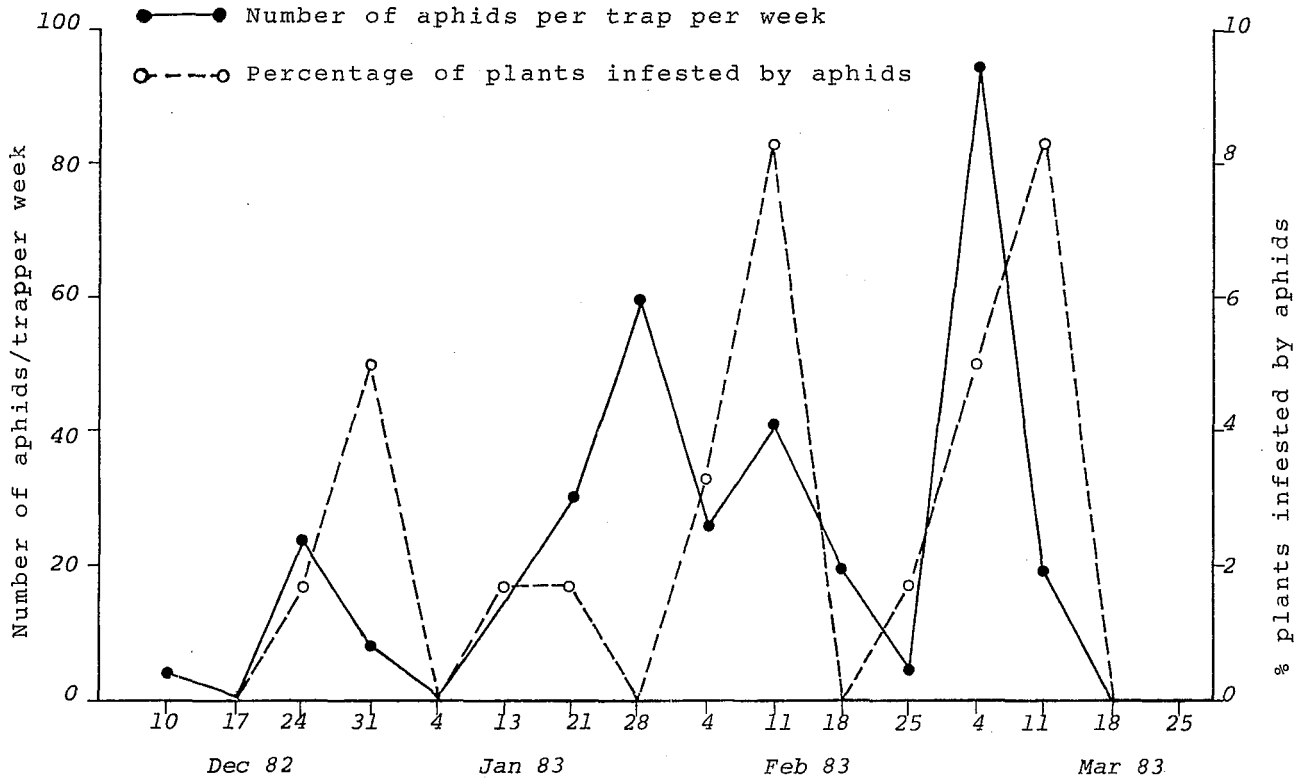

Figure 1. Seasonal catches of aphids in traps and percentage of chickpea plants infested by aphids at Hissar.

Weekly collections of aphids were recorded from each trap commencing early December. The numbers of A. craccivora infested plants were recorded for twenty random plants in indicator/ spreader rows adjacent to each trap.

There were three distinct peaks of catches: on 24 December, 28 January, and 4 March (Fig. 1). Three peaks were also observed in the incidence of the aphid on chickpea, occurring 1-2 weeks later than the peaks in trap catches. It is likely that the increase in the incidence of aphids on chickpea (% plants infested) is preceded by a cycle of dispersal of alates (winged aphids) represented by the peaks in the trap catches. However, the incidence of A. craccivora on plants was very low and these observations need to be confirmed.

Earlier studies of A. craccivora at Hissar have shown its occurrence on legumes such as lentils, chickpeas, alfalfa, funugreek, mung bean, and wild pea (Lathyrus), and on non-legumes such as tomato and potato (Verma et al., 1975)(2). The present observations indicate the seasonality of the aphid and the relationship of trap catches with aphid incidence on the chickpea crop. The shift of vector aphids from reservoir legume hosts to chickpea, which is a major factor in the spread of stunt disease, will be further studied.

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A Pilot Survey for Pest Damage in Chickpeas in Jordan and Syria

Surveys of pest damage in farmers' fields constitute one method of estimating the 'real' losses caused by pests. During 1979-82, limited surveys of pest damage in

chickpeas were carried out by ICARDA (International Center for Agricultural Research in Dry Areas) mostly around its research center in northern Syria. In this region, the leaf miner (Liriomyza cicerina) and the pod borers (Heliothis spp.) appear the most important, the former being more damaging. The present survey was conducted with ICARDA during May 1983 to assess the pest situations in other regions of Syria and Jordan, in comparison with that obtaining in northern Syria, including the ICARDA research center at Tel Hadya.

Samples were mostly from fields close to motorable roads, at intervals of 20 to 30 km. Each field sampled was at least 0.5 ha in area, and we examined the crop at five points each of 1 m^2. At each point we counted the number of plants per m^2, and the numbers of Heliothis larvae and of total and Heliothis-damaged pods on five random plants. The incidence of leaf miner on the five plants was recorded on a 1 to 9 scale (1 = no damage; 9 = very heavy damage) based on the proportion of damaged leaflets. Data such as crop protection practices, general cropping situation, and expected yields were also recorded, depending on available local information.

