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Influence of trash mulch and weeds on the incidence of stalk borer and abundance of the predaceous ant *Crematogaster subnuda* Mayr in sugarcane

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ABSTRACT: **Investigations on the influence of trash mulch and weeds in sugarcane revealed significantly higher populations of the predatory ant, *Crematogaster subnuda* Mayr in trash mulched and weedy fields and lower incidence of stalk borer, *Chilo auricilius* (Dudgeon) than the controls. This reduction in the incidence was also corroborated by laboratory and field tests.**

KEY WORDS: *Chilo auricilius*, *Crematogaster subnuda*, stalk borer, sugarcane, trash mulch, weed cover.

Among several biotic factors, native predators play a significant role in the suppression of insect pests. More than a hundred species of predaceous organisms have been reported to inhabit sugarcane (Easwaramoorthy *et al.*, 1991). Besides, 64 species of spiders have been reported from sugarcane ecosystem (Easwaramoorthy *et al.*, 1991). Information on most of these organisms is available on their host records. Easwaramoorthy *et al.* (1996) studied the prey acceptance of commonly occurring spiders in sugarcane ecosystem whereas spider abundance in sugarcane was studied in relation to cultural practices, irrigation and post-harvest trash burning by Srikanth *et al.* (1997). Despite these works, there is no information on their effect on the suppression of insect pest infestation in this crop, at least in India. It was, therefore, considered imperative to study the effect of the most abundant predaceous ant in the sugarcane ecosystem in the subtropics, *viz.*, *Crematogaster subnuda*, on the infestation of stalk borer, *Chilo auricilius* Dudgeon, a major pest of sugarcane in this area. This ant is most abundant on sugarcane in this area particularly during rainy season when its nests are abundantly available in the whorls of sugarcane. These are predominantly numerous in weedy and trash covered fields. Our studies have indicated that pest infestation was generally low when these ants were predominant (Anonymous, 1999-2000; Shahi and Srivastava, 2002). Trash, in this crop, mostly includes cane leaves, accumulated in the field after the harvest. Its mulching has been reported to reduce shoot borer incidence (Parthasarathy, 1959). Many weeds have been reported as collateral hosts of the borer pests but their role in the control of these pests is not established (David, 1985).

These studies were carried out at the farm of Indian Institute of Sugarcane Research, Lucknow. For this study, observations were recorded from separate sugarcane fields (app. 1 ha each) of variety Co Lk 8102, having trash mulch and weed flora (during monsoon season) and no trash mulch and weed flora, for comparison. These were normal fields where cane was grown under the general practice of cane cultivation for commercial cane supply. These were ratoon fields where ratooning was initiated during January–February. The population of *C. subnuda* was scored from 30 clumps, selected at random on the two diagonals, from every field during September when the crop was about six months old. Since its population depended on the number of its nests in that particular clump and the ants were often too numerous to count, the number of its nests was scored afterwards in lieu of the number of individual ants, as an index of the population. The incidence of stalk borer was recorded by counting the infested canes out of total canes from 30 random samples drawn from each 6 m long row length in each field just before the harvest. This experiment was carried out for three crop seasons whereas the whole study was conducted during 1999-2004. The data were analyzed for significance of difference by 't' test after their angular transformation.

The predaceous activity of *C. subnuda* was tested using field collected ants, normalised by starving for 24 hrs. Stalk borer larvae were laboratory cultured. These were offered just after hatching to the normalised ants in small glass vials (50 mm x 15 mm) with the mouth covered by muslin cloth. The larvae were offered to the ants in the ratios, 1:1, 1:5, 1:10, 1:15, 1:20, 1:25, 3:5, 5:5 and control (with only 3 larvae together without any ant). The observations were recorded after 24 hours on the survival of the borer larvae and the ants.

The predaceous activity of the ant was also tested in the field on four selected canes under two conditions. In one, the canes were having profuse population of the ant and in the other there was no ant at all. Thereafter, freshly laid egg mass of stalk borer was stapled on both type of canes in September. These canes were examined for stalk borer infestation after 25 days. The test was repeated and the data were analyzed by Z test for difference of proportion.

