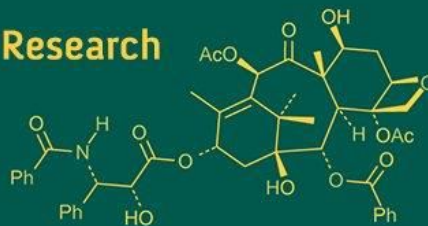
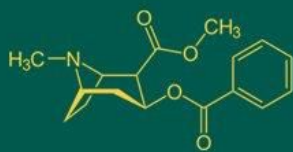


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Record of insect pests and their natural enemies on little millet in Bilaspur district of Chhattisgarh

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Abstract

The field experiment was conducted at Instructional farm of Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during *Kharif* 2023. The studies revealed that the insect-pests which attacked in the vegetative stage to panicle stage were grasshopper (*Hieroglyphus banian*), aphid (*Hysteroneura* sp.), army worm (*Mythimna separata*), white spotted flea beetle (*Monolepta signata*), painted bug (*Bagrada hilaris*) except earhead bug (*Calocoris angustatus* Lethiery) which was prevalent only during panicle and maturity stage of the crop. The natural enemies viz, ladybird beetle (*Coccinella transversalis* Fab.), dragonfly (*Orthetrum sabina*), lynx spider (*Oxyopes* sp.), damselfly (*Agriocnemis lacteola* Selys), milkweed assassin bug (*Agriocnemis lacteola*) and robber fly (*Holocephala* sp.) were observed in different growth stages of little millet (CG kutki-1) during the experimental period.

Keywords: Little millet, insect-pests and natural enemies

Introduction

Little millet is scientifically known as *Panicum sumatrense* (Roth. ex. Roem. & Schult.). It is a cereal crop that belongs to the grass family Poaceae. The term "millet" is used to refer to several types of small-seeded annual grasses. It is an important indigenous crop in the Indian subcontinent. The year 2023 is celebrated globally as the "International Year of Millets" to create health and nutritional awareness about millets to eventually promote their consumption and production. (Yadav *et al.*, 2024) ^[16]. In India, it is grown in Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, and Maharashtra, which are main small millet growing states in the u. s. a. Small millets are a group of crops or minor coarse cereals, viz., little millet (*Panicum sumatrense* R.), kodo millet (*Paspalum scrobiculatum* L.), foxtail millet (*Setaria italica* L.), barnyard millet (*Echinochloa frumentaceae* link.) and proso millet (*Panicum miliaceum* L.), Millets are more often than not grown in low-rainfall regions resist long dry spells and get better rapid after deficit rains with negligible for low input conditions (Sukanya *et al.*, 2023) ^[13]. Little millet known as unique nearby names in distinct kingdom and language like kutki in Hindi and koshra in Chhattisgarhi, equal/Savi in kannad, Sammulla in Telugu, Chama in Malayalam and Samai in Tamil and so forth. It matures very early in 70-75 days it serves as a really perfect capture crop for multiple and relay cropping machine (Sathish *et al.*, 2017) ^[11]. every one hundred g little millet grain includes 65.5 g carbohydrate, 10.1 g protein, 3.89 g fat, 346 Kcal strength, 7.7 g dietary fibre, 16.1 mg calcium, 130 mg phosphorus, 91 mg magnesium, 1.8 mg zinc, 1.2 mg iron, 0.26 mg thiamine, 0.05 mg riboflavin, 1.3 mg niacin and 362 µg folic acid (Venkatesh Bhat *et al.*, 2018) ^[14].

