Mysore J. Agric. Sci., 51 (2) : 271-275, 2017

Field Evaluation of Sunflower (*Helianthus annuus* L.) Genotypes for their Reaction to Green Leaf Hopper, *Amrasca biguttula biguttula* (Ishida) (Hemiptera : Cicadellidae) infestation

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ABSTRACT

One hundred and sixty two sunflower (*Helianthus annuus* L.) accessions were screened under field conditions at the Main Research Station (MRS), Hebbal, Bengaluru, during *Rabi* season of 2015 for their reaction to leaf hopper, *Amrasca biguttula biguttula* Ishida infestation. The results revealed that, the ten accessions *viz*., RH-95-C-1, AHT 12, OPV 2, CMS 103 B, KBSH 53, KBSH 72, OPV3, NCP 198, KBSH 1 and AHT 13 showed resistance reaction, whereas, DRSF 108, RHA 284, EC 734840, EC 734844, NCP 22, NCP28, KBSH 41, Morden and UASB 560 were found to be highly susceptible. Among the remaining accessions, 101 accessions were moderately resistant and 43 accessions were in the susceptible category. The spatial distribution of the leafhopper studied on sunflower entries during two different phenological stages of the crop (45 and 75 DAS) revealed that the leafhopper confined maximum population to the middle portion of the plant canopy, followed by top portion during both growth stages in the level canopy of sunflower.

Keywords: *Amrasca biguttula biguttula, helianthus annuus,* field screening, resistance, canopy distribution

IN Sunflower (*Helianthus annuus* L.) the work for the development ofinsect resistant cultivar / hybrid in particular reference to sucking pests, is still in its infancy. It is an elite oilseed crop of our country with high quality edible oil and wider adaptability and occupies an area of 7.21 lakh hectares with a production of 4.99 lakh tonnes and a productivity of 692 kg / ha. However, Karnataka occupies first position in India by accounting for an area of 3.84 lakh ha, a production of 1.93 lakh tonnes and productivity of 503 kg / ha (Anon., 2013). Although sunflower crop has the yield potential of 2.0 to 2.5 tonnes / ha under favourable conditions, its mean productivity levels are quiet low in India, mainly due to several biotic and abiotic stress factors. Among the bioticfactors, the attack of insect pests is the major limiting factor in its successful cultivation.

Of the 251 insect and acarine species that have been recorded on sunflower at the global level (Rajamohan, 1976), insect pests like Capitulum borer, *Helicoverpa armigera* (Hub.); Green semilooper, *Thysanoplusia orichalcea* (Fab.); Bihar hairy caterpillar, *Spilarctia obliqua* (Walker); tobacco caterpillar, *Spodoptera litura* (Fab.); cabbage semilooper, *Trichoplusia ni* (Hub.) and leaf hopper, *Amrasca biguttula biguttula* were considered to be of major economic importance in India (Basappa, 1995; Jagadish *et al*., 2004).

Leafhoppers, *A. biguttula biguttula* (Homoptera : Cicadellidae) are the important sucking pests of sunflower in India (Rana and Sheoran, 2004). Both nymphs and adults suck the plant sap and their severe infestation leads to curling of leaves and the characteristic "hopper burn" symptom. Crop loss due to insect pests in sunflower varies from region to region. As a result of severe outbreak of seedling pests, the plant stand of sunflower crop could be reduced by more than 30 per cent (Basappa and Bhat, 1998). The leaf hopper alone causes crop loss ranging from 18.5 to 46.3 per cent in Maharashtra (Anon., 1979).

Many insecticides are being used to control the pest complex of sunflower, which pose health and environmental hazards. Plant resistance is a potential alternate management strategy to reduce such pest damage, since it is eco-friendly, cost effective and can be integrated with cultural and biological control measures (Chirumamilla *et al*., 2010).

Since host plant resistance can be effectively exploited and utilized against sucking pests (Saritha *et al*., 2008), the present investigation was undertaken to screen sunflower germplasm for resistance against leaf hopper under field conditions.

Material and Methods

The study was conducted at Main Research Station, Hebbal, Bengaluru, Karnataka falls under the eastern dry Agro-climatic zones of Karnataka state during *Rabi* season 2015. The experiment was sown on Nov. 13, 2015 in unreplicated rows of 4 m length.

The experiment was initiated in order to determine the sources of resistance to leaf hopper population, of which 162 germplasm lines and experimental hybrids were screened under field conditions for their reaction to the leaf hopper. Observations on mean leaf hoppers per plant and hopper burn injury were recorded on 45th and 75th DAS. All agronomic practices were followed as per the Package of Practices, UAS, Bengaluru (Anon., 2015).

