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# Relative analysis on phototactic insect pests and predatory species of paddy ecosystem

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**Abstract**
The experiment was conducted at two locations viz. farmer's field and research farm during *Kharif* 2017 in Waraseoni, Balaghat (M.P.). Research farm was characterized by rigorous cultivation with frequent use of chemical insecticides and fertilizers while farmer's field with conventional cultivation practice and least use of chemical inputs. Assessment of light trap collections in both the locations of paddy ecosystem indicated that in terms of total trap catch, pest species namely *Melanitis ismene* (34:66), *Sogatella furcifera* (35:65), and *Nilaparvata lugens* (36:64) were distinctly higher at farmer's field, while 8 species were observed with no distinct difference at both locations. Comparison of predatory species in paddy ecosystem indicated that trap catches were distinctly higher in 6 species while higher in 7 species at farmer's field. Overall comparison of predator v/s pest species through trap catch revealed that it was 1:7.43 at research field while 1:5.11 at farmer's field.

**Keywords:** light trap, predators, ecosystem and insect pests

## Introduction
Insect light trap is one of the very effective tools of insect pest management in organic agriculture as its mass-traps both the sexes of insect pests and also substantially reduces the carryover pest population [13]. Light trap is recognized as very common oldest, traditional and Indigenous technology in early decade of the 20th century. In recent years entomological realized that light trap occupied an important place in studies all over the world for survey, detection and control of insect pest population in various crops. Although much work has been done on the use of light trap against pests of pulses, but lesser information is available on pests of paddy in Madhya Pradesh particularly in Balaghat district. There are few reports of work done on light trap against pests of paddy crop in different States including Chattisgarh (2), Tamil Nadu [9], West Bengal [11] and Madhya Pradesh [10].
Besides the pests natural enemies are also collected in light trap as reported by [1, 3, 7, 5, 8, 6, 10]. Therefore documentation of information on major phototactic species of insect pests and natural enemies in paddy ecosystem is also very important. The present study is put forth for the comparative analysis on activity of major predatory and pest species of paddy in two distinct (forming-ecological) locations through light trap catches.

## Materials and Methods
The experiment was carried out at two distinct farming ecological locations viz., research farm and farmer's field during the *Kharif* season of in 2017 at Waraseoni. The climatic conditions prevalent in Waraseoni, Balaghat are essentially semi-arid, sub-tropical and monsoon type. It is situated at 21.48ºN latitude, 80.15ºE longitude and at an altitude of 760m above the mean sea level. The experiment was conducted by standard design of light trap (Jawahar model) by using 125 watt mercury vapour lamp. Light traps were operated every night. Research Farm was characterized by intensive cultivation area with adoption of regular inter cultural practices, regular application of chemical fertilizers and frequent use of chemical insecticides in both the seasons. While the farmers field is characterized by non intensive cultivation practices, rare use of chemical pesticides for plant protection which reflects in terms of least disturbance to stable ecosystem, specially to the beneficial fauna (Predatory species). For comparing the trap catch of pests and predators of both locations the data of 'single day per week collection' of Farmer's field as well as of Research Farm of the same day, was considered for the valid comparison during the principal cropping season (*Kharif*) from July to December at each location. From the light trap catches the specimen of concerned species were preserved as per

the recommended procedure. The comparison was made by converting the season's total trap catch of each insect species in to ratio of percentage as proposed by [14].

**Results and Discussion**

The species wise result is as follows:

**(i) Comparison of quantitative difference in major insect pest species of paddy (Harmful species).**

Comparative data of monthly collection and season's total of two locations based on four day's collection of four weeks per month are presented.

Over all comparison of the data of comparative trap catches of two locations with comparative proportion, in terms of percent ratio indicates that trap catches in Farmer's field (B) were distinctly higher compared to Research Farm (A) in three species and almost similar in eight species as summarized below-

| **1. Category of distinctly higher catches at Farmer's Field** | **Ratio A : B** |
|---|---|
| 1. *Melanitis ismene Cram.* | (34:66) |
| 2. *Sogatella furcifera* | (35:65) |
| 3. *Nilaparvata lugens* | (36:64) |
| 2. Category of **almost similar catches** (No distinct difference) | |
| 1. *Nephotettix* sp. | (41:59) |
| 2. *Orseolia oryzae* | (43:57) |
| 3. Grass hoppers (Complex) | (46: 54) |
| 4. *Mythimna separata* | (49:51) |
| 5. *Gryllus sp.* | (49:51) |
| 6. *Cnaphalocrocis medinalis* | (53:47) |
| 7. *Anomala virids* | (53:47) |
| 8. *Scirpophaga incertulas* | (48:52) |

