

STUDY ON THE SCREENING OF SUGARCANE VARIETIES AGAINST THE DIFFERENT BROODS OF T. NIVELLA

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Abstract

Sugarcane is an agro - industrial crop and cultivation spread over a wide range of agro – ecological zone of India. The mature stalk is typically composed of 11 – 16 % fiber, 12 – 16 % soluble sugars, 2 – 3 % non – sugars and 63 – 73 % water. A sugarcane crop is sensitive to the climate, soil type, irrigation, fertilizers, insects, diseases control, varieties and the harvest period. The average yield of cane stalk is 60 – 70 tons per hectare per year. It varies between 20 and 180 tons per hectare per year depending on crop management approach. The long duration crop is attracted by *T. nivella* F., a notorious pest, which causes dead – heart disease to the plant. 24 varieties of sugarcane were screened and reveal that third and fourth brood showed minimum infestation while CoP 7104 and CoP 9103 were tolerant to the third and forth brood of the top borer. In September all the varieties registered maximum infestation. Yield loss due to infestation by different broods also confirms the above finding in different varieties.

Keywords: Agro – industrial, infestation, *T. nivella*, CoP 7104 and CoP 9103

Sugarcane is the world's largest crop by production quantity. In 2012, FAO estimates it was cultivated on about 160 million hectares in more than 90 countries, with a worldwide harvest of 18.3 billion tons. Brazil was the largest producer of sugarcane in the world. The next five major produces, in decreasing amounts of production, were India, China, Thailand, Palestine and Mexico.

In India, broadly there are two district agro – climatic regions of sugarcane cultivation India viz, Tropical (Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat, Madhya Pradesh, Goa, Pondicherry and Kerala) and sub tropical (Uttar Pradesh, Haryana and Punjab). For varietal development five agro – climatic zones have been identified-North western zone (ii) North central zone (iii) North eastern zone (iv) peninsular zone (v) Coastal zone. Sugarcane is a major agro – industrial crop after textiles. Sugarcane supports two important rural and cottage industries, namely jiggery and khansari (unrefined raw white) sugar. In addition, some by products of sugar industry, such as raw material for alcohol- based industry, power generation and organic fertilizers respectively.

Insect – pest scenario

Sugarcane is attacked by many insect species, Box (1953) listed 2041 insects including Acrida, covering 98 families under 13 orders. Over 140 insects have so far been recorded from the sugarcane plants in India of which, about 32 can be regarded as real pest that attack every part of the plant and cause an estimated loss of Rs 300 crores to the sugarcane industry every year. The insect pests – shoot and root borers, soil grubs, termites. The stalk is damaged by about a dozen species of tissue borers, coccids and beetle borers etc. Many of the newly varieties of sugarcane possess resistance to insect pests. The highly variable genetic material, which is maintained at Coimbatore (India) and Florida (USA), possesses many visible characters of great diversity such as lignifications of cell walls and length of spindle etc. and can be successfully used for evolving varieties resistant to top borer.

And these studies will provide to face the pest challenge by manipulating the manageable ecological parameter in the form of screening of varieties, cropping pattern etc.

Top Borer *T. nivella* belongs to Order Lepidoptera and family pyralididae. They complete their life – cycle within 7 – 8 weeks. Adult moth looks silvery white with a wing expansion of 3cm Male is cylindrical white, while female is thick and short with brilliance, body is covered with crimson hairy tuft.

The instar form enters through top of mid –rib and bores downwards. Central shoot is tunneled and crop is damaged. The bunched top and stunted growth are the outer morphology of sugarcane plant showing this disease. Internally vascular bundle is totally damaged. Infestation dries the shoot as well as reduces the sucrose content.

The method used is Pradhan and Prasad (1953) which includes Randomised Block Design with eight treatments including control and their replications for evaluating the relative efficacy of different insecticides against sugarcane top borer *T. nivella*. The data were analysed statistically 24 varieties of sugarcane were screened which revealed that 3rd and 4th brood showed the minimum 9 and 13 infestation while the maximum 15.8 and 34.4 per count in CoP 7104 and CoP 103 respectively. Some varieties were found tolerant to 3rd and 4th brood of the top borer.

