

ENTOMOLOGY RESEARCH FINDINGS/ RECOMMENDATIONS

Division of Crop Protection

01. Research Findings of Research based on Sugarcane Woolly Aphid (SWA); *Ceratovacuna lanigera* (Homoptera: Aphididae)

i. Natural enemy spectrum of SWA includes only arthropod predators and six species have been identified (Wanasinghe *et al*; 2012).

- *Dipha aphidivora* (Lepidoptera: Pyralidae)
- *Micromus* sp. (Neuroptera: Hemorabiidae)
- *Eupeodes* sp. (Diptera: Syrphidae)
- *Micraspis discolor* (Coleoptera: Coccinellidae)
- *Synonycha* sp. (Coleoptera: Coccinellidae)
- *Micraspis allardi* (Coleoptera: Coccinellidae)

Reference:

- VKASM Wanasinghe, NC Kumarasinghe and KMG Chanchala (2012). Natural Enemies of Sugarcane Woolly Aphid (*Ceratovacuna lanigera*): A survey in Passara, Sri Lanka. Proceeding of the forth symposium on plantation crop research, pp 163-170 (Annex 01).

ii. Variations of population density of the three natural predators of SWA

According to the data collected to find out the variations of population density of the three natural predators of SWA (*Dipha aphidivora*, *Micromus* sp. and unidentified Syrphid fly larva) from January 2012 to December 2014 indicated that, *Dipha aphidivora* and *Micromus* sp. were recorded throughout the sampling period. Peak populations of *Dipha aphidivora* were recorded in months of December and January in each year. Peak populations of *Micromus* sp. were recorded during the time periods with low number of *Dipha aphidivora* and the correlation coefficient value between the population levels of *Dipha aphidivora* and *Micromus* sp. is 0.0047. Unidentified Syrphid fly larva was recorded an uneven distribution during the study period (Annual Research Progress, 2014)

iii. Relationship of the three natural predators of SWA with some weather parameters

The results of the Pearson correlation coefficient values of each three predator with rainfall, temperature and relative humidity (Table 1) have indicated that, there were no significant

correlations of each predator with the weather parameters (Annual Research Progress, 2014) (**Annex 02**).

Table 1: Pearson correlation coefficient values of each three predator with rainfall, temperature and relative humidity

	<i>Dipha aphidivora</i>	<i>Micromus</i> sp.	Unidentified Syrphid Fly larva
Monthly average rainfall (mm)	-0.413825602	-0.04313	-0.12288
Monthly average temperature (°C)	-0.088168862	0.092444	-0.37389
Monthly average relative humidity (%)	-0.12099	-0.08037	0.197435

iv. Within- plant distribution of SWA

The studies on within- plant distribution of SWA indicated that, the highest population level of SWA is found on mature leaves. The SWA is often found on leaves with greyish green colour than on those of yellowish green colour (Chanchala *et al*; 2012).

Reference:

KMG Chanchala, VKASM Wanasinghe, NC Kumarasinghe, BDSK Ariyawansa, PMA Karunarathna (2012). Distribution Pattern of Woolly Aphid on Sugarcane Plant Based on Leaf Colour. Proceeding of the symposium on Miner export crops, Pp 91-94 (**Annex 03**).

v. Within-leaf distribution of SWA

The studies on within-leaf distribution of SWA on a sugarcane leaf indicated that, they prefer to colonies on the middle portion of the leaves than top and bottom due to wide area available and protection from sunlight and natural enemies (Annual Report, 2015) (**Annex 04**).

vi. Host Plant Resistance (HPR) Studies for SWA

- The variety SL 97 1442 has been identified as a highly susceptible variety for SWA
- The varieties SL 83 06 and SLC 2009 01 showed low susceptible to SWA than other varieties (SL 71 30, SL 92 4918, SL 92 5588, SL 96 128, SL 96 328, SL 97 1442 and SLI 121). Also we observed that, the rate of population buildup of SWA on those two varieties were lower than others. It indicates that these two varieties show low susceptible for the SWA infestation than other commercially available varieties and therefore these varieties

can be grown in plantations/ areas with high SWA infestations (Annual Research Progress, 2014).