The entire manufacturing of millets in the global is 98 million tonnes, with sorghum contributing 63%, observed via pearl millet with a contribution of 24%. Kodo millet, little millet, and barnyard millet are exclusively grown in India with a production of 1-three million tonnes (NAAS, 2022) ^[8]. India is the most important grower (with 19% contribution) and producer (20% manufacturing) of millets within the global. The percentage of India in Asia stands at 85% in Area and 80% in production (FAOSTAT, 2023) ^[2]. Little millet is currently grown at some point of India in approximately a million hectares. In India, little millet cultivated in a place of 291 thousand hectares with annual manufacturing of 102

thousand tones and productiveness of 349 kg per hectare which is very less in comparison to different cereal vegetation (Katara *et al.*, 2019) [5]. Chhattisgarh has 5.88 million hectares of cultivable land. Rice is the essential crop of the vicinity. In 2006, Chhattisgarh occupied 248.5 thousand hectares of land (which is 21.18% of India's 1173.5 thousand ha) underneath small millets with overall manufacturing of fifty two.1 thousand lots (that is simplest 10.22% of overall national manufacturing of 509.8 thousand tons) and yield of 210 kg/ha in opposition to national productivity of 434 kg/ha (Sahu and Sharma, 2018) [10].

World wide, at the least 150 insect species are recorded as feeding on millets (Nwanze and Harris, 1992) [9]. In India, nearly 32 in line with cent of the crop is lost because of insect pests (Borad and mittal, 1983) [1]. In millets, shoot flies, ear head insects, aphids, and grasshoppers are taken into consideration serious pests (Kalaisekar *et al.*, 2017) [4].

Materials and Methods

The experiment was carried out at Instructional Farm of BTC CARS, Bilaspur, a constituent college of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). The Little millet variety, CGkutki-1 were sown in the plot size of 10 m × 10 m (L×W) with planting distance of 20 cm × 10 cm during Kharif 2023 with following all improved recommended package of practices for raising the crop under unprotected conditions. To record the observations of insect pests damaging and visiting the crop along with their natural enemies, 10 plants were randomly selected and the observations were recorded at weekly intervals from germination to harvesting of the crop.

Results and Discussion

A. Insect pests observed on little millet crop (Table 1, 3&Fig 1)

1. Grasshopper, *Hieroglyphus banian* (Orthoptera: Acrididae)

The grasshopper, *Hieroglyphus banian* appeared on little millets during 34th standard meteorological week (SMW) i.e. 20th-26th August (3rd week) with a mean leaf damage of 2.33% at vegetative growth stage of crop. The leaf damage due to the pest gradually increased and reached to its peak in the 3rd week of September (38th SMW) with a mean leaf damage of 29.85%. Then, the damage per cent gradually declined and attained 15.38% during 42nd SMW i.e. 15th October at maturity cum harvest stage of the crop (Plate-1). The present finding is in conformity with Kumar *et al.* (2023) [6] who also reported that grasshopper infestation was initiated in little millet during the second week of August (33rd SMW) with 3.84 per cent affected leaf. During the study period pest incidence was ranged from 2.35 to 4.22 per cent. The highest grasshopper incidence was recorded in 40th SMW with 4.22 per cent leaf infestation.

2. Aphid, *Hysteroneura sp.* (Hemiptera: Aphididae)

The aphid appeared on little millet during 35th standard meteorological week (SMW) i.e. 27th August- 2nd September (4th week) with a mean population of 0.80 aphids/plant at vegetative stage of crop. The population build up gradually and reached to its peak in the 2nd week of September (37th SMW) with a mean population of 6.90 aphids/plant. Then, the population gradually declined and reached to its minimum levels of 1.70 aphids/plant during 42nd SMW i.e. 15th October at maturity cum harvest stage of the crop

(Plate-2). Similarly, present finding is in accordance with the findings of Starks *et al.* (1982) [12] who also reported that both nymphs and adult aphids (*Rhopalosiphum maidis* Fitch), shoot bugs (*Peregrinus maidis* Ashm.), plant bugs (*Aspavia armigera* T., *Callidea* spp.) and chinch bugs (*Blissus leucopterus* Say) suck the sap from young leaves and the whorl which causes distortion, yellowing and wilting of pearl millet plants leading to shriveled chaffy grains.

