Re-assessment of insect pest problem on pigeon pea (Cajanus cajan)

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SUMMARY

(1) Re-examination of the insect pest complex of pigeon-pea reveals nineteen species causing damage to the reproductive growth stages.

(2) Records of pest population seasonality indicate late Yala (August) as a likely period for avoiding most pests, but a remaining pest, *Melanagromyza obtusa*, has a peak population at that time.

(3) Analysis of plant type shows that short bushy types with many tightly packed flowers, as typified by MI 10, attract a disproportionately high pest population.

(4) Comparison of yield factors under sprayed and unsprayed conditions is a useful method of assessing plant resistance.

INTRODUCTION

Long-standing efforts to promote the cultivation of pigeon-pea or toor dhal (*Cajanus cajan*) in the dry zone have been largely nullified by failure to overcome the problem of insect pest damage.

Thevasagayam and Canagasingham (1960) reported that the decline in yield of annual varieties of pigeon-pea then in use was due mainly to several insect pests attacking buds, flowers and pods. They tested several insecticides and reported that the pests could be economically controlled with Endrin and Dieldrin.

However, over a decade later, Fernando (1972) reported that insect "pod-borer" damage was still the major factor limiting the cultivation of pigeon-pea, and he suggested that the height (3m) of the varieties available was restricting effective application of insecticides. At this time a dwarf (1m) variety, MI 10, was released. This dwarf plant type was claimed to allow easy and effective spraying and it was seen as " the wonder crop of the dry zone ".

Unfortunately, promotion of this variety has also failed so far ; insect damage is still the major problem though other factors are also involved.

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The continued failure to overcome insect damage by the use of insecticides coincided in the early 1970's with a general hardening of attitudes against pesticides and a demand for alternative methods of pest management. These circumstances prompted re-examination of the insect pest complex on pigeon-pea and instigation of studies of natural enemies, population seasonality and host plant susceptibility.

Natural enemy surveys and the possibilities for biological control of some major pest species has been reported elsewhere (Fellowes and Amarasena, T. A. Vol. CXXXIII No. 2).

THE INSECT PEST COMPLEX

Pests attacking pigeon-pea in the dry zone have been previously reviewed by Thevasagayam and Canagasingham (1960). They reported negligible damage to vegetative growth, but serious damage to buds, flowers and pods caused by seven pest species.

In this survey a total of about forty species has been recorded on pigeon-pea about half of these causing only negligible damage to vegetative growth.

The following species are considered together to cause serious damage to reproductive growth :

Flower-Eating Blister Beetles

Mylabris pustulata Thunb.	(Coleoptera, Meloidae)
Mylabris thunbergi Pic.	(Coleoptera, Meloidae)

Bud, Flower and Pod-Borers

Maruca testulalis Gey.	(Lepidoptera, Pyralidae)
Heliothis armigera Hb.	(Lepidoptera, Noctuidae)
Lampides boeticus L.	(Lepidoptera, Lycaenidae)
Lampides bochus Cramer	(Lepidoptera, Lycaenidae)
Catochrysops lithargyria M.	(Lepidoptera, Lycaenidae)
Sphenarches anisodactylis Walk.	(Lepidoptera, Pterophoridae)
Exelastis atomosa Wals	(Lepidoptera, Pterophoridae)

Seed Borers

Etiella zinckenella Tr.	(Lepidoptera, Phycitidae)
Melanagromyza obtusa Mall.	(Diptera, Agromyzidae)

Pod-Sucking Bugs

Riptortus strenuus H.	(Heteroptera, Coreidae)
Riptortus linearis F.	(Heteroptera, Coreidae)
Riptortus pedestris F.	(Heteroptera, Coreidae)
Riptortus fuscus F.	(Heteroptera, Coreidae)
Cletus signatus Wlk.	(Heteroptera, Coreidae)
Anoplocnemis phasiana F.	(Heteroptera, Coreidae)
Clavigralla gibbosa Spinola.	(Heteroptera, Coreidae)
Nezara viridula L.	(Heteroptera, Pentatomidae)

M. testulalis, H. armigera, M. pustulata, L. boeticus and *M. obtusa* were listed as major pests by Thevasagayam and Canagasingham (1960). *L. boeticus* is now known to be only one member of a complex of at least three Lycaenidae, including *L. bochus* and *C. lithargyria*. In all the collections taken, *L. boeticus* and *C. lithargyria* occurred in about equal numbers with *L. bochus* in a small minority. The immature stages of these Lycaenidae have similar appearances and habits and are difficult to distinguish.

S. anisodactylus was reported by Thevasagayam and Canagasingham (1960) as *S. caffer Zell,* a very similar species now known to be confined to Africa. A second plume moth, *E. atomosa*, is now recognised, the immature stages being similar in habit and appearance to *S. anisodactylus.*

Two species of thrips (unidentified) have been noted in the flowers, but the the damage claimed by Thevasagayam and Canagasingham (1960) has not been observed.

