

Seasonal Changes of Aphids and Their Predators on Sugarcane (*Saccharum officinarum*) in Garhwalaya Himalayas

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Abstract

An extensive survey was conducted on aphid infestations, seasonal occurrence and their predators on sugarcane from six localities of three different zones of Garhwalaya Himalaya. Aphids were collected from these localities throughout 2005—2007. The study indicates that there are eight species under five genera of aphids and 11 species of predators under five genera. Among all of these aphid species, sugarcane woolly aphids SWA are causing serious damage.

Key words : Aphids, Predators, Seasonal occurrence, Sugarcane, Garhwalaya.

Sugarcane is the second largest cash crop in India. Sugar production has emerged as one of the major agro-industries in the rural areas of India. It is an important source of income and employment for the farming community in the sugar producing countries. This plant is suffered by the infestation of aphids and its incidence in pestiferous forms as reported in Uttar Pradesh and Uttaranchal (1, 2). The aphids are widely distributed in India and its adjoining countries. It damages the growing sugarcane (mainly mid ribs, leaves). Adults aphids are observed from September to January in Garhwalaya (range is between north latitude 29° 26' 15'' and 31° 05' 30'' and between east longitude 78° 18' 45'' and 80° 08' 0'') (3). The aphids attack all stages of sugarcane but the intensity is more severe in later stages; thousands of nymphs and adult aphids colonize the lower surface of leaves and desap the plant. The woolly wax material secreted by aphid, particularly the latter instar imparts a white appearance to the infested leaves. It is reported that in the areas where the pest has caused severe damage, there is yield reduction of up to 25% (4). In recent years, sugarcane plants are found to be heavily infested by aphids, particularly by sugarcane woolly aphid (SWA), *Ceratovacuna lanigera* Zehntner causing serious damage to the plant and loss of sugar yield in several parts of India, specially in southern states in India (5, 6), and also these aphids rapidly

rise above economic threshold level when suitable conditions prevail. Monitoring the population of such natural enemies will be of immense importance in scheduling control measure of this pest. Some predators were associated with different aphids on sugarcane in India to exercise a check on their rate of multiplication (7—10). Owing to its economic importance, the present paper reports the incidence and extent of damage, seasonal variation and predatory insects to control the aphids on sugarcane in Garhwalaya Himalayas throughout 2005—2007.

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Methods

Study Area

Regular monitoring and extensive surveys conducted by inspection of sugarcane cultivated fields during 2005—2007 in Garhwal region in 800—2400 m asl. The survey was made with respect to three different phyto-geographical zones viz. tropical upto (1,000 m asl.), sub-tropical (1,000—1,5000 m asl), and temperate (1,500—2,400 m asl) and the localities were Srinagar (600 m), Nagni (800 m), Jaripani (1,800 m), Ranatal (2,400 m), Harsil (2,400 m) and Ranichauri (1,900

Table 1. Aphids and their sub-families found in sugarcane.

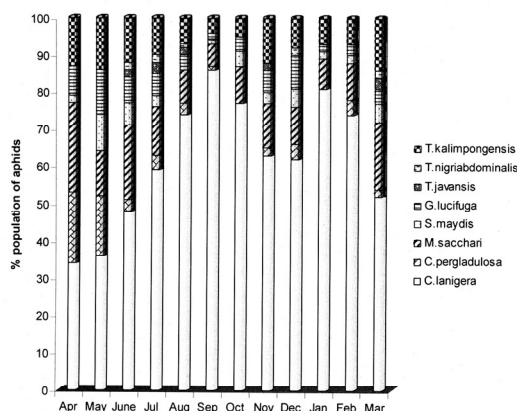
Aphid sp.	Sub-family
1. <i>Ceratovacuna lanigera</i> Zehntner	Hormaphidinae
2. <i>C. perglandulosa</i> Basu, Ghosh & Raychaudhuri	-Do-
3. <i>Melanaphis sacchari</i> Zehntner	Aphidinae
4. <i>Sipha (Rungia) maydis</i> Passerni	Chaitophorinae
5. <i>Tetraneura (Indotetraneura) Javansis</i> v.d.G	Pemphiginae
6. <i>T. kalimpongensis</i> Raychaudhuri, Pal & Ghosh	-Do-
7. <i>T. nigriabdominalis</i> (Sasaki)	-Do-
8. <i>Geoica lucifuga</i> Zehntner	-Do-

m). The plots were kept free from insecticides and normal agronomical practices were followed.

