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Short communication

Correlation of meteorological parameters with the incidence and activity of shoot and trunk borer in shisham stands

M.S.ALI, A. SATTAR and O.P. CHATURVEDI
Department of Forestry, Department of Agronomy
Rajendra Agricultural University, Bihar, Pusa -848 125 (Samastipur)

Dalbergia sissoo Roxb. (Vernacularly shisham/ sissoo, leguminasea) is widely distributed throughout Indian subcontinent and other South Asian countries. It is truly a multipurpose tree, produces nitrogen, rich fodder, green manure, high quality fuel wood and charcoal, strong durable poles and timber and beautiful dark brown wood for furniture and paneling. It grows naturally on sandy or gravelly alluvial sites on the river embankments and prefers porous soils with sand, pebbles or stones having good drainage and aeration .Among the biotic stresses, the insects affected the growth pattern of shisham tree causing huge economic loss to tree growers of Bihar and also reported by few early workers (Mathur and Singh, 1959; 1959b; Brown, 1968 and Bhandari, 1987; Shekh, 1989) Among the problematic pest complex of *D. sisso,* the living twig shoot borer, *Cladoblastic melitrichus* and dry trunk borer, *Strombium barbatum* caused severe loss of biomass year after year under different stressed land situations of Bihar. Their larvae and grubs enter into new shoot tips of the plant and gradually cause cessation of shoot growth, sheding of buds and flowers and drying of the plant (Ali *et.al* 2000). The impact of weather factors as a whole is complex and has not been fully understood. The present study attempts to give seasonal population fluctuation of these insects in relation to meteorological parameters under the agroclimatic conditions of Bihar.

Study on population fluctuation of *C. melitrichus and S. barbatum* was conducted in agro-forestry field at Pusa(25°59'N latitude, 85°48' E longitude and elevation 53.12m) in north Bihar. The area comes under sub-humid sub-tropical monsoon climate. The seasonal incidence, outbreak and population *D. Sissoo* twig borers were recorded by random selection of fifty shisham mature saplings and young trees in the agro-forestry farm at Dhab land area. After tagging and coding, pest population was recorded at 7 days interval during March-June (2000-2001). For recording the borer population, whole shisham, tree was divided into four directional parts viz., apical,middle and lower shoot and below long twig main trunk for observation of non gregarious larvae and grubs of the pest. The host plant parts were periodically observed between 6.0 to 8.0 am for counting infesting larvae and grubs by

Table 1 : Population variation of shisham shoot and trunker borer *Cladoblastic melitrichus* and meteorological parameters(2000-2001)

Meteorological (SMW)	Mean percentage of apical shoot borer	Mean percentage of middle shoot borer	Mean percentage of lower shoot borer	Mean percentage of lower trunk borer	Meteorological observations				
					Max Temp(X_1)	Min Temp(X_2)	RH1 (X_3)	Rh2 (X_4)	Rain (X_5)
11	10.5	12.4	8.1	1.1	31.6	14.2	78	36	0
12	12.3	13.3	9.1	2.3	34.6	15.9	81	30	0
13	14.4	16.5	10.1	4.4	38.0	17.5	54	21	0
14	16.3	18.6	17.2	5.1	36.6	20.0	70	37	0
15	18.4	19.5	23.3	5.2	35.0	22.4	83	49	21.0
16	20.2	20.7	23.5	6.4	45.2	22.7	86	51	18.0
17	22.2	21.6	23.7	7.5	34.9	23.9	81	53	0
18	23.1	22.5	18.7	8.2	43.7	25.6	77	45	0
19	23.1	22.8	29.3	8.6	38.8	25.5	85	59	28.0
20	23.5	22.7	33.5	9.0	31.5	24.5	86	69	74.6
21	24.1	22.9	34.6	10.1	32.5	24.7	87	69	41.0
22	24.1	23.2	43.0	11.1	34.1	26.3	87	71	116.0
23	24.2	23.2	39.1	12.6	34.8	25.8	90	69	94.0
24	25.1	24.0	42.2	13.7	32.4	26.1	91	77	112.0
25	20.1	18.7	34.9	15.1	34.3	22.0	84	69	13.7
26	12.7	131	9.9	3.1	33.4	16.3	73	28	0
27	13.1	13.4	11.2	5.6	33.8	17.4	83	33	0
28	13.4	13.6	12.3	8.4	35.9	16.8	77	20	0
29	13.5	13.8	20.6	8.5	37.2	21.0	75	32	0
30	14.6	15.4	18.4	8.7	34.5	19.8	73	31	60.0
31	18.7	16.1	17.5	9.3	37.0	27.5	67	38	0
32	18.8	18.2	23.4	9.8	32.9	23.1	77	59	80.0
33	19.1	26.4	25.5	10.4	31.5	23.8	84	57	11,0
34	19.2	30.5	24.6	11.7	33.2	24.8	80	57	27.0
35	19.8	27.3	21.2	12.2	35.0	24.7	85	53	50.0
36	23.2	22.12	30.8	15.5	32.4	25.5	86	65	38.5
37	23.4	33.8	31.5	18.7	33.1	25.6	85	67	12.5
38	24.1	34.9	27.7	19.1	34.1	27.1	82	59	11.0
39	24.2	39.3	35.4	24.2	32.0	26.0	92	75	213.5
40	24.1	36.2	34.3	30.7	33.8	23.1	86	68	24.0