A complex of Coreid and Pentatomid bugs, not previously recorded, cause severe damage to immature pods. These bugs, dominated by *Riptortus spp.*, pierce the pod and suck developing seeds. Attacked seeds shrivel and may develop secondary rots.

E. zinckenella is a cosmopolitan pest, often causing severe damage to grain legumes. Larvae feed on the seed inside fully developed pods. So far this pest has been recorded to only a minor extent on pigeon-pea.

Records from regular monthly-planted crops show that the relative importance of these pest species varies from season to season, and from year to year. So far the records tend to confirm the observation of Thevasagayam and Canagasingham (1960) that *M. testulalis* is the single most important pest of the Maha season, and *M. obtusa* of the Yala season.

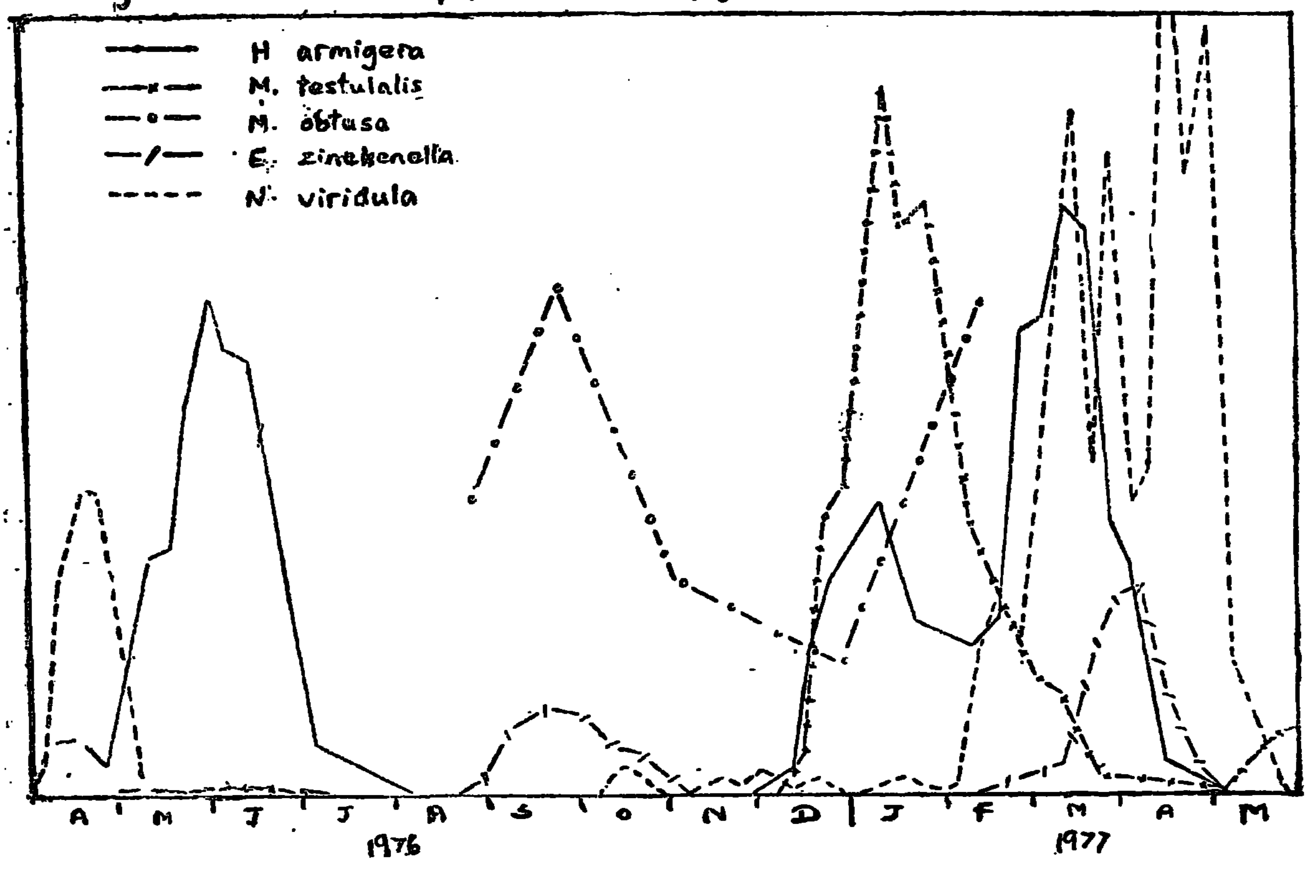
SEASONALITY OF MAJOR PESTS

Records have been kept from a Robinson type 125 watt M. V. light trap operated nightly on the Station, and from systematic sampling of pigeon-pea variety MI 10 planted at monthly intervals.