Sampling

Observations on the populations (abundance, damages and predators) were taken from 20 randomly selected sugarcane plants at weekly intervals. Counting was done by taking the parts as sample from sugarcane (midribs, leaves). Adult Aphids are collected by using simple hand nets and preserved in 70% ethyl alcohol. For studying the minute taxonomic characters for specific identifications, the specimens were boiled for 5 minutes in 95% ethyl alcohol. After that alcohol was decanted off and the aphids were boiled again in 10% KOH solution till the specimens appeared somewhat transparent. KOH solution was decanted off and the specimens were again rinsed in 95% ethyl alcohol. Then the insects were heated in chloral-phenol (saturated solution of chloral hydrate in distilled liquid phenol) and were mounted in gum chloral. The prepared slides were then studied under stereo-binocular microscope using ocular micrometer for observation and identification (11).

The incidence of aphid population and predators were recorded in all of these localities. The predators were mainly found on the SWA infested field. Counts were randomly made at an interval of one month starting from the first appearance of aphids on the infested sugarcane. From the infested plant parts (mainly midribs and leaves), predators were collected and preserved on 70% ethyl alcohol. Their total number was determined according to the methods of Shands and Simpson (12).

**Figure 1.** The percentage of different aphid populations throughout the year.

Results

Incidence of Aphids Infestations

The aphids encountered during the present study shows periods of activity and general abundance in different phyto-geographical strata of a total of eight species under five genera among them four from Pemphiginae, two from Hormaphidinae, one from Chaitophorinae, one from Aphidinae (Table 1). Figure 1 show the percentage of damage caused by the various aphid species. Among all of these sub-families *C. lanigera* causes maximum damage of sugarcane.

Predators of Aphids on Sugarcane

The predators were mainly found on the SWA infested field. The predators were under the families Pyralidae (Lepidoptera)—one species; Hemerobiidae (Neuroptera)—one species; Chrysopidae (Neuroptera)—one species; Syrphidae (Diptera)—three species and Coccinellidae (Coleoptera)—five species. Details are as follows.

Lepidoptera : Pyralidae

1. *Dipha aphidivora* (Meyrick)

Neuroptera : Hemerobiidae

2. *Micromus igorotus* Banks

Neuroptera : Chrysopidae

3. *Chrysopa* sp.

Diptera : Syrphidae

4. *Ischiodon scutellaris* (Fabricius)

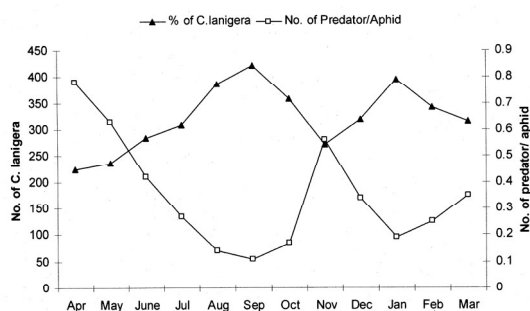


Figure 2. Seasonal incidence of aphids (*C. lanigera*) and their associated predators on sugarcane. Counting was done by taking 5 leaves as sample from insecticides-free field.

5. *Metasyrphus confrator* (Wiedemann)
 6. *Dideopsis aegrota* (Fabricius)
- Coleoptera : Coccineillidae
7. *Cheilomenes sexmaculata* (Fabricius)
 8. *Coccinella septempunctata* Linnaeus
 9. *Synonycha* sp.
 10. *Scymnus* sp.
 11. *Brumus* sp.

Seasonal Variations of Aphids and Their Predators

The present studies on seasonal incidence of aphid showed that they were maximum in September. The crops above 3 to 4 months of age received the aphid infestation and increased its severity from June and reached a maximum during September. From then, it declined to some extent by November which again started to increase and reached a second peak during January. Figure 2 shows that the maximum active period for aphid was during September to June while the maximum active period of the predator was November and April. The aphids tended to reduce during summer months till the onset of monsoon.

Discussion

Population of aphids in Garhwalaya Himalayas were studied in two consecutive years. On traversing through infested areas, the extent of loss caused by SWA was found to be greater than any other aphids. From the beginning it spreads into the entire field in short span of 2–3 weeks. SWA ranged from 5 to 100% in isolated patches. Activity of aphid is con-

finned to patches in a field where the severity of attack is high.

