

Annual Progress Report: 2016-17

4. Agricultural Entomology



Atherigona pulla



Unidentified parasitoid on shoot fly



Shoot fly adult



Fish meal trap

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4. Agricultural Entomology

Executive summary

Pest scenario in small millets: In finger millet, the grasshopper is a major biotic constraint followed by the Pink stem borer (*Sesamia inferens*), Aphids (leaf aphid and panicle aphid), *Mylocerus* weevil and ear head caterpillar, *Helicoverpa armigera* etc. The low population of grass hopper (2.3/m²) and moderate damage by grasshopper 0 to 40 per cent recorded at Berhampur. Aphid incidence was high on leaf ranges from 0 to 40 % compared to panicle aphid 20-30 %. *Mylocerus* weevil noticed very low incidence 0 to 2/m². Dead heart caused by stem borer ranged from 0 to 2%. At Ranchi, grasshopper population was 2.0 to 7.0/m² and moderate damage by grasshopper 2.3 to 10.2 per cent. Aphid incidence was high on leaf ranges from 0 to 4.0 % compared to panicle aphid 0 -2.0 %. *Mylocerus* weevil noticed very low incidence 0 to 6.0/m². Earhead web worm (0 -3%) and earhead caterpillar (20-30 %) was recorded at Bangalore. Shoot fly was the major pest on other millets (viz., kodo, little, proso, foxtail and baryard millet) at four different centres.

Grasshopper:

Finger millet IVT: The lowest grasshopper/plant incidence was recorded on VL-352, DHFM 78-33 and PR 10-35 at Bangalore. The only one entry free from grasshopper/m² incidence i.e PR 10-35 at Berhampur and PR 10-35, GPU 94 are also free from grasshopper/m² at Ranchi.

Finger millet AVT: All India mean per cent grasshopper damage was 9.39/m². Low per cent grasshopper damage was recorded in VL 379 at Berhampur and Ranchi. The lowest grasshopper/plant incidence was recorded on VL-386 at Bangalore. India average of grasshopper population was 2.62 /m² from Ranchi and Berhampur and it ranged from 1.58 to 4.0/m².

Mylocerus sp. Weevil:

Finger millet IVT : The lowest *Mylocerus* weevil/plant incidence was recorded on VL-387 at Bangalore. Very low incidence noticed in Berhampur. The germplasm PR 10-35 recorded 1.5 weevil/m² at Ranchi.

Finger millet AVT: Lowest *Mylocerus* weevils/plant was recorded on VL 386 and VR 708. Where as in Ranchi recorded lowest *Mylocerus* weevils/m² in VL 386.

Earhead caterpillar:

Finger millet AVT: The pest incidence was noticed only at Ranchi. The lowest per cent earhead caterpillar recorded on VR 708, VL 386 and BM-1 (local check).

Aphid:

Finger millet AVT: The aphid incidence was noticed only in Ranchi. The germplasms VL-386 and VL-708 recorded low per cent aphid density and also on fingers affected with aphids.

Leaf hopper and Flea beetles:

FMAVT: The leaf hopper and flea beetle incidence noticed only at Bangalore. Lowest leaf hopper incidence was recorded in VL 352 followed by VR 708. The low flea beetle incidence was noticed on VR 708, VL 386 and VL 352.

Shoot fly (*Atherigona* sp. Rond):

Kodo millet AVT: Across the locations and genotypes the range was from 21.0 to 43.0 % dead hearts with an average of 29 % deadhearts. The mean shoot fly infestation was lowest at Bangalore (5.0 %DH) and highest at Dindori (63.0 % DH). The entries TNPSC 176 and BK-48 recorded 21 and 23 % low deadhearts, respectively

Little millet AVT: Across the locations and genotypes, the deadheart % range was from 11 to 22 % (mean 15%). The mean shoot fly infestation was recorded lowest at Dindori (12%), Berhampur (13%) followed by Bangalore (16 %DH) and highest at Ranchi (20.0 % DH). The entries DHLT 28-4 (DHLM 28-4), TNPSU 174 and BL 150 recorded 12, 13 and 13 % low deadhearts, respectively.

Proso millet AVT: Across the locations and genotypes, the deadheart % range was from 17 to 28 % being an average of 24 %. The mean shoot fly infestation was recorded lowest at Bangalore (6% DH) and highest at Ranchi (42 % DH). The entries GPUP 24, and GPUP 26 recorded 17 and 20 % low deadhearts, respectively. Higher dead hearts noticed in TNAU 151 (28 %), GPUP 25 (28 %) TNPM 234 (26 %), TNPM 231 (26 %) and TNAU 145 (26). Ranchi has been considered as hot spot for shoot fly incidence in proso millet.