In month of September all the varieties registered the maximum infestation in all types of sugarcane viz, Autumn, spring and Ratoon crop was registered respectively.

Yield loss due to infestation was confirmed. In respect to BO128 yield, early maturity variety, the minimum (0.024%) loss per cane was met in 5th broods attack while in 4th and 3rd it was 18.661% and 66.51 % respectively.

Seasonal history of *T. nivella*

The seasonal history of sugarcane top borer *T. nivella* had been reported by number of research workers, the activity of the pest started from last week of February on ratoon as well as autumn planted cane crop. The two broods of the pest completed their life cycle before onset of monsoon. The activity of 3rd brood started with the break of monsoon i.e. sometimes in the last week of June or first week of July with maximum temperature of 38° C, relative humidity of 70 – 80 per cent and continued till the advent of the winter (Gupta 1959). However, he also noted its six and seven overlapping broods during a year in Maharashtra and Hyderabad respectively. According to Agarwala and Prasad (1955), there were five broods which varied from 28 March to 30 April, 1st May to 6th June to 26th July, 27th July to 22nd September to hibernation at last 2nd, 3rd, 4th and 5th brood respectively. Haque and Agarwala (1995) reported that the emergence of parent months occurred at the end of February, middle of April, 3rd week of June, 1st week of August and middle of September, for 1st, 2nd, 3rd, 4th and 5th brood of *T. nivella* respectively.

Agarwala and Parasad (1956) recorded the greatest activity in 4th brood. According to Khanna (1956 – 57), their developments are the fastest in the 3rd brood and the slowest in the 5th were observed. The peak period of its activity ranged from early May to early August and the activity ranged from early May to early August and the activity declined in October followed by hibernation of the larvae under Bihar condition (Butani 1961). Kalra (1961) reported that there were 4 to 5 distinct broods during a year in North India. Further he also recorded the first brood *T. nivella* attack on ratoon sprouts during March while the second and third in May and July, respectively.

Varietal screening:

According to Issac (1939), hard midrib varieties of sugarcane, was found to be less susceptible to *T. nivella*. Rao (1947) found a non – significant correlation between hardness of midrib and tolerance to sugarcane top borer infestation. According to Verma and Mathur (1950), there was correlation between abundance of denticles on the mid rib and tolerance of *T. nivella* under field condition.

Agarwal (1959) observed that varieties Co 285, Co 356 and Co 421 showed appreciable tolerance to *T. nivella*. According to Pali (1965), there was higher the liquidification of midrib greater the tolerance to *T. nivella*.

Varieties Co 89029, Co 89030, Bo 102, Bo 99, CoSe 84233, CoSe 84234, CoSe 84235, , Bo 91, and CoS 767 were having low to medium incidence of top and stalk borers in Bihar (Technical Report, 1993 – 94).

In order to ascertain the influence of sugarcane top borer *T. nivella* against varietal tolerance, a field trial was laid out in randomized block design. There were 24 sugarcane varieties including standard of different maturity groups viz., early, mid early and late season with three replications having plot size of 10 x 5.4 m² with six rows of 90 cm apart. Paths between replication and plots were maintained apart at 1 metre and 0.5 metre respectively. The Varieties were planted in the month of February. The agronomical practices were followed as per recommendation such as manuring, interculturing, earthening up, irrigational etc. The varieties

were free from any insecticide application. The particulars of varieties including check have been presented as under:

The data pertaining to the incidence of sugarcane top borer, *T. nivella* (3rd and 4th brood) was recorded as the method adopted by Pradhan and Prasad (1953). The percentage incidence of the sugarcane top borer was recorded from 50 randomly selected canes diagonally of 4 rows of 16 columns in each plot.