3. Army worm, *Mythimna separata* (Noctuidae: Lepidoptera)

The army worm appeared on little millets during 34th standard meteorological week (SMW) i.e. 20th August- 26th August (3rd week) with a mean population of 0.30 larvae /plant at vegetative stage of crop. The population build up gradually and reached to its peak in the 4th week of September (39th SMW) with a mean population of 0.60 larvae /plant. Then, the population gradually declined and reached to its minimum levels of 0.10 larvae /plant during 42nd SMW i.e. 15th October at maturity cum harvest stage of the crop (Plate-3). Present finding is in accordance with the findings of (Gahukar, 1984) [3] who also reported that *Mythimna separata* Walker, *Spodoptera litura* (Fab.) (Noctuidae: Lepidoptera), Caterpillars are defoliators of ragi, maize, bajra and sorghum.

4. White spotted flea beetle, *Monolepta signata* (Chrysomelidae: Coleoptera)

The white spotted flea beetle appeared on little millets during 33th standard meteorological week (SMW) i.e. 13th August- 19th August (2nd week) with a mean population of 0.20 beetles /plant at vegetative stage of crop. The population build up gradually increased and reached to its peak in the 3rd week of September (38th SMW) with a mean population of 0.60 beetles /plant. Then, the population gradually declined and reached to its minimum levels of 0.10 beetles/plant during 41th SMW i.e. 14th October at maturity cum harvest stage of the crop (Plate-4). Earlier findings of Kumar *et al.* (2020) [7] revealed that *Monolepta signata* was found active throughout the cropping season of black gram. Incidence of white spotted leaf beetle was commenced from 16th standard meteorological week (SMW) i.e., 18th April' 18 with a mean population of 0.72 grubs and adults/plant. The highest mean population of white spotted leaf beetle (4.32 grubs and adult/plant) was observed during first week of May, 22nd SMW (2nd May' 18).

5. Painted bug, *Bagrada hilaris* (Pentatomidae: Hemiptera)

The painted bug first appeared on little millets during 34th standard meteorological week (SMW) i.e. 20th - 26th August (3rd week) with a mean population of 0.10 bug /plant at vegetative stage of crop. The population build up gradually and reached to its peak in the 2nd week of September (37th SMW) with a mean population of 0.40 bug /plant. Then, the population gradually declined and reached to its minimum levels of 0.10 bug/plant during 42nd SMW i.e. 15th October at maturity cum harvest stage of the crop (Plate-5). The present finding is in conformity with Wali *et al.* (2022) [15] who also studies on pearl millet revealed the serious infestation of *Bagrada hilaris* from vegetative to reproductive stage of the crop.

6. Earhead bug, *Calocoris angustatus* Lethieri (Alydidae: Hemiptera)

The earhead bug appeared on little millets during 36th standard meteorological week (SMW) i.e. 3rd - 9th September (1st week) with a mean population of 0.30 bug /plant at panicle stage of crop. The population build up gradually and reached to its peak in the first week of October (40th SMW) with a mean population of 1.40 bug /plant. Then, the population gradually declined and reached to its minimum levels of 1.10 ear head bug/plant during 42nd SMW i.e. 15th October at maturity cum harvest stage of the crop (Plate-6). The present finding is in conformity with Kumar *et al.* (2023) [6] who also reported that the mean population of earhead bug was first appeared during September and active up to October month. The population of bug ranged from 0.33 to 0.89. The highest population of the pest (0.89 bug/plant) was observed in 42nd SMW of October month.

B. Natural enemies of insect pests in little millet crop (Table 2, 4& Fig 2)

1. Lady bird beetle, *Coccinella transversalis* Fab. (Coccinellidae: Coleoptera)

The lady bird beetle appeared on little millets during 33rd standard meteorological week (SMW) i.e. 13th -19th August (2nd week) with a mean population of 0.10 beetle/plant at vegetative stage of crop. The population build up gradually and reached to its peak in the second week of September (37th SMW) with a mean population of 1.00 beetle/plant. Then, the population gradually declined and reached to its minimum levels of 0.20 beetle/plant during 42nd SMW i.e. 15th -21st October at maturity cum harvest stage of the crop (Plate-7).