Foxtail millet AVT : The incidence of shoot fly range was from 5.0 to 14.67% DH with an average of 9.4 % deadhearts. The data on shoot fly deadhearts recorded in entries SiA 3205 and SiA 3085 at Bangalore was found significant. The eight entries viz., SiA 3205, SiA 3085, SiA 3164, SiA 3156, DHFT 5-6, DHFT 77-3, SiA 3163 and SiA 3179 recorded low deadhearts (<10 %) and rest of the entries moderately suffered from damage of shootfly.

Barnyard millet AVT: The shoot fly deadheart range was from 7.0 to 23 % DH with an average of 13.91 % deadhearts. Shoot fly deadhearts recorded at Bangalore was found significant. The entries DHB 23-3 and DHBM 99-6 recorded low deadhearts.

Management of shoot fly in small millets

Little millet : All India average the highest yield 804 kg/ha recorded in treatment spraying of 1500 ppm azadirachtin at 15 DAS followed by 796 kg/ha in NSKE 5 % at 15 DAS, 1.5 times recommended seed rate (734 kg/ha) and sprayed with NSKE 5 % at 7 DAS (703 kg/ha) treatments are significantly different from control.

Proso millet: The highest yield 385 kg/ha recorded in treatment spraying of 1500 ppm azadirachtin at 15 DAS followed by 370 kg/ha in NSKE 5 % at 15 DAS, 1500 ppm azadirachtin at 25 DAS (358.6 kg/ha), early sowing (7 days before normal sowing) (334.4 kg/ha) and 1.5 times recommended seed rate (325.9 %) treatments are significantly differ compared to control.

Detailed report

Introduction: A total of 87 entries were evaluated against insect pests' reaction from seven trials (FMIVT, FMAVT, BAVT, FAVT, KAVT, LAVT and PAVT), two trials on low cost management of little millet and proso millet shoot fly. All the entries were evaluated under natural conditions.

SM (E) 401 : Pest survey, surveillance and seasonal incidence with different dates of sowing

401.1.1: Survey for insect pests of Finger millet

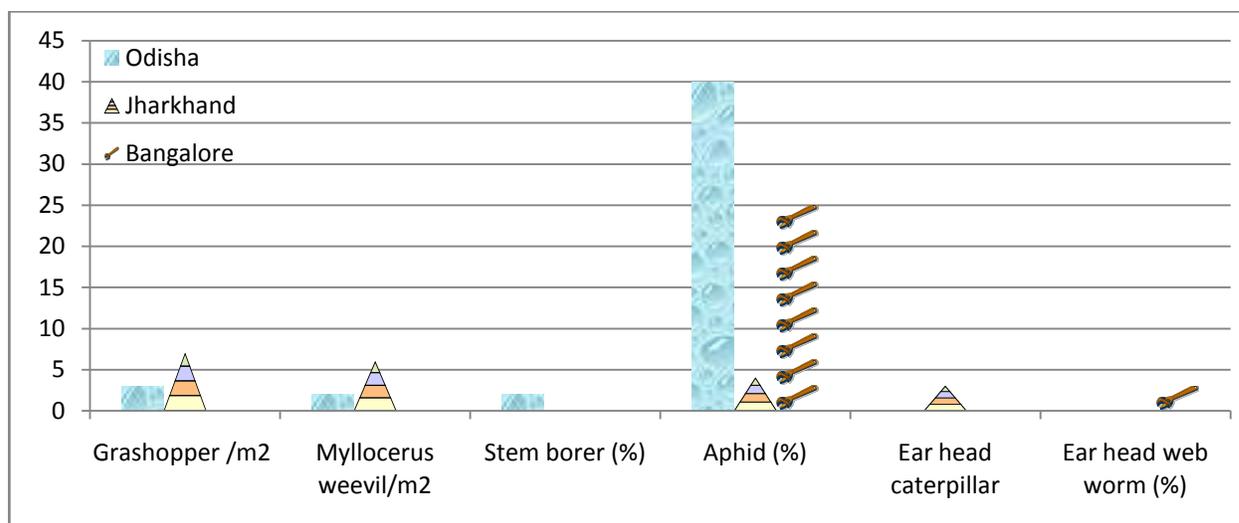
In most of the parts, there were late but scanty and scattered rains received during *Kharif* crop was established very well during seedling stage. The grass hopper is a major biotic constraint followed by the Pink stem borer (*Sesamia inferens*), Aphids (leaf aphid and panicle aphid), *Mylokerus* weevil and ear head caterpillar, *Helicoverpa armigera* etc.