The particulars of the varieties including check are as under

Varieties	Name of varieties
V ₁	CoS 90217
V ₂	CoS 90230
V ₃	CoS 90237
V ₄	CoS 9102
V ₅	CoP 9103
V ₆	CoP 9104
V ₇	CoP 9015
V ₈	CoP 9016
V ₉	CoP 9201
V ₁₀	CoP 9202
V ₁₁	CoP 9203
V ₁₂	CoP 9204
V ₁₃	CoP 9205
V ₁₄	CoP 9206
V ₁₅	CoP 9301
V ₁₆	CoP 9302
V ₁₇	BO 126
V ₁₈	BO 127
V ₁₉	BO 128
V ₂₀	BO 129
V ₂₁	BO 130
V ₂₂	Bo 91 (Std.)
V ₂₃	CoS 767 (“)
V ₂₄	CoS 1148

The observations on the incidence of *T. nivella* were taken on ‘dead heart’ basis in different varieties of sugarcane. The data are presented in table 1.

It is evident from the table that out of 24 varieties of different maturity group Viz., early , mid early and main season , the incidence of 3rd brood of *T. nivella* was recorded minimum (9.20%) in BO 127, whereas, maximum incidence was observed to be 15.80 per cent in CoP 9104. Response to different varieties of sugarcane against *T. nivella* incidence was statistically significant. The incidence of 3rd brood of *T. nivella* were found in this sequence : CoP 9104 (15.80) > Bo 91 (15.60) > CoP 9105 (15.57) > CoS 90217 (15.50) > CoS 90237 (15.40) > CoS 1148 (15.27) > CoS 767 (14.60) > CoP 9103 (14.40) > CoP 9202 (12.60) > Bo 126 (12.50) = CoP 9302 (12.50) = CoP 9106 (12.50) > Bo 130 (12.30) > CoP 9201 (11.83) > CoP 9102 (11.80) > CoP 9204 (11.59) > CoP 9203 (11.57) > Bo 128 (11.50) > Bo 129 (10.80) > CoP 9206 (10.50) = CoS 90230 (10.50) > CoP 9205 (10.00) > CoP 9301 (9.70) > Bo 127 (9.20).

Further from the table 1 it reveals that all varieties were attacked by 4th brood of T. Nivella. The maximum (32.40 per cent) incidence of the pest was recorded in CoP 9103 while minimum (13.00%) in Bo 127 , which were statistically significant. Some of the varieties were behaved tolerance to T. nivella in respect to both broods. The observation of 4th broods of T. nivella recorded and reported in this sequence: CoP 9103 (32.40) > CoS 767 (30.50) > CoS 90237 (29.70) > Bo 91 (29.50) > Bo 126 (28.90) > CoP 9104 (25.60) = Cos 90127 (25.60) > CoP 9102 (25.20) = Bo 128 (25.20) > CoP 9204 (24.40) > CoP 9203 (22.60) > CoP 9106 (22.40) > CoP 9105 (21.50) > CoS 90230 (21.30) > CoP 9302 (20.50) >

Table 1: Incidence of T. nivella on different varieties of sugarcane

S. No.	Variety	Mean incidence of top borer	
		3 rd brood	4 th brood
1	CoS 90217	23.16 (15.50)	30.38 (25.60)
2	CoS 90230	18.84 (10.50)	27.47 (21.30)
3	CoS 90237	23.06 (15.40)	33.01 (29.70)
4	CoP 9102	20.07 (11.80)	30.10 (25.20)
5	CoP 9103	22.27 (14.40)	34.69 (32.40)
6	CoP 9104	23.39 (15.80)	30.39 (25.60)
7	CoP 9015	23.21 (15.57)	27.60 (21.50)
8	CoP 9016	20.66 (12.50)	28.22 (22.40)
9	CoP 9201	20.08 (11.83)	22.46 (14.60)
10	CoP 9202	20.72 (12.60)	26.73 (20.30)
11	CoP 9203	19.18 (11.57)	28.36 (22.60)
12	CoP 9204	19.87 (11.57)	29.69 (24.40)
13	CoP 9205	18.38 (10.00)	26.04 (19.30)
14	CoP 9206	18.86 (10.50)	26.18 (19.50)
15	CoP 9301	18.12 (9.70)	23.46 (16.40)
16	CoP 9302	20.67 (12.50)	26.90 (20.50)
17	Bo 126	20.67 (12.50)	32.51 (28.90)
18	Bo 127	17.64 (9.20)	21.09 (13.00)
19	Bo 128	19.77 (11.50)	30.12 (25.20)
20	Bo 129	19.12 (10.80)	23.69 (16.20)
21	Bo 130	20.50 (12.30)	26.82 (20.40)
22	Bo 91	23.25 (15.60)	32.88 (29.50)
23	CoS 767 (“)	22.43 (14.60)	33.51 (30.50)
S.E. Mean		1.423	1.147
CD		4.051	3.265