In this study we found that initial aphid infestation was noticed only on the underside of leaves all along the mid rib and subsequently covering ventral side of the leaves. Its infestation usually occurred in patches in the beginning and then spread into the entire field within a short span of two to three weeks. The infested cane could be identified from a distance based on the color changes, stunted growth in addition to whitish woolly aphids on the ventral side of the leaves. Due to this, there was a reduction in qualitative and quantitative parameters. A copious amount of honeydew was secreted on the upper surface of lower leaves, cane, trash and soil leading to sooty mould development under severe infestations, the deposition of flocculent detected from a distance.

Due to the sap feeding by all these aphids, yellowing and drying of leaves occurred from the tip along the margins, later entire leaves became dry under cane cultivation.

Melanaphis sacchari Zehntner is of sporadic occurrence like *C. lanigera*. It may sometimes form large colonies on the lower surface of leaves causing similar damage. *T. kalimpongensis* attacks the roots of sugarcane. Others aphids also attack the sugarcane and as a result there is serious damage of cane cultivation.

The severity was more near the river beds, along canal and over irrigated fields (13). The incidence of different aphids on sugarcane causing notable losses (7 to 39%) and sugar recovery (1.2 to 3.43%) were reported earlier (1).

It was also observed that as the population of predator increased, the population of aphids decreased and the range of predator population varied between 0.1–0.8/aphids. Agarwala and Bardhanroy (14) have also observed that the predators become active at low aphid density/plant. This information is helpful in understanding about the predator's potential as a biological control agent that plays a greater role in the natural suppression of the pest in undisturbed environment.

References

1. Patil R. K., G. K. Ramegowda, V. Rachappa, S. Lingappa and P. S. Tippannavar. 2003. Record of woolly aphid, *Ceratovacuna lanigera* Zehntner (Homoptera :

- Pemphigidae) in northern Karnataka. *Insects Env.* 9 : 57—58.
2. Pandey K. P., R. Singh and R. R. Singh. 2006. Resurgence of sugarcane aphid, *Ceratovacuna lanigera* Zehntner (Homoptera : Aphidiade) on sugarcane crops in Western UP and Uttaranchal. *J. Aphidol.* 18 : 75—77.
 3. Atkinson E. T. 1973. *The Himalayas gazetteer*. 1973. Cosmo Publ., Delhi, India 3 : 228—320.
 4. Kourousu U. and S. Aoki. 1986. Sexuparae of sugarcane woolly aphid *Ceratovacuna lanigera*. *Kontyu.* 54 : 523—524.
 5. Raychaudhuri D. N. 1984. Food plant catalogue of Indian Aphidinae. The Aphidol. Soc., Kolkata, India.
 6. Balikai R. A., Y. K. Kotikal and R. K. Patil. 2007. Sugarcane white woolly aphid *Ceratovacuna lanigera* (Zehntner) (Homoptera : Aphididae) situation in northern Karnataka. *J. Aphidol.* 21 : 39—40.
 7. Aoki S., U. Kourousu and S. Usuba. 1984. First instar larvae of the sugarcane woolly aphid, *Ceratovacuna lanigera* (Homoptera : Pemphiginae) attack its predators. *Kontyu.* 52 : 458—460.
 8. Agarwala B. K., S. Das and A. K. Bhaumik. 1987. Natural food range and feeding habits of aphidophagous insects in northeast India. *J. Aphidol.* 1 : 18—22.
 9. Agarwala B. K. and A. F. G. Dixon. 1992. Laboratory study of cannibalism and interspecific predation in ladybirds. *Ecol. Entomol.* 17 : 303—309.
 10. Arakaki N. 1992. Predators of the sugarcane woolly aphid, *Ceratovacuna lanigera* (Homoptera : Aphididae) in Okinawa and predator avoidance of defensive attack by the aphid. *Appl. Ent. Zool.* 27 : 159—161.
 11. Raychaudhuri D. N. 1980. Aphid of north-east India and Bhutan. The Zool. Soc., Calcutta, India.
 12. Shands W. A. and G. W. Simpson. 1950. Control of aphids on potatoes with DDT when used with fungicides. *Maine Agr. Expt. St. Bull.*, pp. 1—480.
 13. Ramegowda R. K., R. K. Patil, M. Vidya, M. S. Puttanavar and S. Lingappa. 2006. Incidence and spread of sugarcane woolly aphid, *Ceratovacuna lanigera* Zehntner (Homoptera : Aphididae) in Karnataka. *J. Aphidol.* 20 : 19—23.
 14. Agarwala B. K. and P. Bardhanroy. 1999. Numerical response of ladybird beetles (Col. : Coccinellidae) to aphid prey (Hom : Aphodidae) in a field bean in north-east India. *J. Appl. Ent.* 123 : 401—405.