- a. **Berhampur:** Ten fields were surveyed nearby Berhampur region. The crop was sown with either locally cultivated finger millet (Bhairabi) or a local. There was low population of grass hopper (2.3/m²) and moderate damage by grasshopper 0 to 40 per cent. Aphid incidence was high on leaf ranges from 0 to 40 % compared to panicle aphid 20-30 %. *Mylokerus* weevil noticed very low incidence 0 to 2/m². Dead heart caused by stem borer ranged from 0 to 2%. Natural enemies found during survey are lady bird beetles and spiders population ranged from 0-3 and 0-4/m², respectively (Table 1.1).

- b. **Ranchi:** Nine fields were surveyed nearby Ranchi region. The crop was sown with either locally cultivated finger millet (A 404) or a local. There was low population of grass hopper (2.0 to 7.0 m²) and moderate damage by grasshopper 2.3 to 10.2 per cent. Aphid incidence was high on leaf ranged from 0 to 4.0 % compared to panicle aphid 0 -2.0 %. *Mylocerus* weevil noticed very low incidence 0 to 6.0/m². There was no incidence of dead heart caused by stem borer. Earhead caterpillar incidence ranged from 0 to 3.0 per cent. Natural enemies found during survey are lady bird beetles and spider population ranged from 0-5.0 and 0-3.0/m², respectively. (Table1.2)
- c. **Bangalore:** Wide survey may not be possible due to drought prevailed in the state. Earhead web worm and ear head caterpillar was recorded at Bangalore. An aphid on panicle was also observed.

Summary of pest situation in finger millet growing states- -2016

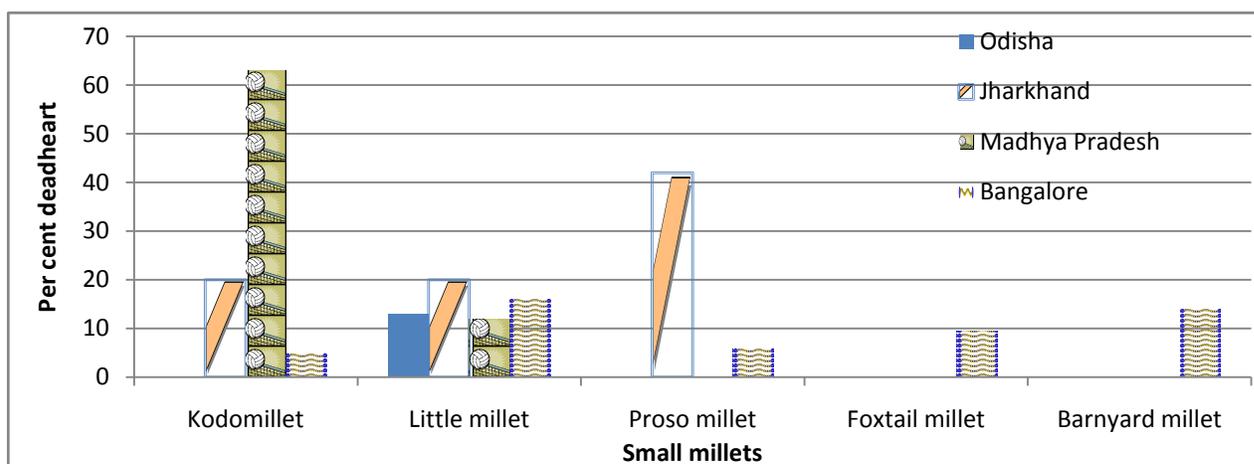
S. No.	State	Grasshopper /m ² plant	<i>Mylocerus</i> weevil/m ²	Stem borer (%)	Aphid (%)	Ear head caterpillar	Ear head web worm (%)	Remarks
1	Odisha	3.0	2.0	2.0	40	0.0	-	Summer heavy incidence of stem borer noticed at Berhampur.
2	Jharkhand	7.0	6.0	0.0	4.0	3.0	-	Higher incidence of defoliators at ranchi viz., grasshoppers and weevils
3	Bangalore				20-30		0-3	Earhead caterpillar was higher



Sl. No.	Crop	Odisha	Jharkhand	Madhya Pradesh	Bangalore	Remarks
1	Kodomillet	-	20.0	63.0	5.00	Dindori found to be the hot spot for shoot fly
2	Little millet	13.0	20.0	12.0	16.00	Among the centers, Ranchi and Bangalore recorded high shoot fly incidence.

