

Status of Shoot Fly *Atherigona approximata* Malloch as a Pest of Bajra *Pennisetum typhoides* Crop in Gujarat State*

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ABSTRACT

With advent of hybrid varieties of bajra crop (*Pennisetum typhoides*) over last decade or so, a relatively unknown pest viz. bajra shoot fly *Atherigona approximata* Malloch has assumed a status of the major pest of bajra in some of the bajra growing States of the country. In Gujarat State also very large area under bajra has been brought under hybrid varieties. Therefore status of shoot fly as a pest of bajra in the State has been reviewed drawing relevant data from number of experiments conducted at Junagadh, Jamnagar, Vijapur etc. It is brought out that the pest occurs regularly in the seedling stage of the crop causing dead hearts. The incidence at Jamnagar is relatively high compared to that at Junagadh, while at Anand and Vijapur the incidence is quite low. There is a remarkable increase in incidence with progressive delay in sowing. Bajra sprouts in off season, seed multiplication plots of bajra, haryali (*Cynodon dactylon*) and to some extent boru (*Pennisetum* spp.) serve as alternate hosts for this pest. Generally no insecticidal treatment is warranted, as losses due to dead hearts is quite low. In case of high incidence foliar application of endosulfan 0.05% or methyl-demeton 0.025% at 600 l/ha contains the incidence.

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INTRODUCTION

AS EARLY AS 1924 Ramchandra Rao (1925) reported *Atherigona approximata* Malloch, now popularly known as bajra shoot fly feeding on local bajra crop. Till recently, its damage to local bajra varieties was so low that it was hardly listed as a pest of bajra crop. With successive releases of HB-1, HB-2 and HB-3 bajra hybrids, very extensive area has been covered under the hybrids in this State as well as in other bajra growing States. This situation has however, brought in a great change in the pest and disease complex of this crop. Now the infestation by bajra shoot fly in the early seeding stage in bajra hybrid field has been of a

regular occurrence. Detailed information on bajra shoot fly has been of immediate concern as the dead hearts created by this pest in the early growth phase can cause plant stand problem in case of severe infestation. Over the past few years, studies have been conducted at various locations in Gujarat State on the extent of infestation and regarding evolving suitable control measures of bajra shoot fly. In this paper the pest status of bajra shoot fly has been discussed in light of such studies already made. At the outset a brief outline on nature of damage by this pest is given.

Pest:

The adult of this shoot fly has greyish

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thorax with yellowish abdomen. It is a small sized Diptera, approximately half the length of *Musca domestica*, with characteristic pair of black spots on third, fourth and fifth abdominal segments in female. In males these spots are found on third and fourth segments only. The adults of this fly bear a very close resemblance to those of sorghum shoot fly *Atherigona soccata*, also an important pest of hybrid jowar. The males of these two shoot flies can be distinguished from the characteristics of their trifoliate processes, but the females are difficult to distinguish.

Nature of damage:

The female shoot fly lays eggs usually on the under surface of young bajra seedlings. The eggs are whitish yellow, boat shaped and easily visible to the naked eye. Young maggots hatch out in about $2\frac{1}{2}$ days and crawl towards the stems and enter the central shoots by cutting the stem with their pointed mouth hooks. The maggots have tendency to move downwards in the stems and dead hearts are created within 4 to 5 days of infestation. The central shoots whither which can be pulled out easily. A characteristic bad odour emanates from such infested central shoots. Young maggots are dirty white but the larval colour changes to yellow becoming deep yellow in grown up maggots. Pupation takes place inside the infested stems in about 9 days time. Usually only young plants and new tillers are infested and the maggots are not able to cut through the hardened stems of grown up bajra plants. In earlier studies taken up at Jamnagar, damage to earheads

was reported due to shoot fly larval penetration and internal feeding on soft and pliable pannicle stalks of emerging earheads. However in the critical field observation in last 3 seasons at Junagadh this type of damage to earheads by shoot fly is not noticed, except in a few stray cases.

Carry over of the shoot fly:

In studies carried out to determine carry over of the pest around college farm at Junagadh during 1975 and 1976, it has been revealed that the pest is sustained on haryali grass (*Cynodon dactylon*) to more or less extent throughout the year. During dry months patches of the grass near water sources sustain the pest. All young growths of bajra plant are susceptible and serve as host material whenever available. The young sprouts from the harvested bajra fields are highly prone to shoot fly attack and sustain the pest in off season. Tender growths of boru, (*Pennisetum* spp) a wild plant growing near water sources or along streams etc., also get infested to a small extent during hot summer months. The observations taken on alternate hosts for carry over study are presented in Table 1.

