Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5687

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 1845-1849 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Intercropping on Incidence of Shoot Fly, *Atherigona pulla* (Wiedemann) in Little Millet

Ravulapenta Sathish*, M. Manjunatha and K. Rajashekarappa

University of Agricultural and Horticultural Sciences (UAHS), Department of Entomology, Shivamogga, Karnataka – 577 225

*Corresponding Author E-mail: sathishento12@gmail.com

Received: 24.07.2017 | Revised: 8.08.2017 | Accepted: 10.08.2017

ABSTRACT

An experiment was conducted at Zonal Agricultural and Horticultural Sciences (ZAHRS), UAHS, Hiriyur during 2015-16 to evaluate some intercropping systems for the management of shoot fly (Atherigona pulla) in little millet. Little millet was intercropped with cowpea, field bean, onion, garlic, coriander and dill compared with sole crop (Little millet). Effect of different intercrops on shoot fly incidence revealed that little millet + onion and little millet + garlic cropping systems was shown superiority in reducing oviposition, per cent deadheart and high grain and fodder yield both in kharif and rabi but, conserved less coccinellids compared to other crops (cowpea and field bean). The results on B: C ratio revealed that little millet + onion, little millet + field bean and little millet + cowpea recorded highest B: C ratio compared to others.

Keywords: *Little millet, Atherigona pulla, Shoot fly management, Intercrops.*

INTRODUCTION

Little millet (*Panicum sumatrense* Roxb.) is an important indigenous crop of Indian Subcontinent. It is grown in Tamil Nadu, Karnataka, Andhra Pradesh, Orissa, Bihar, Madhya Pradesh and Maharashtra. It is locally known as Same or Samai. It matures very early in 70-75 days it serves as an ideal catch crop for multiple and relay cropping systems. It is well known for its drought tolerance and is one of the least water demanding crops. This crop being eco-friendly is highly suitable for sustainable agriculture. The nutritional quality of this grain is superior to fine cereals. Although this crop has best of the attributes, its cultivation sometimes requires attention to manage the only serious pest, shoot fly (*Atherigona pulla*). This pest alone can cause loss up to 80 per cent or even 100 per cent[1]. Moreover the grains and fodders are fed to cattle; grains are directly consumed by human beings and also used in poultry. Hence, the use of chemicals is not advisable. Moreover, insecticides are hazardous to many target and non-target species, disturbance in crop eco-system led scientists to find out newer, safer, cost effective alternatives as the components of integrated pest management (IPM)[2]. Management of this pest through intercropping will play vital role in the organic production of small millets. So, keeping these points in view, the present investigation was undertaken.

Cite this article: Sathish, R., Manjunatha, M. and Rajashekarappa, K., Effect of Intercropping on Incidence of Shoot Fly, *Atherigona pulla* (Wiedemann) in Little Millet, *Int. J. Pure App. Biosci.* **5(4):** 1845-1849 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5687

MATERIALS AND METHODS

Field experiment was conducted to to study the effect of intercropping on the incidence and damage of shoot fly during *kharif* and *rabi* seasons of 2015-16 at Zonal Agricultural and Horticultural Research Station (ZAHRS) farm, UAHS, Hiriyur. A little millet variety Sukshema used for sowing in Randomized Block Design (RBD) with three replications and 9 treatments including untreated check (UTC) (Table 1). The crop was sown with a spacing of 30 cm between rows in a plot of 3 m x 3 m.

Table 1: Treatment details for the management of little millet shoot fly, *Atherigona pulla* through intercrops

Tr. No.	Treatments
T_1	Little millet + Cowpea (1:1)
T_2	Little millet + Field bean (1:1)
T_3	Little millet + Garlic (1:1)
T_4	Little millet + onion (1:1)
T_5	Little millet + Garlic + onion (1:1:1)
T_6	Little millet + Dill (1:1)
T_7	Little millet + Coriander (1:1)
T_8	Little millet + Dill + Coriander(1:1:1)
T_9	Little millet (un treated check)

In order to assess the incidence of shoot fly, the observations were made at 14th, 21st and 28th day after emergence (DAE) on randomly selected five plants per plot. The following observations on different parameters were recorded at different stages of the crop.

Number of eggs per plant

In each plot, five plants were randomly selected to observe the number of eggs. So, number of eggs was counted from each plant and total number of eggs on five plants (sum of eggs in five randomly selected plants) were taken and averaged to represent the eggs present on each plant.