Figures in parenthesis are original values and figure in $\sqrt{x+y}$ Bo 130 (20.40) > CoP 9202 (20.30) > CoP 9206 (19.50) > CoP 9205 (19.30) > CoP 9301 (16.40) > Bo 129 (16.20) > CoP 9201 (14.60) > Bo 127 (13.00).

The observations were restricted only two broods of T. nevilla which were quite detrimental to case yield. The sugarcane yield was greatly influenced by these broods of the pest.

The present investigation on screening of different sugarcane varieties got support of earlier workers. Though the information regarding this aspect very scanty. According to Agarwal et. al. (1973) the resistant/moderately resistant varieties under commercial cultivation viz. CoJ 67 (Punjab) Co 1007 (Madhya Pradesh) and Co 1158 (UP and Haryana) were recommended for large scale cultivation to migrate crop losses due to different broods of T. nivella.

ICAR Technical Report 1995 – 96, the minimum incidence of T. nivella was recorded in CoS 767 at Lacknow (4th brood) while in Co 1148 was recorded 14.88 per cent incidence of 3rd brood. Further, it was reported that T. nivella incidence was comparatively low in four varieties namely CoH 9, Co 89009, CoP 90221 and H 85 at Jalandhar (Punjab).

Studies on the percentage yield loss of different sugarcane varieties of S. excerptalis

The data in respect to loss due to different broods of T. nivella in per cane weight recorded and presented in Table 2.

It is evident from the table that the percentage yields loss per cane was minimum in 5th brood affected cane which was 9.26 per cent in comparison to healthy cane of cultivar BO 120, an early maturing variety recommended for cane cultivation in Bihar. Losses in cane, weight was observed to be 25.08 per cent in 4th

brood of *T. nivella* affected cane. The maximum yield loss was recorded 69.059 per cent in case of 3rd brood affected cane of the same variety i.e. BO 120.

Further, it is evident from the table 2 that the same trend was found in case of BO 128 variety, a mid early maturity group of cane variety recommended for Bihar state. The minimum yield loss per cane (0.024 %) was recorded in case of 5th brood of *T. nivella* affected cane. While 18.661 per cent and 66.51 per cent yield loss were observed in case of 4th and 3rd brood respectively.

Table 2: percentage yield loss due to different broods of *T. nivella* in sugarcane

Varieties/ Status of Sugarcane	BO 120		BO 128		BO 91	
	Yield in g/cane	Loss in weight per cane (%)	Yield in g/cane	Loss in weight per cane (%)	Yield in g/cane	Loss in weight per cane (%)
Healthy cane	601.2	-	730.02	-	739.45	-
Top borer affected cane (3 rd brood)	186.015	69.059	244.85	66.51	301.065	59.206
Top borer affected cane (4 th brood)	450.41	25.081	592.33	18.661	452.185	38.848
Top borer affected cane (5 th brood)	454.5	9.246	728.53	0.204	725.44	1.894

It is evident from the same table that yield loss per cane was recorded in following sequences i.e. 1.894 per cent, 38.84 per cent and 59.206 per cent in 5th brood, 4th brood and 3rd brood, respectively of *T. nivella* in BO91.

It reveals from the table that the maximum yield losses on the basis of per cane weight was recorded in 3rd brood of *T. nivella* in respect to all cultivars viz. , BO 120, BO 128 and BO 91 of different maturing groups of cane cultivar under Bihar condition. And this loss can be controlled by the integrated pest management including synthetic and botanical pesticides.

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