Incidence studies:

Surveys conducted at five locations viz, Talod, Anand, Vijapur, Junagadh and Jamnagar representing important bajra growing tracts in the State have indicated that the bajra shoot fly has been of regular occurrence in all hybrid bajra plots and dead hearts could be observed usually 10 day after germination. However the incidence has been below

TABLE 1

Incidence of bajra shoot fly on various host plants surveyed during 1975-76.

Year	Month	Infestation on (% dead hearts)		
		Bajra	Haryali	Boru
1975	May	25.00	40.00	5.00
	June	1.00	8.00	6.00
	July	4.00	48.00	0.00
	August	47.08	45.00	0.00
	September	54.30*	35.00	0.00
	October	5.00*	18.00	0.00
	November	96.00*	4.00	0.00
	December	0.00	5.00	0.00
	January	0.00	4.00	0.00
1976	February	3.00	3.00	0.00
	March	6.00	3.00	0.00
	April	9.00	4.00	0.00
	May	22.00	5.00	0.00
	June	1.00	7.00	0.00
	July	2.00	45.00	0.00

* Sprouts from *kharif* bajra stubbles.

5% in almost all seasons at Talod, Vijapur and Anand centres when sowing is done after receiving sufficient monsoon rains. There has not been any serious complaint of shoot fly infestation in these areas, even from the growers in the past few years. The data on incidence of shoot fly, during 1975-76 at Junagadh and Jamnagar during 1976-77 at Junagadh are presented in Table 2. It could be seen from data in Table 2 that at Junagadh the shoot fly incidence is found predominantly on the young tillers, as the dead hearts are recorded almost after one month of sowing. The germinating seedlings escaped damage presumably as the fly population was very low in the beginning of the season at Junagadh. Comparatively the damage to seedlings is higher at Jamnagar. Bajra crop is essentially a rainfed crop and sowing is done as soon as adequate rains are received.

TABLE 2

Incidence of bajra shoot fly at different time intervals after sowing of bajra crop.

Location		Junagadh	Junagadh	Jamnagar	
Date of sowing		29-6-75	6-7-76	24-6-75	
Variety		HB-3	HB-5	HB-3	
Date of observation	Dead heart %	Date of observation	Dead heart %	Date of observation	Dead heart %
	1975-76		1975-76		1975-76
10-7-'75	0.0	21-7-'76	0.0	8-7-75	9.25
17-7-'75	0.0	30-7-'76	2.71	15-7-75	14.69
24-7-'75	0.00	7-8-'76	3.15	22-7-75	20.05
31-7-'75	5.0	13-8-'76	2.50		
7-8-'75	16.0	23-8-'76	1.21		
20-8-'75	8.0	1-9-'76	1.37		
28-8-'75	12.5	10-9-'76	1.48		
4-9-'75	12.5	17-9-'76	1.82		
11-9-'75	9.5				
18-9-'75	1.0				

Shoot fly incidence remains of the lower order and plant stand loss due to dead hearts is compensated by tillers put forth by growing plants. Trials conducted at Jamnagar have established that shoot fly incidence is always higher in bajra fields which are sown late. Similar trend was observed in other three improved strains screened. The data in Table 3 reveal that shoot fly can build up very heavy infestations if the sowing of the bajra crop is delayed. However this heavy incidence is in context of early sowing of other normal bajra fields in the given season. In practice sowing in large tracts will not be delayed if adequate rains are received and therefore this contingency of delayed sowing and subsequently attracting heavy incidence is not likely to happen to any appreciable extent. The seed production plots which are sown late, as a rule of course, will face serious situation and prophylactic control measures may be necessary in

TABLE 3

Incidence of bajra shoot fly on three improved bajra varieties at different sowing dates.