- Two types of leaf trichome of different sugarcane varieties were identified (Figure 1).

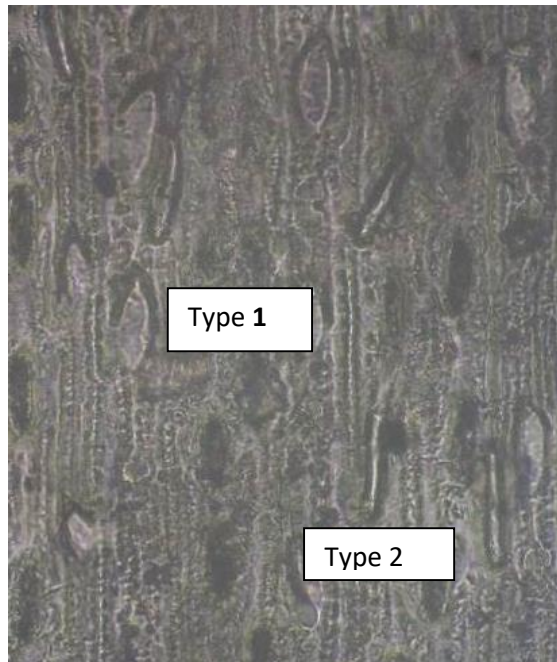


Figure 1: Two types of leaf trichome on lower side of sugarcane leaves; Type 1: spherical shape; Type 2: rod shape

- Leaf trichome densities have no effect on population growth, host plant preference and feeding rates of woolly aphid in different sugarcane varieties, and hence, confirming that leaf trichome density has no influence on woolly aphid infestation of different sugarcane varieties.
- Identifying that the weight of the honeydew excreted as an accurate method to determine the feeding rate of woolly aphid on different varieties.

vii. User Friendly Alternatives for the Recommended Synthetic Insecticide against Sugarcane Woolly Aphid in Sri Lanka

As user friendly alternatives for the synthetic insecticide against SWA in Sri Lanka; Tobacco extraction with liquid dish wash (Tobacco extraction 100 ml + Water 400ml + 1ml of liquid dish wash) or diluted liquid dish wash alone (liquid dish wash 0.4 ml + water 100 ml) can be used (Annual Report, 2014).

Reference:

Puwath Hasuna, Sugarcane Research Institute. March 2015. Volume 06. Page 04-05 (**Annex 05**)

02. Identification of New Pest Species Attack to Sugarcane in Sri Lanka

- i. First record of *Aceria sacchari*; Eriophyidae (Sugarcane Blister Mite) in Sri Lanka (Annual Report, 2015). It published in International Journal of Scientific and Research Publications.

Reference:

VKASM Wanasinghe, KMG Chanchala, D Navia, L. Nugaliyadde and NS Aratchige (2018). The First Record of *Aceria sacchari* Wang, an Eriophyoid Mite, in Sugarcane Plantations in Sri Lanka. International Journal of Scientific and Research Publications, Volume 8, Issue 9, September 2018 (ISSN 2250-3153). Pg 266-268 (**Annex 06**)

- ii. First report of Fall Army Worm; *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in sugarcane in Sri Lanka in December 2018 (Annual Report 2018). It published in the international sugar and sugarcane conference in Thailand.