**(ii) Comparison of quantitative difference in trap catches of predatory species (Beneficial as bio control agents)**

In all 13 species of predatory nature as bio control agent were observed. Data of comparative trap catches with proportion (in percent) of catch of two distinct locations Research Farm and Farmer's field presented indicate that trap catches in Research Farm were consistently low in all the 13 species with no exception, grouping them in two categories as below-

| **1. Category of distinctly very higher catches at Farmer's Field (above 70%)** | **Ratio A:B** |
|---|---|
| 1. *Erthesina fullo* | (22:78) |
| 2. *Geocoris bullatus* | (23:77) |
| 3. *Ectomocoris cordiger* | (26:74) |
| 4. *Cicindela* sp. | (27:73) |
| 5. *Sirthenea* sp. | (27:73) |
| 6. *Deserida lineala* | (28:72) |
| **2. Category of higher catches at Farmer's Field (below 70% upto 57%)** | |
| 1. *Coccinella* sp. | (30:70) |
| 2. *Conthacona furcellata* | (31:69) |
| 3. *Cantharia* sp. | (33:67) |
| 4. *Crospedophorus* sp. | (34:66) |
| 5. *Hydrophilus* sp. | (34:66) |
| 6. *Antilochus* sp. | (36:64) |
| 7. *Chlaenius* sp. | (43:57) |

**(iii) Comparative study of ratio between total predatory species and total pest species of paddy at both locations**

Comparing the total population of predatory species only, results show that (Figure 1) it was distinctly higher, more than double, in Farmer's Field (9, 311) compared to Research Farm (4,203).While the total population of pest species was nearly $1^1/_2$ (one & half) times in Farmer's Field (47,670) than Research Farm (31, 242).

Compared to the activity of predator species as 1.0 the ratio of pest species was 7.43 at JNKVV and 5.11 at Farmer's Field. In other words, the activity of pest species was distinctly higher (nearly 7 times) at Research Farm, compared to Farmer's Field. Significantly very high activity of beneficial predacious species in light trap at farmer's field, compared to research farm (Figure 2) shows the importance of minimum use of pesticides and least disturbance to ecosystem, a characteristic of a farmer's field, in promoting the activity of beneficial biocontrol agents.

Similarly overall comparison of predator v/s pest species through trap catch revealed that it was 1:4 at research field while 1:2.39 at farmers field [10].

[12] Reported that observations were made during 1983-84 crop season at Jabalpur (M.P.) on beneficial crop parasitic and predatory insects collected on light trap. In all 21 predacious and 8 parasitic species were recorded to appear in significant numbers. Their proportion compared to the catch of harmful pest species was very low below 2 per cent [4]. Found that in a field study in 1994 in Egypt, a light trap was used to monitor pest infestation in cotton over 8 months. Twenty two insect species were recorded. Pests constituted 89.29% of the catch while predators 7.5%.

**Table 1:** Comparative study of activity of major insect pests of paddy collected in light trap in main activity season (*Kharif*) year 2017 at two different locations Research Farm and Farmer's Field