For recording leaf hopper population, five plants of each entry were randomly selected and labelled for recording observations both at 45 and 75 DAS. The observations were recorded on two upper leaves, two middle leaves and two bottom leaves of plant canopy and later it was expressed as mean number per plant (*i.e.*, mean no. / six leaves / plant). Both nymphs and adults were counted.

Hopper burn injury was recorded on the same five labelled plants in each entry following a 0 to 5 scale (Anon, 2013) and expressed as mean injury grade per plant.

Based on the leaf hopper injury grade, the accessions were categorised as detailed below. In that ten entries were categorised as resistant and nine entries were highly susceptible. Germplasm entries of sunflower were screened for evaluating their resistance potential against *A. biguttula biguttula* and the same set of entries were used for studying canopy distribution pattern of sunflower by counting the number of leaf hoppers at two top, two middle and two bottom leaves.

Leaf hopper injury grade	Resistance category*
0-1	R
2	MR
3	S
4-5	HS

Note: R: Resistant, MR: Moderately Resistant, S: Susceptible, HS: Highly susceptible

Results and Discussion

The results revealed that mean population of leaf hoppers ranged from 0.50 to 2.66 and 0.83 to 5.66 the infestation at 45 DAS and 75 DAS, respectively, across the different genotypes and hopper burn injury grade ranged from 0.00-1.80 and 0.40-4.60 at 45 DAS and 75 DAS, respectively.

Based on the observations ten accessions *viz*.**,** RH-95-C-1, AHT 12, OPV 2,CMS 103 B, KBSH 53, KBSH 72, OPV3, NCP 198, KBSH 1and AHT 13 had relatively lower leaf hopper population (< 1.0 hopper / plant) and hopper burn injury grade (0-1) than other accessions and were grouped as resistant, whereas, nine accessions *viz.,*DRSF 108, RHA 284, EC 734840, EC 734844, NCP 22, NCP28, KBSH 41, Morden and UASB 560 recorded the highest mean populations (>3 hoppers / plant) and hopper burn injury scale (>3 injury grade) and based on the mean injury grade these entries were rated as highly susceptible. Among the remaining accessions, 101 accessions were rated as moderately resistant and 43 accessions were rated as susceptible (Table I). Rana and Sheoran (2004) reported that the hopper population ranged from a minimum of 2 on HSFH 848 to a maximum of 4 per plant on KBSH 1. This result was contradictory with the present findings whereas, Bhat and Virupakshappa (1993) observed some hybrids such as KBSH 8 and KBSH 1 recorded the least damage. Morden recorded the highest leaf hopper population at both 45 and 75 DAS (2.66 and 5.66 per plant), respectively. Suganthy and Uma (2011) reported a maximum of 28 hoppers per plant in Morden and they consider Morden as susceptible check.

The present investigation has revealed that the genotypes RH-95-C-1, AHT 12, OPV 2,CMS 103 B,

TABLE 1

Categorization of sunflower genotypes for leafhopper resistance based on mean population of leafhoppers and hopper burn injury grade

Resistance category	Name of the genotypes
Resistant	RH-95-C-1, AHT 12, OPV 2,CMS 103 B, KBSH 53, KBSH 72, OPV3, NCP 198, KBSH 1, AHT 13 (10)
Moderately resistant	KBSH 44, S-207, RSFH 130, RHA 93, GKVK-2, M-17R, AHT 1, AHT 2, AHT 4, AHT 6, AHT8, AHT9, AHT 10, IHT 241, IHT 242, IHT 243, IHT 245, IHT 246, IHT 247, IHT 248, IHT 250, IHT 252, IHT 253, IHT 558, IHT 711, IHT 741, IHT 750, IHT 764, IHT 775, IHT 795, IHT 802, IHT 881, IHT 879, IHT 878, IHT 877, IHT 848, IHT 845, IHT 843, IHT 815, IHT 807, IHT 888, IHT 891, IHT 913, IHT 937, IHT 943, IHT 948, IHT 951, IHT 960, IHT 971, IHT 972, IHT 975, IHT 976, IHT 990, IHT 997, IHT 1061, IHT 1089, KBSH 71, KBSH 73, KBSH 75, KBSH 76, GMU 440, GMU 520, TCSH1, EC78484877, EC 734887, E17A,RHA 469, GMU 601, GMU 604, GMU 606, GMU 607, GMU 608, GMU 609, GMU 612, GMU 613, GMU 614, GMU 615, GMU 616, GMU 617, GMU 618, GMU 619, GMU 621, GMU 622, GMU 623, GMU 624, GMU 626, GMU 627, GMU 628, GMU 630, GMU 631, GMU 633, GMU 634, GMU 636, GMU 637, GMU 639, GMU 640, GMU 641, GMU 642, GMU 644 (101)
Susceptible	EC734846, RHA 378, X15WB, AHT 3, AHT 5, AHT 7, AHT 11, IHT 238, IHT 239, IHT 240, IHT 249, IHT 251, IHT 591, IHT 712, IHT 731, IHT 731, IHT 737, IHT748, IHT 752, IHT 753, IHT 754, IHT 837, IHT 821, IHT 936, IHT 952, IHT 956, IHT 980,IHT 981,IHT 995, KBSH 74, RHA 467, GMU602,GMU 603, GMU 605, GMU610, GMU 611, GMU 620, GMU 625, GMU 629, GMU 632, GMU 635, GMU 643, GMU 645 (43)
Highly susceptible	DRSF 108,RHA 284, EC 734840, EC 734844, NCP 22, NCP28, KBSH 41, Morden, UASB 560 (9)