Deadheart incidence (%)

Total number of plants in the each plot and the number of plants showing symptoms of deadhearts were recorded and converted into percentage deadhearts by using following formulae

$$\text{Deadheart incidence (\%)} = \frac{\text{Number of plants with deadhearts/plot}}{\text{Total number of plants/plot}} \text{ X } 100$$

Natural enemies

The number of coccinellids, chrysopids and spiders present on five randomly selected plants were counted. Total number present on 5 plants were taken and then averaged to number of coccinellids per plant, number of chrysopids per plant and number of spiders per plant.

Grain yield and fodder yield (q/ha)

Total grains were collected from each plot by threshing the panicles from each plot. Then the grain and fodder weight of the each plot was recorded by weighing them using electronic balance. Then, it was converted to yield per hectare (quintal).

RESULTS AND DISCUSSION

Number of eggs per plant

Significantly least mean number of eggs was observed in little millet + onion and little millet + garlic cropping systems in both *kharif* (0.27 and 0.43eggs/ plant, respectively) and *rabi* (0.47 and 0.44 eggs/ plant, respectively). Highest mean number of eggs were recorded

in little millet sole cropping system (1.57 and 1.38 eggs/ plant, respectively) followed by little millet + field bean (1.20 and 1.33 eggs/ plant, respectively) and little millet + cowpea (1.13 and 1.23 eggs/ plant, respectively) cropping systems (Table 2). The present findings are in agreement with the reports of Karibasavaraja *et al*[3]. who observed lowest number eggs of sorghum shoot fly in sorghum + garlic and sorghum + onion cropping system. But, in contrast with Spurthi *et al*.[4] reported less number of eggs in sorghum + cowpea system.

Per cent deadheart

The mean per cent deadheart was least in little millet + onion and little millet + garlic in both *kharif* (8.08 and 8.59 %, respectively) and *rabi* (6.59 and 7.55 %, respectively) (Fig. 10). However, highest mean per cent deadheart was observed in little millet sole cropping system (31.67 and 28.45 %, respectively) followed by little millet + field bean (24.74 and 21.37 %, respectively) and little millet + cowpea (21.89 and 21.53 %, respectively) cropping systems (Table 3). The present findings are in accordance with Karibasavaraja *et al*[3] who observed less per cent deadhearts in sorghum + garlic and sorghum + onion cropping system.

Natural enemy population

During the entire study period, only predatory coccinellid population was found. Over all, in both *kharif* and *rabi*, little millet + cowpea (1.27 and 1.40 coccinellids/ plant, respectively) and little millet + field bean (1.16 and 1.29 coccinellids/ plant, respectively) cropping system conserved highest coccinellid population compared to untreated check (sole crop) whereas, significantly least mean coccinellid population was observed in little millet + onion (0.33 and 0.47 coccinellids/ plant), little millet + garlic + onion (0.36 and 0.44 coccinellids/ plant), little millet + garlic (0.38 and 0.78 coccinellids/ plant) cropping systems (Table 4). The results are in line with the Mote *et al*[5] who reported maximum number of predatory coccinellids in cotton + cowpea intercropping systems.

Yield and cost economics

Among the intercropping systems, little millet + onion and little millet + garlic recorded the highest grain and fodder yield (Table 5). Lowest yield was observed in little millet + field bean and little millet + cowpea in both the seasons. The results on B: C ratio revealed that little millet + onion, little millet + field bean and little millet + cowpea recorded highest B: C ratio whereas lowest was observed in untreated check (sole crop). The results suggested that yields of both the crops are reduced when grown as mixed or intercropped, compared with the crops when grown alone but in most cases combined yield per unit area from intercropping are higher.

Table 2: Effect of intercrops on the oviposition by shoot fly, *A. pulla* during in little millet during *kharif* and *rabi* (2015-16)