| Insect species collected | | Number of insects collected in light trap/total of 4 days (at each locations A&B) collection per month (Single day's collection per week) | | | | | | | | | | | | Total of a season | | Ratio in per cent A v/s B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | July | | Aug. | | Sept. | | Oct. | | Nov. | | Dec. | | | | |
| | | A | B* | A | B | A | B | A | B | A | B | A | B | A | B | |
| 1. | *Melanitis ismene* | 14 | 11 | 15 | 30 | 11 | 16 | 21 | 31 | 11 | 35 | 0 | 0 | 72 | 123 | 34:66 |
| 2. | *Mythimna separata* | 0 | 0 | 13 | 12 | 125 | 96 | 67 | 48 | 104 | 129 | 9 | 20 | 318 | 305 | 51:49 |
| 3. | *Cnaphalocrocis medinalis* | 0 | 0 | 87 | 50 | 1171 | 760 | 1571 | 1665 | 1704 | 1473 | 18 | 16 | 4551 | 3964 | 53:47 |
| 4. | *Scirpophaga incertulas* | 8 | 12 | 22 | 22 | 50 | 56 | 31 | 30 | 15 | 13 | 0 | 0 | 126 | 133 | 48:52 |
| 5. | *Nilaparvata lugens* | 0 | 0 | 264 | 396 | 1424 | 2155 | 3014 | 5866 | 5468 | 9520 | 250 | 374 | 10420 | 18311 | 36:64 |
| 6. | *Sogatella furcifera* | 0 | 0 | 202 | 364 | 1258 | 2057 | 2842 | 5547 | 4469 | 8475 | 176 | 149 | 8947 | 16602 | 35:65 |
| 7. | *Nephotettix* sp. | 0 | 0 | 69 | 125 | 515 | 556 | 1133 | 2243 | 1090 | 1091 | 137 | 103 | 2944 | 4117 | 41:59 |
| 8. | *Orseolia orizae* | 27 | 29 | 26 | 27 | 58 | 72 | 59 | 87 | 22 | 36 | 0 | 0 | 192 | 251 | 43:57 |
| 9. | *Anomala viridis* Fab. | 0 | 0 | 0 | 0 | 52 | 35 | 27 | 36 | 0 | 0 | 0 | 0 | 79 | 71 | 53:47 |
| 10. | Grass hoppers (Complex) | 58 | 68 | 131 | 150 | 144 | 171 | 63 | 79 | 21 | 21 | 0 | 0 | 417 | 489 | 46:54 |
| 11. | *Gryllus* sp. | 1102 | 703 | 756 | 804 | 638 | 947 | 635 | 784 | 45 | 66 | 0 | 0 | 3176 | 3304 | 49:51 |

Trap location A = Research Farm
Trap location B = Farmer's Field

**Table 2:** Comparative study of activity of predatory species collected in light trap in paddy ecosystem in main activity season (*Kharif*) year 2017 at two different locations Research Farm and Farmer's Field

| Insect species collected | | Number of insects collected in light trap/total of 4 days ( at each location A&B) collection per month (Single day's collection per week) | | | | | | | | | | | | Total of a season | | Ratio in per cent A v/s B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | July | | Aug. | | Sept. | | Oct. | | Nov. | | Dec. | | | | |
| | | A | B | A | B | A | B | A | B | A | B | A | B | A | B | |
| **order – colEoptera** | | | | | | | | | | | | | | | | |
| **i) Fam. – Coccinellidae** | | | | | | | | | | | | | | | | |
| 1. | *Coccinella* sp. | 721 | 1543 | 774 | 1730 | 302 | 876 | 569 | 932 | 253 | 705 | 0 | 0 | 2619 | 5786 | 30:70 |
| ii) Fam. – Hydrophilidae | | | | | | | | | | | | | | | | |
| 2. | *Hydrophilus* sp. | 52 | 45 | 63 | 100 | 163 | 445 | 136 | 170 | 41 | 84 | 0 | 0 | 455 | 844 | 34:66 |
| iii) Fam. – Cicindelidae | | | | | | | | | | | | | | | | |
| 3. | *Cicindela* sp. | 15 | 66 | 19 | 36 | 35 | 72 | 34 | 70 | 8 | 12 | 0 | 0 | 111 | 256 | 27:73 |
| iv) Fam. – Cantharidae | | | | | | | | | | | | | | | | |
| 4. | *Cantharis* sp. | 21 | 58 | 59 | 65 | 41 | 118 | 28 | 17 | 0 | 0 | 0 | 0 | 149 | 258 | 33:67 |
| v) Fam. – Carabidae | | | | | | | | | | | | | | | | |
| 5. | *Deserida lineola* | 11 | 52 | 100 | 671 | 27 | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 138 | 340 | 28:72 |
| 6. | *Crospedophorus* sp. | 25 | 93 | 80 | 138 | 16 | 13 | 0 | 6 | 0 | 0 | 0 | 0 | 121 | 252 | 34:66 |
| 7. | *Chlaenius* sp. | 0 | 0 | 20 | 56 | 20 | 46 | 18 | 7 | 0 | 0 | 0 | 0 | 58 | 109 | 43:57 |
| Order – Hemiptera | | | | | | | | | | | | | | | | |
| i) Fam. – Reduviidae | | | | | | | | | | | | | | | | |
| 1. | *Sirthenea* sp. | 22 | 68 | 30 | 69 | 16 | 69 | 09 | 81 | 8 | 09 | 0 | 0 | 85 | 296 | 27:73 |
| 2. | *Ectomocoris cordiger* | 4 | 20 | 19 | 56 | 18 | 42 | 9 | 40 | 6 | 13 | 0 | 0 | 56 | 171 | 26:74 |
| ii) Fam. – Pentatomidae | | | | | | | | | | | | | | | | |
| 3. | *Canthecona furcellata* | 0 | 0 | 0 | 0 | 115 | 172 | 72 | 193 | 23 | 135 | 0 | 0 | 210 | 475 | 31:69 |
| 4. | *Erthesina fullo* | 0 | 0 | 0 | 0 | 9 | 34 | 36 | 135 | 7 | 22 | 0 | 0 | 52 | 191 | 22:78 |
| iii) Fam. – Pyrrhocoridae | | | | | | | | | | | | | | | | |
| 5. | *Antilochus* sp. | 21 | 18 | 14 | 42 | 36 | 28 | 27 | 83 | 15 | 27 | 0 | 0 | 113 | 198 | 36:64 |
| iv) Fam. – Lygaeidae | | | | | | | | | | | | | | | | |
| 6. | *Geocoris bullatus* | 0 | 0 | 0 | 5 | 7 | 24 | 11 | 44 | 18 | 62 | 0 | 0 | 36 | 135 | 23:77 |