2. Dragonfly, *Orthetrum sabina* (Libellulidae: Odonata)

The dragon fly appeared on little millets during 32nd standard meteorological week (SMW) i.e. 6th -12th August (1st week) with a mean population of 0.10 fly/plant at vegetative stage of crop. The population build up gradually and reached to its peak in the first week of September (36th SMW) with a mean population of 0.70 fly/plant. Then, the population gradually declined and reached to its minimum levels of 0.20 fly/plant during 42nd SMW i.e. 15th -21st October at maturity cum harvest stage of the crop (Plate-8).

3. Lynx spider, *Oxyopes sp.* (Oxyopidae: Araneae)

The spiders appeared on little millets during 33rd standard meteorological week (SMW) i.e. 13th -19th August (2nd week) with a mean population of 0.10 spider/plant at vegetative stage of crop. The population of spider build up gradually and reached to its peak in the second week of September (37th SMW) with a mean population of 0.60 spider/plant. Then, the population gradually declined and reached to its minimum levels of 0.10 spider/plant during 42nd SMW i.e. 15th - 21st October at maturity cum harvest stage of the crop (Plate-9).

4. Damselfly, *Agriocnemis lacteola* Selys (Coenagrionidae: Odonata)

The damselfly appeared on little millets during 34rd standard meteorological week (SMW) i.e. 20th -26th August (3rd week) with a mean population of 0.10 fly/plant at vegetative stage of crop. The population build up gradually and reached to its peak in the second week of September (37th SMW) with a mean population of 0.40 fly/plant. Then, the population gradually declined and reached to its minimum levels of 0.10 fly/plant during 42nd SMW i.e. 15th - 21st October at maturity cum harvest stage of the crop (Plate-10).

5. Milkweed assassin bug, *Agriocnemis lacteola* (Reduviidae: Hemiptera)

The milkweed assassin bug appeared on little millets during 34rd standard meteorological week (SMW) i.e. 20th -26th August (3rd week) with a mean population of 0.10 bug/plant at vegetative stage of crop. The population build up gradually and reached to its peak in the first week of September (36th SMW) with a mean population of 0.40 bug/plant. Then, the population gradually declined and reached to its minimum levels of 0.10 bug/plant during 42nd SMW i.e. 15th - 21st October at maturity cum harvest stage of the crop (Plate-11).

6. Robber fly, *Holocephala sp.* (Asilidae: Diptera)

The robber fly appeared on little millets during 34rd standard meteorological week (SMW) i.e. 20th -26th August (3rd week) with a mean population of 0.10 fly/plant at vegetative stage of crop. The population build up gradually and reached to its peak in the second week of September (37th SMW) with a mean population of 0.30 fly/plant. Then, the population gradually declined and reached to its minimum levels of 0.20 fly/plant during 40th SMW i.e. 1st - 7st October at maturity cum harvest stage of the crop (Plate-12).

Table 1: Insects pests observed on little millet crop at Bilaspur during *Kharif* 2023

S.N.	Common Name	Scientific Name	Order	Family	Damaging stage	Period of activity	Crop stage	Peak activity
1	Grasshopper	<i>Hieroglyphus banian</i>	Orthoptera	Acrididae	Nymph and Adult	August - October	Vegetative stage Panicle stage	Third week of September
2	Aphid	<i>Hysteroneura sp.</i>	Hemiptera	Aphididae	Nymph and Adult	August-October	Vegetative stage Panicle stage	Second week of September
3	Army worm	<i>Mythimna separata</i>	Lepidoptera	Noctuidae	Caterpillar	August-October	Vegetative stage Panicle stage	Last week of September
4	White spotted flea beetle	<i>Monolepta signata</i>	Coleoptera	Chrysomelidae	Grub and beetle	August-October	Vegetative stage Panicle stage	Third week of September
5	Painted bug	<i>Bagrada hilaris</i>	Hemiptera	Pentatomidae	Nymph and adult	August - October	Vegetative stage Panicle stage	Second week of September
6	Earhead bug	<i>Calocoris angustatus</i> Lethieri	Hemiptera	Alydidae	Nymph and Adult	September-October	Panicle to maturity stage	First week of October