Reference:

VKASM Wanasinghe, KMG Chanchala, AP Karunathilake, A Nikpay and L Nugaliyadde (2019). First report of Fall Army Worm; *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in sugarcane in Sri Lanka. Proceedings of the international sugar and sugarcane conference in Dusit Thani Hotel, Pattaya, Chonburi, Thailand from 31st July to 2nd August 2019. Page 39 (**Annex 07**)

03. Research Findings of the research based on *Deltocephalus menoni* (Homoptera: Cicadellidae); the insect vector of the White Leaf Disease (WLD)

A. Some Biological and Ecological Aspects of *Deltocephalus menoni*

- i. *Deltocephalus menoni* prefers laying eggs in loamy and sandy soils and in soil near WLD-infected plants than healthy sugarcane plants.
- ii. *Deltocephalus menoni* prefers to feed on WLD-infected sugarcane plants than on healthy sugarcane plants.

- iii. 4 to 5 month is the most vulnerable age of the sugarcane crop for the feeding of *D. menoni* under natural environment.
- iv. *D. menoni* as an insect with monophagy feeding behaviour. According to the feeding calendar, the dusk and the dawn are the most active feeding times of it. Female insects are the most suitable for the feeding tests.
- v. The light traps can be used to monitor the population levels of *D. menoni* and 7.30pm to 8.30 pm is the most active time period under artificial light (at night) condition.
- vi. For the laboratory tests, 15 minutes at 4⁰C is recommended to anaesthetize of *D. menoni*
- vii. Identified best time period for applying insecticides for controlling *D. menoni* in sugarcane plantations.

Reference:

KMG Chanchala and VKASM Wanasinghe (2019). Determining the best application time of insecticides for controlling *Deltocephalus menoni* (Hemiptera: Cicadellidae), a vector of Sugarcane White Leaf Disease in Sri Lanka. Proceeding of International Conference Sugarcon 2019 at ICAR-Indian Institute of Sugarcane Research, Lucknow, Uttar Pradesh, India from February 16-19, 2019. Page 192 (**Annex 08**)

- viii. Studies were conducted on how to affect leaf lamina colour of different sugarcane varieties for the behavioral characteristics of *D. menoni*. Results revealed that, higher intensities of red and green colour compositions in leaf lamina cause for making the plant less attractive for aggregation, insect feeding, nymphal period and adult longevity of *D. menoni*.

Reference:

KMG Chanchala, SH Kiriella, VKASM Wanasinghe, KS Hemachandra, L Nugaliyadde and WRG Witharama (2019). Does leaf lamina colour affect the behavioral characteristics of *Deltocephalus menoni* (Hemiptera: Cicadellidae); a vector of Sugarcane White Leaf Disease? Proceedings of the international sugar and sugarcane conference in Dusit Thani Hotel, Pattaya, Chonburi, Thailand from 31st July to 2nd August 2019. Page 27 (**Annex 09**)

- ix. Use of sweep net is the best population monitoring technique for *Deltocephalus menoni* (**Annex 10**)
- x. Maximum flight distance of *Deltocephalus menoni* is 75m and it was only 0.08% of the total release and mean dispersal distance of *Deltocephalus menoni* was 2.3 m/day (**Annex 11**)

B. Host Plant Resistance (HPR) Studies for *D. menoni*

- i. *Sorghum bicolor* and *Spontanium* spp. have been identified as alternative breeding and feeding hosts of *D. menoni* but *Erianthus arundinasius* as a non-host plant.
- ii. SL 92 5588 and SLC 2009 01 have been identified as less preferred sugarcane varieties for feeding by the *D. menoni*.
- iii. CO 775, SL 96 128, SL 96 328 and SL 97 1442 recorded as the most preferred sugarcane varieties for feeding of WLD vector and SL 92 5588, *Saccharum spontaneum* and *Erianthus arundinaceous* as less preferred varieties.
- iv. CO 775, SL 96 128, SL 96 328 and SLC 2009 01 recorded as the most supportive sugarcane varieties for adult survival of WLD vector
- v. SL 96 328, SL 96 128 and SLT 4921 are the most favourable varieties for survival of nymphs of WLD vector
- vi. Nymphal period of the WLD vector is less on SL 96 128, SL 96 328 and SLT 4921 and more on SL 92 5588, SL 83 06 and SLT 4921. *Erianthus arundinaceous* does not facilitate the nymphal development
- vii. SLT 4921, CO 775 and SL 83 06 were identified as more preferred varieties for oviposition of WLD vector.
- viii. Mustard (*Brassica juncea* (L.) Czern & Coss) has been identified as a repellent crop for *D. menoni*.