Trap location A = Research Farm Trap location B = Farmer's Field

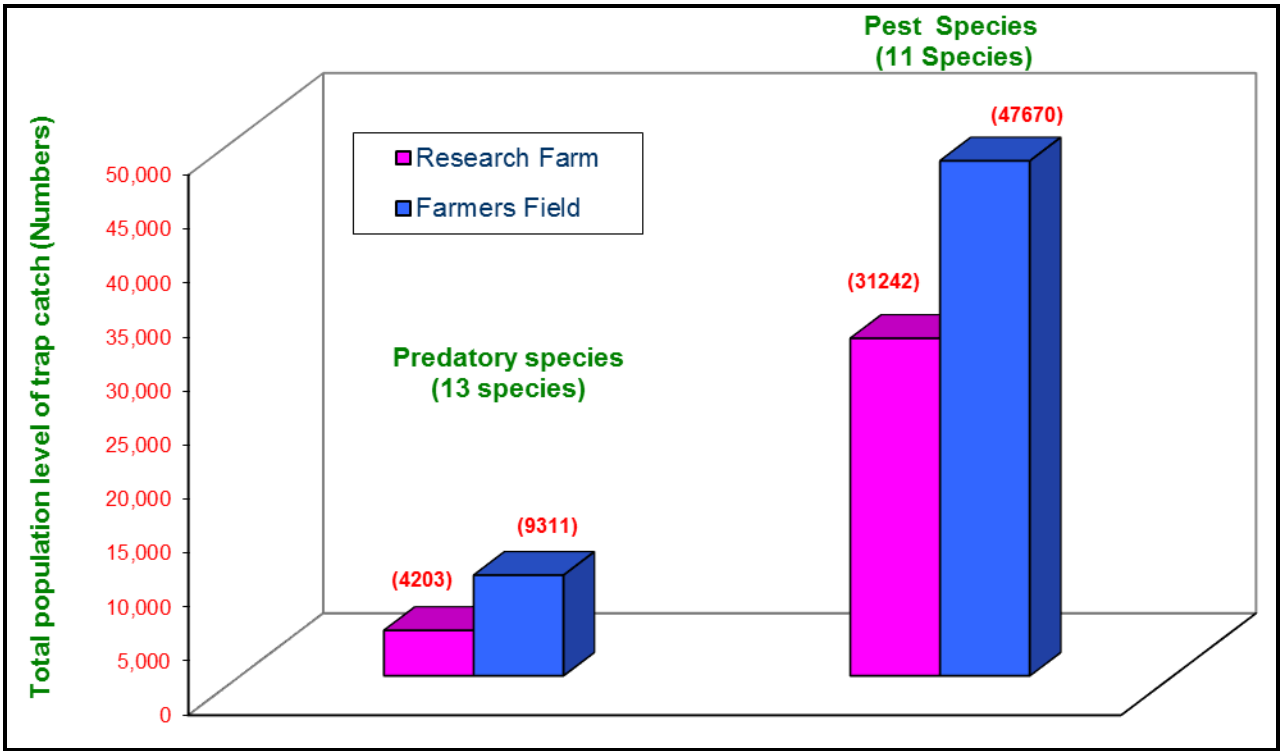


**Fig 1:** Comparison of total population of predatory species and pest species at both the locations