3	Proso millet	-	42.0	-	6.00	Ranchi found to be the hot spot for shoot fly
4	Foxtail millet	-	-	-	9.40	Need to take up few more trials at other centers also
5	Barnyard millet	-	-	-	13.91	

Per cent shoot fly incidence on different small millets
Summary of shoot fly incidence on small millets at different states - 2017



SM (E) 401. 1. 2: Seasonal incidence of insect pests on finger millet

1. **Berhampur:** Five different dates of sowing experiment was carried out at research station. Insect pest of finger millet were recorded with 10 days interval (Table 2.1)
 - a. **First Date of Sowing (DOS)- 02.07.2016 :** There was low population of grasshopper (3.0 to 5.0 /m²) and moderate damage by grasshopper 11.54 to 28.58 per cent. Aphid incidence was high on leaf ranged from 0 to 40 %. There was no incidence of *Mylocerus* weevil, stem borer and Ear head caterpillar. Meager populations of natural enemies were observed viz., lady bird beetles and spiders.
 - b. **Second DOS - 16.07.2016:** There was low population of grasshopper (2.0 to 4.0 /m²) and moderate damage by grasshopper 14.52 to 29.44 per cent. Aphid incidence was high on leaf ranged from 0 to 30 %. *Mylocerus* weevil incidence was ranged from 0 to 1.0/m². There was no incidence of stem borer and ear head caterpillar. Natural enemy populations were observed viz., lady bird beetles (1.0 to 2.0 /m²) and spiders (1.0 to 2.0 /m²).
 - c. **Third DOS - 03.08.2016:** There was low population of grass hopper (4.0 to 5.0 /m²) and moderate damage by grasshopper 13.70 to 27.60 per cent. Aphid incidence was high on leaves ranged from 0 to 30 %. Meager incidence of *Mylocerus* weevil was observed. There was no incidence of stem borer and ear head caterpillar. Natural enemy populations were observed viz., lady bird beetles (0.0 to 3.0 /m²) and spiders (0.0 to 2.0 /m²).
 - d. **Fourth DOS - 18.08.2016:** There was low population of grass hopper (2.0 to 4.0 /m²) and moderate damage by grasshopper 14.47 to 25.70 per cent. Aphid incidence was high on leaf ranged from 0 to 30 %. Meager incidence of *Mylocerus* weevil was observed. There was no incidence of stem borer and ear head caterpillar. Natural enemy populations were observed viz., lady bird beetles (0.0 to 2.0 /m²) and higher spider population (0.0 to 3.0 /m²).
 - e. **Fifth DOS - 02.09.2016:** There was low population of grass hopper (1.0 to 3.0 /m²) and moderate damage by grasshopper 12.91 to 22.83 per cent. Aphid incidence was high on leaf ranged from 1.0 to 30 %. There was no incidence of *Mylocerus* weevil, stem borer and ear head caterpillar. Natural enemy population was observed viz., lady bird beetles (0.0 to 1.0 /m²) and spiders (0.0 to 2.0 /m²).

2. **Ranchi:** Five different dates of sowing experiment was carried out at research station. Insect pests of finger millet were recorded with 20-25 days interval (Table 2.2).

- a. **First Date of Sowing (DOS) - 30.06.2016:** There was low population of grasshopper (2.0 to 3.0 m²) and moderate damage by grasshopper 1.30 to 3.80 per cent. Aphid incidence was high on leaf ranged from 0 to 4 % compare to panicle aphid 0 to 2.0 %. There was no incidence of stem borer. Meager incidence of *Mylocerus* weevil ranged from 2.0 - 3.0/m² was observed. Earhead caterpillar was noticed only at 65 DAS i.e 3.0 %. Natural enemy populations were observed viz., lady bird beetles (0.0-5.0/m²), syrphids (2.0 -3.0/m²) and spiders (0.0 - 2.0 m²).
- b. **Second DOS - 15.07.2016:** There was low population of grasshopper (4.0 to 6.0 m²) and low damage by grasshopper 2.2 to 5.70 per cent. Aphid incidence was on leaf ranged from 1 to 5.0 % and panicle aphid was 5.0 %. There was no incidence of stem borer. *Mylocerus* weevil incidence was ranged from 2.0 to 3.0 /m². Earhead caterpillar noticed only at 65 DAS (4.0 %). Natural enemy populations were observed viz., lady bird beetles (3.0 to 6.0 /m²), syrphids (1.0 -4.0/m²) and spiders (1.0 to 3.0 /m²).
- c. **Third DOS - 30.07.2016:** There was low population of grasshopper (2.0 to 3.0 m²) and moderate damage by grasshopper 1.8 to 2.60 per cent. Aphid incidence was high on leaf ranged from 0 to 4 % compare to panicle aphid 3.0 %. Meager incidence of *Mylocerus* weevil was ranged from 2.0 to 3.0 /m². Earhead caterpillar noticed only at 65 DAS (5.0 %). There was no incidence of stem borer. Natural enemy populations were observed viz., lady bird beetles (2.0 to 3.0 /m²), syrphids (2.0 -3.0/m²) and spiders (1.0 to 2.0 /m²).
- d. **Fourth DOS - 15.08.2016:** There was low population of grasshopper (2.0 to 4.0 m²) and moderate damage by grasshopper 1.9 to 3.10 per cent. Aphid incidence was high on leaf ranged from 0 to 3.0 % compare to panicle aphid 3.0 %. Meager incidence of *Mylocerus* weevil was ranged from 2.0 to 4.0 /m². Earhead caterpillar noticed only at 65 DAS (2.0 %). There was no incidence of stem borer. Natural enemy populations were observed viz., lady bird beetles (2.0 to 4.0 /m²), syrphids (0.0 -1.0/m²) and spiders (0.0/m²).