Of 54 fields surveyed, 12 were in Jordan, 16 in southern Syria and 21 in northern Syria (Table 1). The crops examined ranged in age between 1 and 5 months; most were in the stages of early flowering to mid podding. Plant stands were generally good, averaging 22 to 37 per m^2. Soils were mostly brown loam, and the crop was usually grown without irrigation.

Leaf miner damage was greater in northern Syria (Table 2). Damage at the time of rating averaged 2.2 to 3.8, but 1 to 3 months later in maturity substantial increases in damage can be expected.

Heliothis larval populations were low, mostly averaging less than one per plant, and none were found in some fields. Pod damage by Heliothis was greater in southern Syria and northern Jordan than in the other regions. In a crop at Jellin research station in southern Syria, we observed 32% pod damage by Heliothis. Chickpea crops in southern Syria and northern Jordan appear more prone to Heliothis damage, while in northern Syria they face greater damage by leaf miner.

The plume moth Marasmarcha ebrenbergiana (Pterophoridae: Lepidoptera) was commonly found on chickpeas. We found the larvae, pupae, and adults of this insect in several locations in southern Syria and Jordan, and at one location in northern Syria. Cursory observations suggest that this insect may damage flowers and tender pods. At some locations in Jordan, we found plants infested with black aphid (probably Aphis craccivora) and a low incidence of stunt (vectored by the aphid). The importance of aphids in disease spread may be worthy of further study.

We also collected some information on the extent of insecticide use on chickpeas. Of thirteen locations in Syria, six were protected with insecticides, while in Jordan none of the six locations received insecticide protection. A cheap dust formulation of DDT plus BHC (cotton dust) was used most commonly, obviously owing to its cheapness and ease of application.

Grateful thanks are due to Dr. W. Reed, and scientists and other colleagues at ICRISAT and ICARDA for their contribution to the successful conduct of this survey. The

Table 1. Numbers of fields sampled, the age of crop, and plant stands in Syria and Jordan, May 1983.

Regions (Districts)	Number of fields sampled	Crop age (months)	Plant stand/m^2
Northern Syria (Azaz, Idlib, Aleppo)	21	3 (1.5-4)	30 (17-70)
Central Syria (Hama)	2	2 (2-2.5)	22 (21-22)
Southern Syria (Darah, Damas, Soueda, Thall, Asalward, Qatoma)	16	2.5 (1-3)	27 (10-35)
Northern Jordan (Irbid)	5	3 (2.5-4)	29 (19-42)
Central Jordan (Madaba, Karak)	7	3.5 (2-4.5)	26 (16-34)
ICARDA (Tel Hadya)	3	4 (2-5)	26 (26-27)

Figures in parentheses are the ranges.

Table 2. Pest infestations on chickpea in Syria and Jordan, May 1983.

Region	Leaf miner incidence	*Heliothis* larvae/ five plants	%pods damaged by *Heliothis*	Total pods/ five plants	No. of fields under each insecticide-protection category		
					P	NP	NK
Northern Syria	3.8 (1.8-5.4)	0.3 (0.0-1.4)	1.3 (0.0-11.1)	16 (0-80)	3	4	14
Central Syria	2.7 (2.5-2.8)	0.1 (0.0-0.2)	0	2 (0-3)	1	0	1
Southern Syria	2.2 (0.2-5.1)	0.4 (0.0-1.8)	6.4 (0.0-31.8)	16 (0-84)	2	9	5
Northern Jordan	2.6 (1.4-3.6)	0.3 (0.0-0.6)	5.8 (0.0-16.4)	60 (2-115)	0	0	5
Central Jordan	2.0 (0.5-3.5)	0.1 (0.0-0.2)	1.9 (0.0-7.4)	46 (0-83)	0	6	1
Tel Hadya (ICARDA)	3.3 (1.8-4.0)	0.7 (0.2-1.4)	0.6 (0.0-0.9)	61 (0-101)	0	3	0

Values in parentheses indicate range.
P = Protected; NP = Not protected; NK = Not known.

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Microbiology

Chickpea Cultivar x *Rhizobium* Strain Interaction in Northern Sudan

The effects of inoculation of six rhizobial strains on the nodulation and seed yields of ten chickpea cultivars were examined in a field experiment in northern Sudan. The seeds were sown 15 hours after inoculation on 12 December 1979, in a split-plot design with four replications and received an immediate postsowing irrigation. The *Rhizobium* strains (and noninoculated control) were main plots and the cultivars were subplots.

There were significant differences among inoculation treatments and among cultivars in nodule dry weights at 50% flowering (Table 1). In the noninoculated control, nodulation was virtually absent. The heaviest nodule dry weights were produced by C.B. 1189 and IC 59, followed by IC 2002 and IC 53. Those produced by Nodulaid and Sudan were not significantly greater than the noninoculated control. The poor performance of Nodulaid, which must have contained only the strains IC 2002 or C.B. 1189, may be owing to its being stored longer (from September 1978) while the other inoculants were received fresh in November 1979. The cultivar NEC 2676 produced the largest nodule dry weight and Baladi the smallest.

Differences in nodulation were not paralleled by differences in seed yields (Table 2). There were no significant differences among inoculation treatments and the second heaviest seed yield was produced by the noninoculated control. The cultivars NEC 2676, -2699, -2454, -2479, and -2224 were significantly heavier yielding than the other cultivars, and the first four also produced the largest nodule dry weight. The mean seed yield of these five cultivars (666 kg/ha) was 30% more than that of Baladi, the local cultivar.