Table 2: Natural enemies observed on little millet crop at Bilaspur during *Kharif* 2023

S.N.	Common Name	Scientific Name	Order	Family	Period of activity	Crop stage	Peak activity
1	Lady bird beetle	<i>Coccinella transversalis</i> Fab.	Coleoptera	Coccinellidae	August-October	Vegetative stage Panicle stage	Second week of September
2	Dragon fly	<i>Orthetrum sabina</i>	Odonata	Libellulidae	August-October	Vegetative stage Panicle stage	First week of September
3	Lynx spider	<i>Oxyopes sp.</i>	Araneae	Oxyopidae	August-October	Vegetative stage Panicle stage	Second week of September
4	Damselfly	<i>Agriocnemis lacteola</i> Selys	Odonata	Coenagrionoidae	August-October	Vegetative stage Panicle stage	Second week of September
5	Milkweed assassin bug	<i>Agriocnemis lacteola</i>	Hemiptera	Reduviidae	August-October	Vegetative stage Panicle stage	First week of September
6	Robber fly	<i>Holcocephala sp.</i>	Diptera	Asilidae	August-October	Vegetative stage Panicle stage	Second week of September

Table 3: Mean population of different insect pests on little millet crop at Bilaspur during *Kharif* 2023

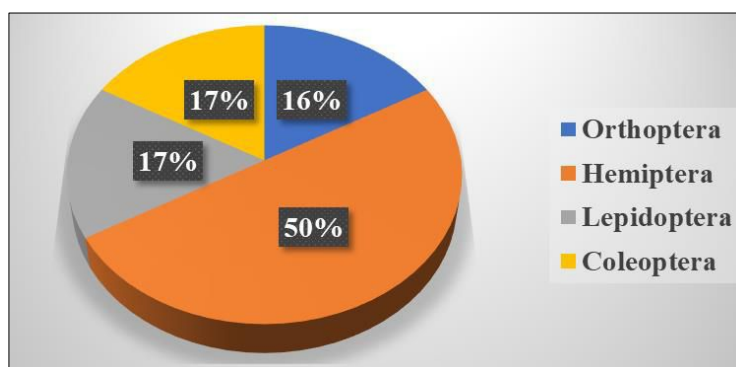
S.N.	SMW	Date	Mean population of insect pest per ten plants					
			Grasshopper Mean leaf damage (%)	Aphid (No.)	Army worm (No.)	White spotted flea beetle (No.)	Earhead bug (No.)	Painted bug (No.)
1	32	06-08-2023	0.00	0.00	0.00	0.00	0.00	0.00
2	33	13-08-2023	0.00	0.00	0.00	0.20	0.00	0.00
3	34	20-08-2023	2.33	0.00	0.30	0.30	0.00	0.10
4	35	27-08-2023	5.45	0.80	0.40	0.40	0.00	0.20
5	36	03-09-2023	6.45	3.50	0.40	0.40	0.30	0.30
6	37	10-09-2023	13.51	6.90	0.50	0.50	0.40	0.40
7	38	17-09-2023	29.85	5.50	0.50	0.60	0.60	0.20
8	39	24-09-2023	21.57	3.40	0.60	0.50	0.80	0.20
9	40	01-10-2023	21.43	2.20	0.40	0.40	1.40	30.0
10	41	08-10-2023	18.75	1.80	0.20	0.10	1.30	0.20
11	42	15-10-2023	15.38	1.70	0.10	0.00	1.10	0.10
Seasonal Mean			12.25	2.35	0.31	0.31	0.54	0.18

SMW = Standard Meteorological Week, No. = Number

Table 4: Mean population of different natural enemies of little millet crop at Bilaspur during *Kharif* 2023