3. **Bangalore:** Five different dates of sowing experiment was carried out at research station. Insect pest of finger millet was recorded with weekly interval (Table 2.3).

- a. **First Date of Sowing (DOS)- 15.07.2016 :** There was low population of grass hopper (0.0 to 0.20/plant). *Mylocerus* weevil incidence was ranged from 0 to 0.75/plant. There was no incidence of stem borer. Earhead caterpillar noticed only at Oct 1st week (70 days) (0.05/plant). Early stage leaf hopper population was observed (0.25/plant). Cetonid was noticed feeding on panicle emergence stage. Meager number of flea beetles observed (0 to 0.05/plant). There was no incidence of earhead bugs. Aphid incidence was low on leaf. Meager populations of natural enemies are observed are lady bird beetles.
- b. **Second DOS - 30.07.2016:** At early stage of the crop, the *Mylocerus* weevil incidence was observed and ranged from 0 to 0.30/plant. The low population of grasshopper (0.0 to 0.05/plant). There was no incidence of stem borer, Cetonid, earhead bugs. Earhead caterpillar noticed only at Oct 2nd week (70 days) (0.05/plant). Meager number of flea beetles observed (0 to 0.10/plant). Aphid incidence was low on leaf. Meager populations of natural enemies are observed are lady bird beetles.
- c. **Third DOS - 17.08.2016:** Meager incidence of *Mylocerus* weevil was observed i.e 0 to 0.25/plant. The low population of grasshopper (0.0 to 0.05/plant). There was no incidence of stem borer, earhead caterpillar. Early stage leaf hopper population was observed (0 to 0.15/plant). Meager number of flea beetles observed (0 to 0.10/plant). There was incidence of earhead bugs (0 to 0.10/plant). Aphid incidence was low on leaf. Meager populations of natural enemies were observed viz., lady bird beetles (0 to 0.10/plant).
- d. **Fourth DOS - 30.08.2016:** At early stage of the crop, the *Mylocerus* weevil incidence was observed and ranges from 0 to 0.10/plant. The low population of grasshopper (0.0 to 0.10/plant). There was no incidence of stem borer, earhead caterpillar and bugs. Very low number of leaf hopper population was observed. Cetonid was noticed feeding on panicle emergence stage. Meager numbers of flea beetles were observed (0 to 0.05/plant). Aphid incidence was observed on panicle stage (milky stage). Meager populations of natural enemies are observed are lady bird beetles and syrphids on panicle formation stage.
- e. **Fifth DOS - 15.09.2016:** At early stage of the crop, the *Mylocerus* weevil incidence was observed and ranged from 0 to 0.05/plant. The low population of grasshopper (0.0 to 0.05/plant) recorded. There was no incidence of stem borer and cetonids. Very low number of leaf hopper population was observed. Meager number of flea beetles observed (0 to 0.10/plant). Aphid incidence was observed on panicle stage (milky stage)(0 to 1.0/plant). Meager populations of natural enemies are observed are lady bird beetles on leaf and panicle aphids.

401.1.2 Seasonal incidence of insect pests on Little millet

Berhampur: Five different dates of sowing experiment was carried out at research station. Insect pest of little millet were recorded with 10 days interval (Table 2.4).