The data on the population of *C. subnuda* (Table 1) clearly showed their significantly higher population in trash covered and weedy fields than their controls except in the former in the second crop season where it was almost equal in the two treatments. The incidence of stalk borer, however, was significantly lower in those trash and weed covered fields than their respective controls except in the former, again, in the second crop season (Table 1). This insignificant difference in the incidence in trash covered and control fields in second crop season appeared due to almost equal nest population of this predaceous ant.

Thus, it is an interesting observation that the ant population was higher in trash covered and weedy fields but the incidence of stalk borer was drastically low under these conditions. This could be probably due to the predation of the younger larvae of the borer by the ant before entry into the cane. In the laboratory, there was no mortality when one larva was offered to one ant. When the number of ants was increased from 5 to 25 per larva, the larvae died in all the treatments. There was only 60% mortality when 5 larvae were offered to 5 ants. However, when 5 ants were offered to only 3 larvae all the larvae died. When 3 larvae were put together without the ant, it suffered mortality of only one larva (33%). This showed that the ant showed strong predaceous activity in groups. The field tests to infest the cane plants artificially by stapling stalk borer egg mass with and without profuse high ant population revealed no infestation at all under high ant population. When ants were not there, 62.5% of the canes were infested which is significantly higher than its control (canes with ants) ($P = 0.01$). This clearly showed that high population of ants interfered with stalk borer infestation.

These observations clearly explained the above reported field data on the incidence of stalk borer. There is a strong preference for nesting by *C. subnuda* in trash covered and weedy fields and these situations tend to keep the incidence of stalk

Table 1. Population of *Crematogaster subnuda* and incidence of stalk borer under trash mulch and weeds at harvest stage.

Treatment	Ant population / clump± SEM			Incidence (%)± SEM		
	1999-2000	2000-2001	2001-2002	1999-2000	2000-2001	2001-2002
With trash cover	23.0[1]± 0.25	0.63± 0.14	2.40[1]±0.34	1.00± 0.93 (5.54) [1]	27.66±2.26 (31.03)	4.80±1.23 (12.47) [1]
Without trash cover	11.40[2] ±0.35	0.70± 0.17	0.16[2]±0.09	7.28±2.03 (14.28) [2]	28.0±2.17 (32.39)	17.26±1.16 (24.65) [2]
C.D. (P=0.05)	0.84	0.43	0.68	4.46	6.26	3.36
With weeds	10.73[1]± 0.20	2.53[1]± 0.43	1.20[1]± 0.27	6.61± ,1.53 (13.87) [1]	5.66± 1.90 (11.84) [1]	1.2± 0.65 (7.80) [1]
Without weeds	2.20[2]± 0.16	1.20[2]± 0.18	0.16[2]± 0.09	21.38±1.68 (26.39) [2]	24.0± 1.93 (28.91) [2]	17.26±1.16 (24.65) [2]
C.D. (P=0.05)	0.48	0.92	0.56	4.54	5.45	2.64

Data in parentheses are means of angular transformed values; Differences between superscript 1 and 2 are significant at 5% probability and those between the remaining values are not significant.

borer under check. Trash mulching has already been reported to reduce the incidence of the shoot borer (Parthasarathy, 1959). Weeds such as *Sorghum halepense* were earlier considered to contribute in the build up of the borer pests, especially stalk borer, but later they were not found important (Gupta and Avasthy, 1954). Our findings, however, showed their role in stalk borer build up, not as a collateral host, but through the abundance of the predaceous ant.

Thus, trash mulching appears to be advantageous from plant protection standpoint. Weeds are supposed to compete with the crops and therefore warrant control. But monsoon weeds cease to grow due to reduced light penetration and die back when the canopy closes with the season's progression. Thus, the risk of their competition with the crop is eliminated (Ali and Reagan, 1985). It will, therefore, be worthwhile if trash coverage is done through mulching in ratoon fields and the post-harvest burning of trash is discouraged. Weed control also should not be practiced during rainy season. These practices do not seem to pose any problem in the cultivation of sugarcane and have rather eco-friendly effects. These are likely to promote the population of natural enemies in general and *C. subnuda*, in particular. Since these two factors have been found to boost the population of this predaceous ant particularly during the rainy season, these should keep stalk borer incidence under check.

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