direct and visual observations using a magnifying glass. Multiple regression equations between borer population and meteorological parameters such as mean maximum and minimum temperature (°C), relative humidity (RH%) and total rainfall (mm) were developed.

Table 2: Correlation coefficients between borer population and different meteorological parameters

Type of borer	Infestation site	Max temp. (^{0}C)	Min temp. (^{0}C)	RH at 700 hrs (%)	RH at 1400 hrs (%)	Total rain fall (mm)
Cladoblastic melitrichus	Apical Portion	-0.04	0.90*	0.62*	0.90*	0.50*
	Middle Portion	-0.20	0.69*	0.52*	0.72*	0.46
	Lower Portion	-0.26	0.77*	0.71*	0.14*	0.64*
Strombium barbatum	Main Trunk	-0.26	0.59*	0.48*	0.67*	0.45

* Significant at 5% level

The activity of the pests started from 11th standard meteorological week (SMW) and increased progressively till 25th (Table 1). The infestation of apical shoot borer ranged between 10.5 to 25.1 per cent in 2000 and 12.8 to 24.2 per cent in 2001. Trunk borer recorded 1.1 to 15.2 per cent variation in 2000 and 3.1 to 30.7 per cent in 2001. Thus highest population (43.0 per cent) was recorded in case of lower shoot borer followed by apical shoot borer during both the years of study. The data showed that the incidence of trunk borer was higher in 2001.

The highest infestation of apical and middle shoot borer was recorded in 24th SMW in both the years of study. However, the higher infestation of lower and trunk borer was recorded one week later in both. The overall infestation of the pest was higher in 2001 perhaps due to higher temperature and low humidity condition in 11th SMW.

Correlation studies

Correlation coefficients between the infestation and different metrological parameters viz., maximum temperature, minimum temperature, relative humidity both at 0700 hrs and 1400 hrs and rainfall were worked out (Table 2) which revealed that maximum temperature had no influence on the incidence and activity of the pest. Minimum temperature showed significant positive correlations ($r = 0.90^*$ to 0.59^*) with infestation of apical, middle lower and trunk borer. Relative humidity at 0700 hrs and at 1400 hrs showed significant influence (Table-2) on pest build up. Rainfall showed a significant positive relationship with only apical and lower shoot borer infestation ($r = 0.50^*$ and 0.64^*). Middle and trunk borer showed non- significant effect with rainfall.

Regression models

Regression equations were developed between infestation of apical, middle, lower and trunk boring insects with prevailing meteorological parameters by pooling the data of 2000 and 2001. The

regression models given below explained 89 to 93 per cent variability with apical and lower shoot borer. A variability of 48 to 57 per cent was observed with middle and trunk borer population.

$P_{as} = -0.6343+0.218X_1+0.495X_2 - 0.022X_3 +0.177X_4-0.002X_5$ (R^2 =0.92)

$P_{ms} = 0.791 - 0.0014X_1 + 0.753X_2 + 0.020X_3+0.255X_4+0.004X_5$ (R^2 =0.56)

$P_{ls} = -9.771 - 0.112X_1 + 0.303X_2 - 0.023X_3+0.479X_4+0.022X_5$ (R^2 =0.89)

$P_{tb} =3.223 - 0.2374X_1 + 0.438X_2 - 0.042X_3+0.573X_4+0.006X_5$ (R^2 =0.48)

Where, P_{as}, P_{ms}, P_{ls}, P_{tb} = Mean per cent infestation of apical, middle, lower and trunk shoot borer respectively.

X_1, X_2 =Maximum and minimum temperature(°C); X_3, X_4 =Relative humidity at 0700 hr and 1400 hr (%) and X_5 =Rainfall (mm)

The study showed that role of minimum temperature and relative humidity at 1400 hrs were more important in build up of borer population than other aspects of meteorological parameters studied.

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