- First Date of Sowing (DOS) - 02.07.2016 :** Shoot fly incidence ranged from 4.17 to 10.64 per cent with mean of 5.05 %
- Second DOS - 16.07.2016:** Shoot fly incidence ranged from 0.0 to 11.76 per cent with mean of 6.10 per cent.
- Third DOS - 03.08.2016:** Shoot fly incidence ranged from 5.12 to 12.76 per cent with mean of 8.05 per cent.
- Fourth DOS - 18.08.2016:** Shoot fly incidence ranged from 4.88 to 11.63 per cent with mean of 7.70 per cent.
- Fifth DOS - 02.09.2016 and sixth DOS - 17.09.2016:** Poor germination

Promising entries with less susceptibility to pests of small millets

S. No.	Trial	Grasshopper	<i>Myloccerus</i> weevil	Aphids	Earhead caterpillar	Shoot fly (<10-20)
1	FMIVT	VL-352, DHFM 78-33, <u>PR 10-35</u> , GPU 94	VL-387, <u>PR 10-35</u>	-	-	-
2	FMAVT	<u>VL-386</u> , VL 379	<u>VL 386</u> and <u>VR 708</u> .	<u>VL-386</u> and <u>VL-708</u>	<u>VR 708</u> , <u>VL 386</u> and BM-1	-
3	KAVT					TNPSC 176 and BK-48
4	LAVT					DHLT 28-4 (DHLM 28-4), TNPSU 174 and, BL 150
5	PAVT					GPUP 24, and GPUP 26
6	FAVT					SiA 3205, SiA 3085, SiA 3164, SiA 3156, DHFT 5-6, DHFT 77-3, SiA 3163 and SiA 3179
7	BAVT					DHB 23-3 and DHBM 99-6

Note: Underlined entries recorded as tolerance to more than one pest

SM (E) 402: Multi-pest resistance screening trial (IVT, AVT I & II)**402. 1.1: Evaluation of finger millet IVT against insect pests (FMIVT)**

Total twenty advanced entries were evaluated against insect pests of finger millet (Table 3)

Grasshopper: The incidence of grasshopper population was recorded in Bangalore, Berhampur (Odisha) and Ranchi (Jharkhand). The lowest grasshopper/plant incidence was recorded on VL-352, DHFM 78-33 and PR 10-35 at Bangalore. The only one entry free from grasshopper/m² i.e PR 10-35 at Berhampur and PR 10-35, GPU 94 were also free from grasshopper/m² at Ranchi. However per cent grasshopper damage was also recorded, PR 10-35 found free from grasshopper damage at Berhampur and Ranchi. GPU 94 also found free from the damage in Ranchi.

***Myloccerus* sp. Weevil:** The incidence of *Myloccerus* weevil population was recorded in Bangalore, Odisha and Jharkhand. The lowest *Myloccerus* weevil/plant incidence was recorded on VL-387 at Bangalore. Very low incidence noticed in Berhampur. The germplasm PR 10-35 recorded 1.5 weevil/m² at Ranchi. The weevil incidence ranged from 1.5 to 3.67 per square meter at Ranchi.

Leafhopper: The leafhopper incidence noticed only at Bangalore. The lowest leafhopper/plant recorded on KOPM 942, KRI 009-04, PR 202, VR-708, KMR 630 and GPU 45.

Aphid: The aphid incidence was noticed only in Ranchi. Around 12 germplasms recorded low aphid density (%) and fingers affected by aphids.

Lady bird beetles and spiders: The higher number of aphid predatory lady bird beetles were recorded in VR 936, VR 1094, VL 503 and GPU 45 at Berhampur. High spider population noticed on VR 1094.

402. 1. 2 Evaluation of finger millet AVT against insect pests

Total six advanced entries were evaluated against insect pests of finger millet. The incidence of insect pest population was recorded in Bangalore, Ranchi and Berhampur (Table 4).

***Mylocerus* sp. weevil:** Lowest *Mylocerus* weevils/plant were recorded on VL 386 and VR 708. Where as in lowest *Mylocerus* weevils/m² recorded in VL 386 at ranchi. The weevil incidence ranged from 0 to 4.0/m².

Earhead caterpillar: The pest incidence was noticed only at Ranchi. The lowest per cent earhead caterpillar recorded on VR 708, VL 386 and BM-1 (local check). The earhead caterpillar incidence ranged from 0 to 4.67 per cent.

Leaf hopper and Flea beetles: The leaf hopper and flea beetle incidence noticed only at Bangalore. Lowest leaf hopper incidence was recorded in VL 352 followed by VR 708. The low flea beetle incidence was noticed on VR 708, VL 386 and VL 352.