Year		1973-74		1975-76	
Location:		Jamnagar		Jamnagar	
Date of sowing	Variety	Dead heart%	Date of sowing	Variety	Dead heart%
7-7-'73	HB-3	7.44	24-6-75	HB-3	3.00
	J-934	6.18	1-7-75		3.7
	J-1270	8.05	8-7-75		13.8
16-7-'73	HB-3	22.46	15-7-75		32.33
	J-934	16.63	22-7-75		35.00
	J-1270	18.67			
23-7-'73	HB-3	23.29			
	J-934	19.38			
	J-1270	16.07			
31-7-'73	HB-3	37.57			
	J-934	29.98			
	J-1270	28.78			

such late sown plots. Every season screening work is carried out, for new germ-plasm and inbred lines developed at the Jamnagar Research Station. As yet, however, no resistance or really tolerant material is available, although incidence of shoot fly has varied from about 8.00% to almost 55.00% in different material screened.

Chemical Control Experiment:

As incidence of shoot fly is of lower magnitude in crops sown at normal time, expensive prophylactic chemical treatment could not be economical. Trials conducted at Jamnagar have also borne out this contention. In view of this, minimum foliar applications of a few selected systemic insecticides have been evaluated for control purposes. Results of two years of such trials conducted at Junagadh are presented in Table 4. Perusal of data in Table 4 again establish

that shoot fly incidence has been well below 10% in all plots including the control. Foliar applications have failed to give adequate protection. Similarly seed treatment with carbofuran which has been very promising in control of jowar shoot fly has not shown any such promising results in control of bajra shoot fly. The difference in yields in various treatments also have been non-significant. Thus even one foliar spray of any insecticides will not be economical.

Taking an overall comprehensive view of shoot fly as a pest of bajra crop in Gujarat State, it is evident that this pest is of regular occurrence in the bajra crop during the first six weeks of the crop growth. However the incidence of dead hearts is not very alarming and usually no chemical control measures are warranted in the crop which is sown soon after receiving adequate rain fall, with onset of monsoon. Removal and destruction of dead hearts from the fields in the first 2-3 weeks if practised on extensive scale by bajra growers in a given locality, will help in reducing the degree of infestation by this pest. In bajra plots sown for seed production or research purposes, prophylactic chemical treatment will be necessary to prevent appreciable losses of valuable seeds. Singh and Jotwani (1973) have reported significant control of shoot fly by preplanting soil application of granular insecticides like aldicarb, phorate, disulfoton or aprocarb @ 3 kg/a. i/ha. Therefore such control measures can be adopted in cases referred to above. In instances where shoot fly damage is

TABLE 4

Relative efficacy and economics of different insecticidal treatments for bajra shoot fly control. Location Junagadh, Date of sowing 1974: 29-6-74. 1975: 29-6-75

Sr.No.	Treatments	Shoot fly infestation %	Grain Yield (kg/ha).			Increase Value Rs.		Treatment Cost (insectici- des+labour)	Profit or loss Rs.	
			1974	1975	1974	1975	1974		1975	(+)
A: Single spray										
1.	Endosulfan 0.05% at 21 days @ 600 l/ha	5.11	532	1353	+ 79	+ 90	71.0	+ 8.0	+ 19.0	
2.	—, —, — 33 days	5.33	458	932	+ 15	-268	71.0	-56.0	-339.0	
3.	—, —, — 45 days	5.00	463	1291	+ 20	+ 37	71.0	-51.0	-34.0	
4.	Control	6.33	440	1247	00	00	0.0	0.0	0.0	
		N.S.	N.S.	N.S.						
B: Two spray										
1.	Endosulphan 0.05% 15 & 30 days	6.2	528	1206	+16	+ 45	71.0	-55.00	-26.0	
2.	Elsan 0.15% —, —, —	5.2	481	1031	-24	-104	195.0	-219.0	-22.0	
3.	Formothion 0.14% —, —, — (Anthio)	5.3	463	950	-39	-173	195.0	-234.0	-36.0	
4.	Monocrotophos 0.03% —, —, —	6.3	468	1112	-35	-35	—	—	—	
5.	Methyla demeton 0.025% —, —, —	6.7	486	950	-20	-173	59.0	-193.0	-22.0	
6.	Carbofuran seed treat (5% seed weight)	4.8	463	870	-39	-241	23.0	-280.0	-2.0	
7.	Control	8.8	509	1153	00	00	0.0	0.0	0.0	
		N.S.	N.S.	N.S.						

N.S. = Not significant

likely to be higher in regular cultivation, one spray of endosulfan 0.05% or methy demeton 0.025% at 600 l/ha after two weeks of sowing will help to contain the incidence at a lower degree, without appreciable loss in grain yield.

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