KBSH 53, KBSH 72, OPV3, NCP 198, KBSH 1 and AHT 13 are resistant to *A. biguttula biguttula* by virtue of recording both relatively lower pest population and injury grade. Thus, the 19 entries (having extreme reactions to leaf hopper) (Table II) will be subjected to further tests both under field and artificial conditions, to confirm the resistance and susceptibility so that, it will help in further determination of morphological and biochemical basis for leaf hopper resistance in sunflower.

The results of the present investigation pertaining to the field screening were similar to the reports of Nagaraju *et al.* (2004), Anonymous (2006, 2007 and 2008) who screened several entries against leafhoppers, by the same methodology, however, their results cannot be compared with the present investigation as the entries / cultivars used by them differ and so also the seasonal variations.

Spatial distribution pattern of leafhopper in sunflower crop canopy

There was significant difference between the population of leafhopper within the crop canopy at both 45th DAS (CD=0.071) and 75th DAS (CD=0.42). During *rabi* 2015, leafhopper population (45th DAS and 75th DAS)was highest in the middle (3.58 / plant and 5.78 / plant), followed by top (2.95 / plant and 4.66 / plant) and least in the bottom (1.5 / plant and 2.11 / plant) at 45th DAS and at 75th DAS, respectively. However, there was no significant difference between top and middle crop canopy at 75 DAS (Table III). These finding however, do not agree with those of Jayaramaiah and Jagadish (1996) in case of *Myzus nicotianae* in tobacco probably due to differences in the host plant and pest species involved. Nevertheless, it indicates that middle level canopy is the most preferred site in sunflower for colonization by leafhopper.

TABLE II

Entries showing resistance and high susceptibility short listed for further studies.

A. Resistant entries

Entries	Mean no of leafhoppers / plant		Hopper burn injury grade	
	45 DAS	75 DAS	45 DAS	75 DAS
RH-95-C-1	0.50	0.83	0.20	1.00
AHT 12	0.66	0.83	0.00	0.80
OPV 2	0.66	0.66	0.00	1.00
CMS 103 B	0.50	0.83	0.20	0.60
KBSH 53	0.66	0.83	1.00	0.60
KBSH 72	0.66	0.83	0.00	1.00
OPV3	0.66	0.83	0.40	0.40
NCP 198	0.66	1.33	0.00	1.00
KBSH 1	0.50	0.66	0.80	0.60
AHT 13	1.33	1.00	1.00	1.00
B. Highly susceptible entries				
DRSF 108	2.00	3.66	1.20	3.40
RHA 284	1.83	3.16	0.80	4.00
EC 734840	1.83	3.66	1.80	4.20
EC 734844	1.66	3.50	1.60	3.20
NCP 22	1.83	3.16	1.00	2.80
NCP28	2.16	3.50	0.60	3.00
KBSH 41	2.33	4.66	1.00	4.40
Morden	2.66	5.66	1.40	4.60
UASB 560	1.66	3.00	1.20	3.60

TABLE III

Spatial distribution pattern of leafhopper in sunflower crop canopy

	45days			75days		
	Bottom	Middle	Top	Bottom	Middle	Top
Mean leafhoppers per leaves	1.5 (1.08a)	3.58 (1.49c)	2.95 (1.37b)	2.11 (1.19a)	5.78 (1.81b)	4.66 (1.65 b)
±SD	1.31	1.48	1.52	1.63	2.48	1.89
SEM±		**0.032**			**0.15**	
CD at P=0.05		**0.071**			**0.42**	

The present findings are contradictory to those of Mahto (1990) who revealed that at lower canopy level of sunflower , leafhopper was significantly more in number than other two levels. He did not find significant difference in nymphal population between middle and upper leaves.