Grasshopper: The incidence of grasshopper population was recorded in Bangalore, Berhampur and Ranchi. The lowest grasshopper/plant incidence was recorded on VL-386 at Bangalore. India average of grasshopper population was 2.62 /m² from Ranchi and Berhampur centers and it ranged from 1.58 to 4.0/m². All India average mean per cent grasshopper damage was 9.39/m². VL 379 found to be the low per cent grasshopper damage recorded at Berhampur and Ranchi. The incidence of grasshopper ranged from 3.4 to 15.41 per cent.

Aphid: The aphid incidence was noticed only in Ranchi. The germplasms VL-386 and VL-708 recorded low per cent aphid density and also on fingers affected with aphids.

Lady bird beetles and spiders: The higher number of aphid predatory lady bird beetles were recorded in VR 708 at Berhampur. Higher spider population was also noticed on VR 708 at Berhampur.

402. 2 Evaluation of kodo millet advanced varieties against shoot fly (KAVT)

Shoot fly (*Atherigona* sp. Rond): Deadhearts caused by the shoot fly was recorded at peak stage of the infestation of shoot fly involving centers at Bangalore, Dindori and Ranchi. Ten advanced entries of kodomillet were evaluated against shoot fly incidence. Dindori place has been considered as hot spot for shoot fly incidence in kodomillet. Across the locations and genotypes the range was from 21.0 to 43.0 % deadhearts with an average of 29 % deadhearts. The mean shoot fly infestation was lowest at Bangalore (5.0 %DH) and highest at Dindori (63.0 % DH). The entries TNPSC 176 and BK-48 recorded 21 and 23 % low deadhearts, respectively (Table 5)

402. 3 Evaluation of little millet advanced varieties to shoot fly (LAVT)

Shoot fly (*Atherigona pulla* Rond): Total fifteen advanced entries were evaluated against little millet shoot fly incidence. Deadhearts caused by shoot fly at peak period were recorded at Bangalore, Berhampur, Dindori and Ranchi. Across the locations and genotypes, the deadheart % range was from 11 to 22 % being an average of 15%. The mean shoot fly infestation was recorded lowest at Dindori (12%), Berhampur (13%) followed by Bangalore (16 % DH) and highest at Ranchi (20.0 % DH). The entries DHLT 28-4 (DHLM 28-4), TNPSU 174 and, BL 150 recorded 12, 13 and 13 % low deadhearts, respectively. Over all very less incidence of shoot fly noticed due to scanty rainfall received in different states. Released varieties viz., OLM 203, JK 8, BL 6 at Bangalore, sabara at Berhampur, BG 1 at Ranchi and JK 8 at Dindori were used as check (Table 6).

402. 4 Evaluation of proso millet advanced varieties to shoot fly (PAVT)

Shoot fly (Atherigona sp. Rond): Total ten advanced entries of proso millet were evaluated against shoot fly incidence. Deadhearts caused by shoot fly at peak period were recorded at Bangalore and Ranchi. Across the locations and genotypes, the deadheart % range was from 17 to 28 % being an average of 24 %. The mean shoot fly infestation was recorded lowest at Bangalore (6% DH) and highest at Ranchi (42 % DH). The entries GPUP 24, and GPUP 26 recorded 17 and 20 % low deadhearts, respectively. Higher dead hearts noticed in TNAU 151 (28 %), GPUP 25 (28 %) TNPM 234 (26 %), TNPM 231 (26 %) and TNAU 145 (26). Ranchi place has been considered as hot spot for shoot fly incidence in proso millet. Released varieties viz., GPUP 21, TNAU 151 and TNAU 145 were used as check (Table 7).

402. 5 Evaluation of foxtail millet advanced varieties to shoot fly (FAVT)

Shoot fly (Atherigona sp. Rond): Deadhearts caused due to shoot fly was recorded peak stage only at Bangalore. Fourteen advanced entries of foxtail millet were evaluated against shoot fly incidence. The range was from 5.0 to 14.67% DH with an average of 9.4 % deadhearts. The very less incidence of shoot fly was noticed on foxtail millet. Shoot fly deadhearts was recorded in entries SiA 3205 and SiA 3085 at Bangalore found significant. The eight entries viz., SiA 3205, SiA 3085, SiA 3164, SiA 3156, DHFT 5-6, DHFT 77-3, SiA 3163 and SiA 3179 recorded low deadhearts (<10 %) rest of the entries were moderately suffered damage from shoot fly (Table 8).

