Internat. J. agric. Sci. Vol.2 No.2 July 2006 : (644-646)

A Review

Bio-ecology and management of sorghum shoot fly, *Atherigona soccata* Rondani

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ABSTRACT

Sorghum (*Sorghum bicolor* (L.) Moench) is an important food and fodder crop in world, which ranks fourth among the major cereals after wheat, rice and maize. More than 150 insect species have been reported as pests on this crop. Among different insect pests, the shootfly, *Atherigona soccata* Rondani is a serious pest particularly in late sown crop. However, it is not uncommon to find harrowing of sorghum crop due to heavy infestation by shootfly. Looking to the seriousness of the pest, an attempt has been made to gather the information on its biology, seasonal incidence, nature of damage, alternate hosts, resistance screening techniques, resistant sources, economic threshold levels, mechanism of resistance, factors associated with resistance and management practices.

Key words : Sorghum, Shoot fly, Atherigona socata, Bio-ecology of management.

Biology and seasonal incidence:

The adult is a grey-colored small fly, which deposits small, white cigar-shaped eggs singly on the abaxial leaf surface of the seedlings parallel to midrib. After hatching in 1-2 days, the maggot enters the seedling base through the whorl and cuts the growing point. The larval period lasts for 8 to 10 days. Grown up larva is yellowish and about 6 mm in length. Pupation takes place either at the plant base or in the soil and lasts for 8 days. The entire life cycle is completed in 17 to 21 days (Sharma and Nwanze, 1997). The shoot fly populations exhibit considerable variation, normally very low from April to June, tend to increase in July and reaches peak in August. From September onwards the population gradually declines and with slight increase there will be a small peak in October and thereafter remains at a moderate level till March (Balikai, 2000). Its activity is influenced by extreme temperatures (above 35ºC and below 18ºC), and also by continuous rains. Balikai and Venkatesh (2001) reported that, rainfall received at one week after emergence and higher day temperature at two weeks after seedling emergence reduced shoot fly infestation, whereas lower afternoon relative humidity at 4 weeks after emergence increased shoot fly infestation. Karibasavaraja *et al.* (2005a) reported that, the pest was active through out the study period of four months starting from 27th to 44th standard week. Further, studies on the shootfly catches in fishmeal trap revealed that, highest peak catch of 488 flies per trap was recorded during 35th standard week. Effect of weather parameters on trap catches revealed that, the maximum and minimum temperature and rainfall had negative relationships. Maximum temperature at two and three weeks prior to trap catch had highly significant positive correlation, whereas the afternoon relative humidity at two weeks before trap catch had positive significant correlation.

Nature of damage:

Infestation normally occurs in the 1-4 weeks after seedling emergence. Maggot causes injury to the growing tip, which results in withering of central leaf popularly known as 'deadheart'. The damaged seedling is killed but may produce side tillers. However, the tillers are also attacked under high shoot fly pressure.

Alternate hosts:

During the off-season, the shoot fly survives on alternate hosts (*Echinochloa colonum* Link., *E. procera* Hubb, *Cymbopogon* sp., *Paspalum scrobiculatum* Linn., and *Pennisetum glaucum* (L.) R. Br.) and on volunteer or fodder sorghums.

Resistance screening techniques:

Adequate shoot fly density for resistance screening can be achieved by manipulating the sowing date, using infestor rows and spreading fishmeal in the field (interlard-fishmeal technique). To confirm resistance observed under field conditions and to study various resistance mechanisms a cage-screening method can be used (Sharma *et al*. 1992).

Sources of resistance:

The germplasm lines IS-1054, IS-1071, IS-2394, IS-5484, and IS-18368 were quite stable for shoot fly resistance across locations. ICSV-700, ICSV-701, ICSV-705, ICSV-714, and ICSV-717 are improved breeding lines with resistance levels comparable to original sources of resistance (Sharma *et al*. 1992). Some other resistant sources are IS-1055, IS-2123, IS-2146, IS-2165, IS-2312, IS-3962, IS-4646, IS-4664, IS-5469, IS-5470, IS-5480, IS-5604, IS-5613, IS-5619, and IS-18551. Narkhede *et al.* (2002) reported RSV-175, RSV-176, RSV-182 and RSV-290 as resistant sources, which were stable across several locations. Similarly KC-1, PGN-8, PGN-19, PGN-20, PGN-64, SEH-2, PFGS-2, PFGS-57 and PFGS-8 have been reported as resistant by Prem Kishore and Kishore (2001). Among 28 lines tested in one set, thirteen of them (ICSR -170, SPV-1156, M 148-138, SPV-1173, IS-33742, A-1, SPV-462, IS-33859, SPV-570, SPV-489, KSV-18R, IS-33843 and 5-4-1 (Muguti) were found to be promising against shootfly. While in another set of 27 lines, fifteen entries (IS-18366, IS-12611, SPV-655, SPV-1155, Afzalpur local, SPV-839, IS-4657, IS-33751, DRC-1000, BRJ-17, Selection-3, DRV-20, IS-188758, M 35-1 and 5-4-1 (Muguti)) were found to be promising against shootfly in *rabi* season (Balikai and Biradar, 2003). Out of 205 sorghum germplasm evaluated for resistance to shoot fly, eighteen genotypes (IS-2191, IS-4481, IS-4516, IS-17596, IS-18366, IS-33714, IS-33717, IS-33722, IS-33740, IS-33742, IS-33756, IS-33761, IS-33764, IS-33810, IS-33820, IS-33839, IS-33843 and IS-3388) were classed as resistant (Balikai *et al*. 1998; Balikai and Biradar, 2004).

Status of released varieties/ hybrids:

Most of the *Kharif* (CSV-2, CSV-3, CSV-4, CSV-5 CSV-6, CSV-9, SPV-462, CSV-13 and *rabi* (CSV-8R, CSV-14R, Swati) varieties and *rabi* hybrid CSH-15R show moderate level of resistance to shoot fly (<40% deadhearts).

Economic thresholds:

The ETL of 4-10, 3-9, and 6-15 per cent deadhearts in sorghum cultivars CSH-1, CSH-5 and Swarna respectively (Rai *et al*. 1978) has been estimated. For every 1 per cent increase in infestation lead to 89.1 and 30.5 kg ha^{-1} reduction in grain yield in CSH-5 and M 35-1 (Mote, 1986).

Mechanism of resistance:

Non-preference:

Significantly higher oviposition has been reported on susceptible cultivars as compared to resistant genotypes. However, Non-preference for oviposition breaks down under no-choice conditions or under high shoot fly pressure in the field.