C. Control Practices for *D. menoni*

- i. Fipronil 0.3 GR (soil application of 18Kg/ha) has been identified as an effective treatment to manage the WLD incidence in sugarcane plantation

04. Biological Control Agents to manage *Pyrilla perpusilla* in Local Sugarcane Plantations

- i. Fulgoraecia (Epiricania) melanoleuca*; Lepidoptera: Epipyropidae (Introduced Ecto parasitoid from Pakistan)
- ii. Parachrysocharis javensis*; Hymenoptera: Eulopidae (Indigenous Egg parasitoid)

Two outbreaks of *Pyrilla perpusilla* in 2013 and 2015 in the seed cane nurseries at Kantale were successfully managed by introducing and establishing *Fulgoraecia (Epiricania) melanoleuca*.

Reference:

VKASM Wanasinghe, KMG Chanchala, MKPC Gunawardena and A Wijesuriya (2019). Control of Sugarcane Leaf Hopper, *Pyrilla perpusilla* by *Fulgoraecia (Epiricania) melanoleuca* Fletcher (Lepidoptera: Epipyropidae) in the seed cane nursery at Kantale, Sri Lanka. Proceeding of International Conference Sugarcon 2019 at ICAR-Indian Institute of Sugarcane Research, Lucknow, Uttar Pradesh, India from February 16-19, 2019. Page 119 (**Annex 12**)

05. Development of a management programme for Fall Army Worm (FAW), *Spodoptera frugiperda* (Lepidoptera: Noctuidae)

Fall Army Worm (FAW) (*Spodoptera frugiperda*) which is an invasive pest of maize has been recorded in sugarcane in since December 2018. Infestations of FAW were observed in all the sugarcane growing areas; Uda Walawe, Sevanagala, Pelwatte, Ethimale, Hingurana, and Kantale. The highest damage incidence (%) was recorded in 2-3 week-old seed cane nurseries of 160 hectares at Pelwatte in the first week of February 2019. Since, no registered insecticide against FAW in sugarcane in Sri Lanka, Thiamethoxam 20% + Chlorantraniliprole 20% WG was applied as 8 g/16 L. The Sugarcane Research Institute provided the above insecticide for controlling the FAW infestations occurred in the sugarcane plantations of the Lanka Sugar Company (Pvt) Ltd, Sevanagala and Pelwatte and the Ethimale Plantations (Pvt) Ltd.

In addition to that, the Sugarcane Research Institute conducted awareness programmes on management of FAW for managers and field officers of all the sugar industries and for farmers in all the sugarcane growing areas. Field classes were conducted at Sevanagala, Pelwatte,

Siyambalanduwa and Hingurana to transfer knowledge on identification of eggs and larval stages of FAW and the relevant management practices.

Laboratory studies to detect egg and larval parasitoids of FAW are being conducted and two species of egg parasitoids; *Telenomus sp.* (Hymenoptera: Scelionidae) and *Trichogramma sp.* (Hymenoptera: Trichogrammatidae) and one predator species; Larvae of *Micraspis allardi* (Coleoptera: Coccinellidae) were identified as natural enemies of FAW in sugarcane in Sri Lanka. Furthermore different types of larval parasitoids, pupal parasitoids and a pathogen have been detected and those insects and fungus should be identified properly.

References:

- i. Puwath Hasuna, Sugarcane Research Institute. December 2018. Volume 09
(Annex 13)
- ii. Newspaper article on natural enemies of Fall Army Worm on 12th May 2019 (Divaina)
(Annex 14)

06. Recommended Insecticides for the Pests of Sugarcane in Sri Lanka (Annex 15)