Tr. No.	Treatments	Number of eggs/ plant							
		Kharif				*Rabi*			
		14 DAE	21 DAE	28 DAE	Mean	14 DAE	21 DAE	28 DAE	Mean
T_1	Little millet + Cowpea	1.20 $(1.27)^{abc}$	1.27 $(1.33)^{ab}$	1.20 $(1.30)^{ab}$	1.23^{bc}	1.33 $(1.35)^{ab}$	1.07 $(1.24)^{abc}$	1.00 $(1.22)^{a}$	1.13^{b}
T_2	Little millet + Field bean	1.33 $(1.34)^{a}$	1.33 $(1.35)^{ab}$	1.13 $(1.27)^{ab}$	1.33^{b}	1.27 $(1.32)^{ab}$	1.20 $(1.29)^{ab}$	1.13 $(1.27)^{a}$	1.20^{b}
T_3	Little millet + Garlic	0.53 $(1.00)^{d}$	0.33 $(0.90)^{d}$	0.33 $(0.90)^{cd}$	0.43^{e}	0.60 $(1.05)^{c}$	0.40 $(0.93)^{e}$	0.33 $(0.90)^{b}$	0.44^{f}
T_4	Little millet + onion	0.40 $(0.93)^{d}$	0.13 $(0.79)^{d}$	0.13 $(0.79)^{d}$	0.27^{f}	0.60 $(1.05)^{c}$	0.40 $(0.94)^{e}$	0.40 $(0.93)^{b}$	0.47^{ef}
T_5	Little millet + Garlic + onion	1.27 $(1.30)^{abc}$	1.07 $(1.25)^{b}$	1.0 $(1.22)^{b}$	1.17^{c}	1.0 $(1.22)^{abc}$	0.80 $(1.14)^{bcd}$	0.53 $(1.02)^{b}$	0.78^{cd}
T_6	Little millet + Dill	0.93 $(1.17)^{c}$	0.73 $(1.10)^{c}$	0.47 $(0.97)^{c}$	0.83^{d}	0.93 $(1.20)^{abc}$	0.60 $(1.04)^{de}$	0.47 $(0.98)^{b}$	0.67^{d}
T_7	Little millet + Coriander	1.00 $(1.19)^{bc}$	0.67 $(1.08)^{c}$	0.40 $(0.94)^{c}$	0.83^{d}	0.80 $(1.14)^{bc}$	0.67 $(1.08)^{cde}$	0.40 $(0.93)^{b}$	0.62^{de}
T_8	Little millet + Dill + Coriander	1.13 $(1.26)^{bc}$	1.13 $(1.27)^{b}$	0.93 $(1.19)^{b}$	1.13^{c}	1.20 $(1.30)^{ab}$	0.80 $(1.14)^{bcd}$	0.53 $(1.01)^{b}$	0.84^{c}
T_9	Little millet (un treated check)	1.53 $(1.40)^{a}$	1.60 $(1.44)^{a}$	1.33 $(1.35)^{a}$	1.57^{a}	1.47 $(1.38)^{a}$	1.40 $(1.35)^{a}$	1.27 $(1.32)^{a}$	1.38^{a}
	S.Em ±	0.05	0.05	0.04		0.07	0.05	0.06	
	CD @ 0.05	0.15	0.14	0.12		0.21	0.16	0.19	
	CV%	7.00	6.96	6.26		10.13	8.45	10.46	
	F test	*	*	*		*	*	*	

Figures in the parentheses are √x+0.5 transformed values;**DAE**= Days after emergence.
Means in the columns followed by the same alphabet do not differ significantly by DMRT (P=0.05)

Table 3: Effect of intercrops on the deadheart per cent by shoot fly, *A. pulla* during *kharif* and *rabi* (2015-16)