Data has been recorded for all pests encountered in systematic crop sampling but in most cases these have been found to vary inconsistently depending on the vigour of crop flowering, rather than being related to overall seasonal factors. Only in the case of the seed borers *E. zinckenella* and *M. obtusa* has it been possible to obtain consistent samples.

Figure I presents the 1976/77 data for the light trap catches of *H. armigera*, *M. testulalis*, *E. zinckenella* and *N. viridula*, and the crop sampling records for *M. obtusa*. Field observations suggest that the population pattern of *N. viridula* s fairly typical of the Coreid bugs also.

Figure I : Seasonal populations of pigeon pea pests



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The data suggests very little prospect of avoiding pest damage in the Maha season, there being peak populations of all major pests between December and March. Late Yala season (July-September) may present a reduced range of pests with only *E. zinckenella* and *M. obtusa* remaining, but the latter is at its peak population.

A possible strategy would be to aim for resistance to *M. obtusa* combined with August maturation. Resistance to *M. obtusa* is regarded as quite feasible The adult female inserts eggs through the pod wall, therefore it may be possible to obtain physical resistance by increasing the thickness and/or toughness of the pod.

PLANT TYPE AND PEST SUSCEPTIBILITY

The available germplasm of pigeon-pea embraces a wide range of determinacy and diversity of plant type, from short bushy annuals to tall perennial tree types.

In the 1975/76 Maha season, 45 selections comprising the ICRISAT 1975 international co-ordinated trial, were assessed for pest populations under unsprayed conditions. The 45 varieties were roughly divided into three groups :

(1) Short bushy stature, short age, tending determinate

(2) intermediate

(3) tall open stature, long age, tending indeterminate

These varieties were grown in a randomised block design with three replicates. At full flower a sample of five flower clusters per plot was taken and counts made of all bud and flower-boring larvae mainly *M. testulalis* and Lycaenidae.

The local standard variety MI 10 was included for comparison.

The results are summarised as follows :

Group		*Mean No. Flowers per Cluster*		*Mean Total Larvae per 100 Flowers*
MI 10	..	13.0	..	16.5
(1) short (15 vars.)	..	10.2	..	12.7
(2) int. (15 vars.)	..	8.2	..	3.8
(3) tall (7 vars.)	..	9.1	..	3.7

There was an evident trend for the intermediate and tall varieties to have less flowers per cluster, and disproportionately less pest larvae per 100 flowers.

When the groups are re-arranged solely according to number of flowers per cluster, this trend is confirmed :

Flowers/Cluster		*Total larvae/100 Flowers*
Over 10.0	..	11.6
8.3-10.0	..	7.1
Under 8.3	..	4.9

Thus a second possible strategy for reduction of the pest problem would be to select for simply branched types with loose flower arrangements.

PLANT RESISTANCE

On the basis of lowest pest populations, ten varieties from the 1975/76 trial (above) were selected for further assessment in Maha 1976/77. The ten varieties plus three local selections were grown in a randomised block design with three replicates. Two trials were conducted : one unsprayed, and the other sprayed, with four applications of monocrotophos or endosulfan at ten-day intervals over the flowering-podding period.

Full yield records were kept for each block and the performance of the varieties compared under sprayed and unsprayed conditions.

The yield factors, pod number, seed number and seed weight, obtained under unsprayed conditions are expressed as a percentage of the corresponding values under sprayed conditions.

Major pest species present were *M. testulalis*, Lycaenidae and Pterophoridae.

Variety	*Unsprayed Yield*	*Unsprayed Yield Values as % of sprayed values*		
	gms/plant	*Pod no. (%)*	*Seed no. (%)*	*Seed Wt (%)*
T. 21 (A)	45.8 a	114.0	107.5	94.0
7181	39.6 ab	74.3	57.5	64.7
6	39.2 ab	92.3	69.9	63.9
7219	36.5 ab	80.9	81.1	84.7
T. 21 (B)	35.9 abc	97.4	80.0	78.2
7190	35.2 abc	109.1	63.8	70.8
7195	29.7 abc	63.2	64.5	71.0
2624	26.8 bc	61.4	65.4	65.8
7179	23.7 bc	85.4	89.3	84.3
Prabhat	23.2 bc	55.6	47.7	56.9
MI 10	22.7 bc	81.8	61.0	61.0
3773	22.5 bc	50.0	29.6	48.9
7118	17.8 c	41.0	29.7	35.5

(CV = 30.8 %)

Unsprayed yield has been analysed using Duncan's multiple range test. Values having a letter in common are not significantly different at p=0.05.

This evaluation reveals varieties, notably T.21 (A), 7219 and 7179, which achieve a high percentage of their potential yield under unsprayed conditions. The method also allows differentiation of varieties which suffer mainly pod loss (e.g. 7219, 7179), mainly seed loss (e.g. 7190, 6) and combined pod and seed loss (e.g. MI 10).

Minor discrepancies in the results are probably due to the fact that some insect damage still occurred in the sprayed block. In further work along these lines a more rigorous spraying schedule should be imposed.

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