S.N.	SMW	Date	Mean population of natural enemies per ten plants (No.)					
			Lady bird beetle	Dragonfly	Lynx spider	Damselfly	Milk assassin bug	Robber fly
1	32	06-08-2023	0.00	0.10	0.00	0.00	0.00	0.00
2	33	13-08-2023	0.10	0.10	0.10	0.00	0.00	0.00
3	34	20-08-2023	0.20	0.30	0.20	0.10	0.10	0.10
4	35	27-08-2023	0.40	0.40	0.20	0.30	0.20	0.20
5	36	03-09-2023	0.50	0.70	0.50	0.30	0.40	0.20
6	37	10-09-2023	1.00	0.50	0.60	0.40	0.20	0.30
7	38	17-09-2023	0.50	0.40	0.40	0.20	0.10	0.10
8	39	24-09-2023	0.70	0.20	0.50	0.20	0.20	0.20
9	40	01-10-2023	0.40	0.60	0.30	0.30	0.30	0.20
10	41	08-10-2023	0.30	0.30	0.10	0.20	0.20	0.00
11	42	15-10-2023	0.20	0.20	0.10	0.10	0.10	0.00
Seasonal Mean			0.39	0.35	0.27	0.19	0.16	0.12

SMW = Standard Meteorological Week, No.=Number

**Fig 1:** Order wise distribution of insect pests recorded on little millet crop

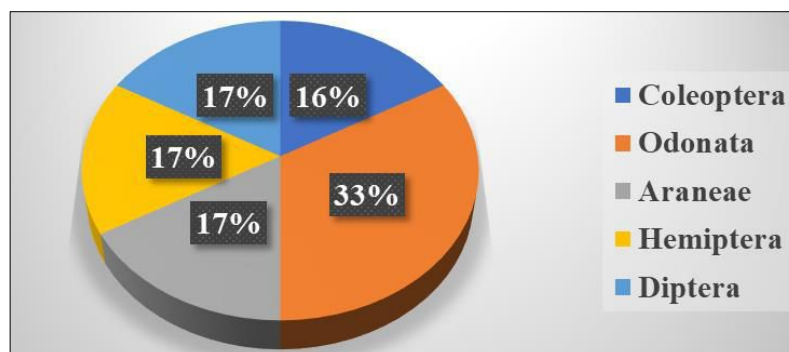


Fig 2: Order wise distribution of natural enemies recorded on little millet crop



Plate 1: Grasshopper, *Hieroglyphus banian*



Plate 4: White spotted fleabeetle, *Monolepta signata*



Plate 2: Aphid, *Hysteroneura* sp.



Plate 5: Painted bug, *Bagrada hilaris*



Plate 3: Army worm, *Mythimna separata*



Plate 6: Earhead bug, *Calocoris angustatus* Lethiery



Plate 7: Lady bird beetle, *Coccinella transversalis* Fab.



Plate 8: Dragon fly, *Orthetrum sabina*



Plate 9: Lynx spider, *Oxyopes* sp.



Plate 10: Damsel fly, *Agriocnemis lacteola* Sel



Plate 11: Milk weed assassin bug, *Agriocnemis lacteola*



Plate 12: Robber fly *Holcocephala* sp.

Conclusion

The examine concludes that the insect-pests which attacked in the vegetative level to panicle degree were grasshopper (*Hieroglyphus banian*), aphid (*Hysteroneura* sp.), military bug (*Mythimna separata*), white noticed flea beetle (*Monolepta signata*), painted worm (*Bagrada hilaris*) besides earhead trojan horse (*Calocoris angustatus* Lethiery) which become customary simplest for the duration of panicle and adulthood level of little millet crop. The natural enemies viz, ladybird beetle (*Coccinella transversalis* Fab.), dragonfly (*Orthetrum sabina*), lynx spider (*Oxyopes* sp.), damselfly (*Agriocnemis lacteola* Selys), milkweed murderer bug (*Agriocnemis lacteola*) and robber fly (*Holcocephala* sp.) had been discovered in distinctive boom levels of crop all through the experimental length.

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