The overall incidence of leafhopper per six leaves and hopper burn injury grade recorded in sunflower during *rabi* 2015. Totally 19 entries (*i.e.,* resistant and 9 highly susceptible) were shortlisted and subjected to artificial screening to ascertain consistent reaction of these entries for leafhopper infestation. The spatial distribution of the leafhopper studied on sunflower entries during two different phenological stages of the crop (45 and 75 DAS) revealed that the leafhopper confined maximum population to the middle portion of the plant canopy, followed by top portion during both growth stages in the level canopy of sunflower.

REFERENCES

ANONYMOUS, 1979, Annual progress report of AICRP on Sunflower forthe year 1978-79, Directorate of Oilseeds Research, ICAR, Hyderabad, p. 109.

ANONYMOUS, 2006, Research achievement in sunflower, AICRP, (Sunflower) Directorate of Oilseeds Research, ICAR, Hyderabad, 117pp.

ANONYMOUS, 2007, Annual Progress Report of AICRP on sunflower for the year 2007-08, Directorate of Oilseeds Research, ICAR, Hyderabad, Pp. 197.

ANONYMOUS, 2008, Technical programme, AICRP on sunflower for the year 2007-08, Directorate of Oilseeds Research, ICAR, Hyderabad.

ANONYMOUS, 2013, Project Director's Report, Annual Group Meeting of Sunflower, Sesame and Niger, DOR, Hyderabad 8-10 April, 20pp.

ANONYMOUS, 2015, Package of practices of agricultural crops. University of Agricultural Sciences, Bengaluru, p. 357.

BASAPPA, H. AND BHAT, N. S., 1998, Pest management in sunflower seed production. In: Hybrid sunflower seed production technology (Eds.)

BASAPPA, H., 1995, Insect pest Management in sunflower-innovative approaches subject matter workshop cum seminar on integrated pest management in oil seeds, October 10-17, 1995, Directorate of oilseeds Research, Hyderabad.

BHAT, N. S. AND VIRUPAKSHAPPA, K., 1993, Integrated pest management in sunflower: Group discussion on IPM strategies in oilseeds in India. Punjab Agril. Univ., Ludhiana, India.

CHIRUMAMILLA, A., LAWRENCE, D., CHARLET, HULKE, H. C., SEILER, G. S., GROSS, T. A., KNODEL, J. J., ROBERT, K. AND AIKEN., 2010, Update on host plant resistance studies of banded sunflower moth and sunflower moth.www.ddr.nal.usda.gov/bitstream/10113/40225/1/IND44344428.pdf accessed on 19.02.11.

JAYARAMAIAH, M. AND JAGADISH, K. S., 1996, Spatial distribution of the tobacco aphid, *Myzus nicotianae* Blackman (Homoptera : Aphididae). Aphidologysymp., 1996. Dep. Zool., Univ. Gorakhpur, Gorakhpur, India.

JAGADISH, K. S., MANTUR, S. G., BHARATHI, S., JAGADEESH, B. N. AND CHANNAKRISHNAIAH,K. M., ANDNAGARAJU, 2004, Evaluation of sunflower genotypes for resistance to *Thripspalmi* - A vector of Necrosis Disease and its distribution in crop canopy. *Environ. Ecol*., **22** (1) : 169-172.

MAHTO, Y., 1990, A note on population dynamics of *Amrasca biguttula biguttula* (Ishida) on sunflower. *Indian J. Ent*., **52**(3) : 506-508.

NAGARAJU, JAGADISH, K. S. AND SHADAKSHARI, Y. G., 2004, Sunflower diseases and management (in Kannada). Extension brochure May 2004. AICRP sunflower, *Univ. Agri. Sci.*, Bangalore, p. 5.

RAJAMOHAN, N., 1976, Pest complex of Sunflower: a bibliography PANS, **20** : 546-563.

RANA, J. S. AND SHEORAN, R. K., 2004, Evaluation of sunflower (*Helianthus annuus* L.) hybrids against insect pests in semi arid tropics. *J. Oilseed res.,* **21**(2): 374-375.

SARITHA, R., K., DHARMA REDDY AND BASAPPA, H., 2008, Screening of sunflower varieties for resistance against sucking pests. *Indian J. Plant Prot*., **36** (1) : 144-147.

SUGANTHY, M. AND UMA, D., 2011, Screening of Promising Sunflower Germplasm against Key Insect Pests. *Madras Agric. J.,* **98** (4-6) : 180-181.

(*Received :* May, 2017 *Accepted :* June, 2017)