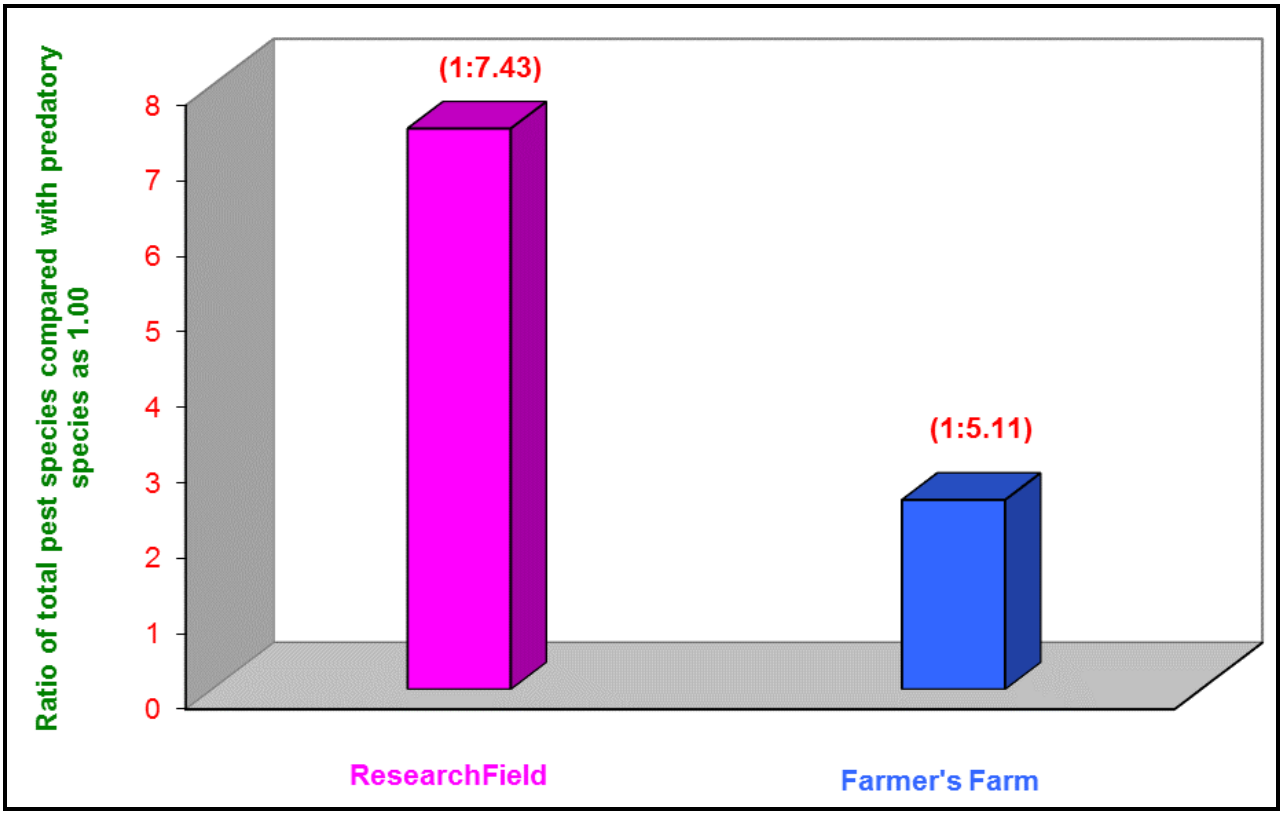


**Fig 2:** Ratio of total pest species compared with total predatory species as standard (1) at two locations

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