Tr. No.	Treatments	Deadheart per cent							
		Kharif				*Rabi*			
		14 DAE	21 DAE	28 DAE	Mean	14 DAE	21 DAE	28 DAE	Mean
T_1	Little millet + Cowpea	18.44 (25.44)^{bc}	22.45 (28.25)^{bc}	24.78 (29.68)^{c}	21.89^{c}	16.60 (24.03)^{b}	19.00 (25.74)^{b}	29.00 (32.52)^{b}	21.53^{b}
T_2	Little millet + Field bean	20.44 (26.89)^{ab}	23.11 (28.69)^{b}	30.67 (33.64)^{b}	24.74^{b}	16.56 (24.02)^{b}	19.11 (25.83)^{b}	28.44 (32.21)^{b}	21.37^{b}
T_3	Little millet + Garlic	4.67 (12.46)^{e}	8.44 (16.88)^{f}	12.67 (20.85)^{e}	8.59^{g}	3.33 (10.22)^{e}	7.33 (15.71)^{d}	12.00 (20.18)^{e}	7.55^{f}
T_4	Little millet + onion	5.78 (13.91)^{e}	7.78 (16.18)^{f}	10.67 (19.07)^{e}	8.08^{g}	2.89 (9.56)^{e}	6.00 (14.17)^{d}	10.89 (19.19)^{e}	6.59^{f}
T_5	Little millet + Garlic + onion	11.33 (19.46)^{d}	17.89 (25.02)^{de}	22.67 (28.44)^{cd}	17.30^{de}	11.33 (19.64)^{c}	12.67 (20.83)^{c}	21.33 (27.52)^{c}	15.11^{d}
T_6	Little millet + Dill	10.67 (19.07)^{d}	16.44 (23.93)^{de}	21.67 (27.71)^{cd}	16.26^{ef}	8.67 (17.07)^{d}	12.00 (20.24)^{c}	16.00 (23.59)^{d}	12.22^{de}
T_7	Little millet + Coriander	9.56 (18.0)^{d}	14.67 (22.53)^{e}	19.00 (25.79)^{d}	14.41^{f}	8.00 (16.37)^{d}	11.33 (19.68)^{c}	17.11 (24.45)^{d}	12.15^{e}
T_8	Little millet + Dill + Coriander	15.00 (22.75)^{c}	19.44 (26.10)^{cd}	25.00 (29.90)^{c}	19.81^{cd}	14.67 (22.53)^{b}	16.67 (24.05)^{b}	22.89 (28.59)^{c}	18.08^{c}
T_9	Little millet (un treated check)	24.33 (29.53)^{a}	31.78 (34.33)^{a}	38.89 (38.59)^{a}	31.67^{a}	20.67 (27.04)^{a}	27.11 (31.39)^{a}	37.56 (37.81)^{a}	28.45^{a}
	S.Em ±	0.96	0.84	0.99		0.63	0.71	0.83	
	CD @ 0.05	2.87	2.51	2.95		1.88	2.12	2.48	
	CV%	7.96	5.87	6.06		5.73	5.59	5.24	
	F test	*	*	*		*	*	*	

Figures in the parentheses are √x+0.5 transformed values;**DAE**= Days after emergence.

Means in the columns followed by the same alphabet do not differ significantly by DMRT (P=0.05)

Table 4: Effect of intercrops on coccinellid population in little millet ecosystem during *kharif* and *rabi* (2015-16)

Tr. No.	Treatments	Number of coccinellids/ plant							
		Kharif				*Rabi*			
		14 DAE	21 DAE	28 DAE	Mean	14 DAE	21 DAE	28 DAE	Mean
T_1	Little millet + Cowpea	1.47 (1.39)^{a}	1.20 (1.27)^{a}	1.13 (1.24)^{ab}	1.27^{a}	1.53 (1.41)^{a}	1.40 (1.31)	1.27 (1.29)	1.40^{a}
T_2	Little millet + Field bean	1.20 (1.27)^{ab}	0.87 (1.16)^{ab}	1.40 (1.35)^{a}	1.16^{a}	1.27 (1.30)^{ab}	1.53 (1.35)	1.07 (1.20)	1.29^{ab}
T_3	Little millet + Garlic	0.47 (0.97)^{de}	0.40 (0.93)^{c}	0.27 (0.87)^{c}	0.38^{bc}	0.40 (0.93)^{d}	0.53 (1.01)	0.40 (0.93)	0.44^{d}
T_4	Little millet + onion	0.33 (0.90)^{e}	0.33 (0.90)^{c}	0.33 (0.90)^{c}	0.33^{c}	0.53 (1.01)^{cd}	0.40 (0.93)	0.33 (0.90)	0.42^{d}
T_5	Little millet + Garlic + onion	0.33 (0.90)^{e}	0.40 (0.93)^{c}	0.33 (0.90)^{c}	0.36^{bc}	0.53 (1.01)^{cd}	0.40 (0.94)	0.40 (0.93)	0.44^{d}
T_6	Little millet + Dill	0.60 (1.04)^{de}	0.47 (0.98)^{c}	0.40 (0.94)^{c}	0.49^{bc}	0.73 (1.10)^{cd}	0.60 (1.05)	0.47 (0.97)	0.60^{cd}
T_7	Little millet + Coriander	0.67 (1.07)^{cd}	0.53 (1.02)^{bc}	0.60 (1.05)^{bc}	0.60^{b}	0.80 (1.14)^{bc}	0.67 (1.07)	0.47 (0.97)	0.65^{c}
T_8	Little millet + Dill + Coriander	0.53 (1.01)^{de}	0.53 (1.01)^{bc}	0.40 (0.93)^{c}	0.49^{bc}	0.60 (1.05)^{cd}	0.40 (0.94)	0.67 (1.05)	0.56^{cd}
T_9	Little millet (un treated check)	1.00 (1.21)^{bc}	1.27 (1.32)^{a}	1.40 (1.37)^{a}	1.22^{a}	1.27 (1.32)^{ab}	1.20 (1.52)	1.13 (1.22)	1.20^{b}
	S.Em ±	0.05	0.06	0.08		0.06	0.12	0.12	
	CD @ 0.05	0.15	0.17	0.25		0.19	0.35	0.37	
	CV%	8.04	9.13	13.46		9.56	18.50	20.34	
	F test	*	*	*		*	NS	NS	