402.6 Evaluation of barnyard millet advanced entries to shoot fly (BAVT)

Shoot fly (Atherigona sp. Rond.): Deadhearts caused due to shoot fly was recorded peak stage at Bangalore. Eleven advanced entries of barnyard millet were evaluated against shoot fly incidence. The range was from 7.0 to 23 % DH with an average of 13.91 % deadhearts. The shoot fly deadhearts recorded at Bangalore was found significant. The entries DHB 23-3 and DHBM 99-6 recorded low deadhearts and rest of the entries were moderately suffered from damage of shoot fly (Table 9).

SM (E) 403: Management of shoot fly in small millets

403.1: Low cost management of shoot fly in little millet

Under management of shoot fly treatments were formulated based on low cost methods viz., seed rate (1.5 times recommended), spraying of 1500 ppm azadirachtin (at different interval 7, 15 and 25 DAS) and early sowing (7 days before normal sowing), spraying of 5 % NSKE (7 and 15 DAS).

30 DAG : Deadhearts caused by shoot fly at 30 DAG were recorded at Berhampur, Dindori and Ranchi. Across the locations and genotypes, the deadheart % range was from 7.49 to 19.58 % being an average of 11.56%. The mean shoot fly infestation was recorded lowest at Berhampur (8.53 %) followed by Dindori (9.15 %) and highest at Ranchi (17.0 % DH). All India average deadheart recorded lower in treatment sprayed with NSKE 5 % at 15 DAS and also significantly different from control followed by treatment spraying of 1500 ppm azadirachtin at 15 DAS ((Table 10.1).

Yield (kg/ha) : The yield was recorded at Berhampur, Dindori and Ranchi. Across the locations and treatments, the yield range was from 804 to 474 kg/ha being an average of 679 kg/ha. The data showed significant at 5 % level. The mean yield was recorded highest at Berhampur (1163kg/ha) in treatment sprayed with NSKE 5 % at 15 DAS followed by Dindori (667kg/ha) in the treatment 1500 ppm azadirachtin at 25 DAS and lowest yield recorded in treatment 1500 ppm azadirachtin at 15 DAS at Ranchi (495 kg/ha). All India average the highest yield 804 kg/ha recorded in treatment spraying of 1500 ppm azadirachtin at 15 DAS followed by 796 kg/ha in NSKE 5 % at 15 DAS, 1.5 times recommended seed rate (734 kg/ha) and sprayed with NSKE 5 % at 7 DAS (703 kg/ha) treatments are significantly different from control. The remaining treatments are non-significant compare to control (Table 10.2).

403. 2: Low cost management of shoot fly in Proso millet

One management trial has been conducted at Ranchi (Jharkhand) with varied treatments. Under management of shoot fly treatments were formulated based on low cost methods viz., seed rate (1.5 times recommended), spraying of 1500 ppm azadirachtin (at different interval 7, 15 and 25 DAS), early sowing (7 days before normal sowing), spraying of 5 % NSKE (7 and 15 DAS) (Table 11).

10 DAG: Low per cent incidence of shoot fly /deadheart recorded at early sowing i.e 7 days before normal sowing (19.3 %) and spraying of 1500ppm azadirachtin at 15 DAS (20 %).

20 DAG: Low per cent incidence of shoot fly /deadheart recorded in spraying of 1500ppm azadirachtin at 15 DAS (24.67 %) and early sowing i.e 7 days before normal sowing (25%).

30 DAG: Low per cent incidence of shoot fly /deadheart recorded in 1.5 times recommended seed rate (21 %) and spraying of 1500ppm azadirachtin at 15 DAS (26.4 %).

Yield (kg/ha): The highest and significant yield 385 kg/ha was recorded in treatment spraying of 1500 ppm azadirachtin at 15 DAS followed by 370 kg/ha in NSKE 5 % at 15 DAS, 1500 ppm azadirachtin at 25 DAS (358.6 kg/ha), early sowing (7 days before normal sowing) (334.4 kg/ha) and 1.5 times recommended seed rate (325.9 %) treatments are significantly differ compared to control. The remaining treatments are non-significant compare to control.

Entomology trials of finger millets and small millets center wise performance during 2016

Centers	Finger millet		Foxtail millet		Kodo millet		Little millet		Proso millet		Barnyard millet		Per cent accepted
	AS	C	AS	C	AS	C	AS	C	AS	C	AS	C	
Berhampur	4	4			1	1	3	3					100
Ranchi	4	4			1	1	2	2	2	2			100
Dindori					1	1	2	2					100
PC Unit	4	4	1	1	1	1	1	1	1	1	1	1	100
Total	12	12	1	1	4	4	8	8	3	3	1	1	

AS: Assigned, C: conducted

- Total experiments assigned : 29
- Total experiments conducted : 29

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