Figures in the parentheses are √x+0.5 transformed values;**DAE**= Days after emergence.

Means in the columns followed by the same alphabet do not differ significantly by DMRT (P=0.05)

Table 5: Evaluation of intercrops on the yield parameters of little millet during *kharif* and *rabi* (2015-16)

Tr. No.	Treatments	Grain yield (q/ ha)		Fodder yield (q/ ha)		B: C ratio	
		Kharif	***Rabi***	***Kharif***	***Rabi***	***Kharif***	***Rabi***
T_1	Little millet + Cowpea	3.65^{ef}	4.74^{ef}	22.19^{d}	33.87^{d}	3.01	3.30
T_2	Little millet + Field bean	3.43^{f}	4.51^{f}	21.81^{d}	33.49^{d}	4.08	4.42
T_3	Little millet + Garlic	4.99^{abc}	6.07^{abc}	35.06^{ab}	46.74^{ab}	2.51	2.62
T_4	Little millet + onion	5.06^{ab}	6.14^{ab}	34.44^{abc}	46.12^{abc}	4.38	4.71
T_5	Little millet + Garlic + onion	4.26^{cde}	5.34^{cde}	24.34^{d}	36.03^{d}	2.62	2.73
T_6	Little millet + Dill	4.52^{bcd}	5.61^{bcd}	26.13^{cd}	37.81^{cd}	2.69	3.05
T_7	Little millet + Coriander	4.70^{abcd}	5.79^{abcd}	29.46^{bcd}	41.14^{bcd}	2.92	3.28
T_8	Little millet + Dill + Coriander	4.11^{def}	5.20^{def}	23.96^{d}	35.64^{d}	2.69	3.05
T_9	Little millet (un treated check)	5.31^{a}	6.39^{a}	42.03^{a}	53.71^{a}	1.22	1.72
	CD @ 0.05	0.78	0.26	8.34	2.78		
	CV%	10.09	0.78	16.72	8.34		
	S Em ±	0.26	8.11	2.78	11.90		
	F test	*	*	*	*		

Means in the columns followed by the same alphabet do not differ significantly by DMRT (P=0.05)

Acknowledgement

The author is thankfully acknowledged for providing financial assistance received from INSPIRE fellowship sponsored by Department of Science and Technology (DST), New Delhi.

REFERENCES

1. Jagadish, P. S., Murali, P. R. and Seetharam, A., Evaluation of germplasm lines and cultural practice on the incidence of little millet shoot fly, *Atherigona pulla* Wiede. Environ. Edu. Res., Tokyo Gakungie Univ. No. 7-45-47 (1995).
2. Balikai, R. A., Integrated pest management for shoot fly (*Atherigona soccata* Rondani) in rabi sorghum, *Agric. Sci. Dig.* **23(4):** 291-293 (2003).
3. Karibasavaraja, L. R., Balikai, R. A. and Deshpande, V. P., Inter croppings for management of sorghum shoot fly, *Ann. Plant Prot. Sci.* **13(1):** 237-238 (2005).
4. Spurthi, G. S., Shekharappa, Patil, R. K., Puttanavar, M. S. and Ramegowda, G. K., Effect of intercropping on incidence of shoot fly, *Atherigona soccata* Rondoni in sorghum, *J. Entomol. Res.* **31(4):** 319-321 (2007).
5. Mote, U. N., Patil, M. B. and Tambe, A. B., Role of intercropping in population dynamics of major pests of cotton ecosystem, *Ann. Plant. Prot. Sci*. **99(1)**: 32-36 (2001).