4. RESULTS

4.1 Estimation of Herbivorous Insect Species Diversity

The experiments were conducted in order to provide information necessary to determine the index of species diversity H′, the seasonal abundance and the mean number of herbivorous insects associated with mungbean in various cropping systems. The results obtained from this experiment revealed that the mungbean/sesame system tended to exhibit the highest value of H′ while mungbean/sorghum system showed the lower value of H′ (Table 1). However, there was no significant difference between the index of species diversity of mungbean monoculture and mixed culture in the mungbean/upland rice, mungbean/maize, and mungbean/sesame systems as determined by F-test. It is interesting to note that the mean density of herbivorous insects in the mungbean monoculture was significantly higher than those in mixed cultures. The equitability (J) was also observed in all mungbean cropping systems. The maximum value of evenness was 0.72 obtained from the mungbean/sesame system, whereas the minimum value of evenness was 0.61 in the mungbean/sorghum system. However, there were no significant differences among the index values of evenness in all of the mungbean cropping systems. The species richness (r_{MA}) in mungbean mixed cultures appeared somewhat higher than that in mungbean monoculture. The maximum r_{MA} observed in the mungbean/upland rice system was higher than in the mungbean monoculture system ($P<0.01$). Although there were slight differences among the r_{MA} of mungbean/maize,

mungbean/sorghum and mungbean monoculture, there were no statistically significant.

The mean density of herbivorous insects per 25 sweeps throughout the sampling period of 4 to 10 weeks after planting was summarized in Table 2. The results exhibited that there were statistically significant differences among the mean densities of the phytophagous species counted in all mungbean cropping systems as determined by F-test ($P<0.01$). The highest mean density of herbivores was 40.14±9.97 observed in mungbean monoculture, whereas the lowest density of herbivores was 15.32±4.07 observed in mungbean/sesame system. In the mungbean/upland rice, mungbean/maize and mungbean/sorghum systems the density of herbivores was rather low as compared to the density of herbivores in mungbean monoculture. The peak of seasonal abundance of herbivorous insect was reached on the seventh week after planting. The population density of herbivorous insect in the mungbean monoculture increased from 10.00 insects on the fourth week to 74.50 insects on the seventh week but decreased to 9.50 insects on the tenth week. In the mungbean/upland rice system insect population density increased continuously from 3.5 insects on the fourth week to 43.50 insects on the seventh week after planting but decreased to 8.5 insects on the tenth week. The trend of population in mungbean/maize system was observed to increase from 8.25 insects on the fourth week and decreased to 6.75 insects on the tenth week after planting. Likewise, in the mungbean/sesame system insect population density increased from 3.00 insects on the fourth week to 29.50 insects on the eight week and decreased to 4.25 insects on the tenth week.

Table 1. Herbivorous insect species diversity associated with mungbean grown in monoculture and mixed cultures.

Diversity measures	Cropping systems				
	S1	S2	S3	S4	S5
Total number of morphospecies, S	20	21	19	19	18
	Mean density (individual per 25 sweeps) [1]				
Megachile sp.	0.03	0.07	0.00	0.10	0.00
Cleyphus sp.	0.00	0.00	0.00	0.04	0.04
Dicladispa sp.	0.00	0.53	0.00	0.53	0.14
Monolepta signata Oliv.	0.11	0.29	0.57	0.14	0.11
Paradiscodon sp.	0.00	0.00	0.00	0.11	0.00
Acidodes sp.	0.07	0.00	0.00	0.00	0.00
Bruchus chinensis Linn.	0.21	0.00	0.00	0.00	0.00
Aulacophora similis Oliv.	0.00	0.04	0.00	0.00	0.00
Nezara viridula Fab.	5.39	0.96	3.92	1.42	0.71
Riptortus sp.	2.00	0.92	0.25	0.60	0.85
Cletus sp.	1.18	0.61	0.54	0.32	0.68
Paromius vincta Say	0.64	0.50	0.46	0.21	0.32
Nysius sp.	0.21	0.29	0.14	1.00	0.00
Bothrogonia sp.	0.00	0.00	0.07	0.00	0.07
Cofana spectra	0.18	0.46	0.35	0.18	0.10
Balclutha hebe (Mats)	12.93	10.00	8.92	5.03	4.64
Sogatella vibit (Huapt.)	0.04	0.04	0.04	0.18	0.11
Ophiomyia phaseoli Tyron	10.46	2.25	5.03	2.78	7.35
Nephotettix sp.	0.04	0.11	0.04	0.04	0.00
Amata sp.	0.14	0.00	0.00	0.00	0.00
Jassid	0.00	0.18	0.00	0.18	0.21
Drosophilids	2.71	0.68	0.71	5.29	6.61
Agromyzid	8.46	2.86	2.18	0.79	0.21
Sciarids	0.11	0.00	0.50	0.54	0.46
Tephritid	0.00	0.00	0.64	0.00	0.00
Pyralid	0.25	0.14	0.21	0.00	0.07
Chrysomelids	0.00	0.11	0.21	0.00	0.00
Langurid	0.00	0.07	0.00	0.00	0.00
Mirid	0.14	0.46	0.25	0.00	0.04
Total number of individuals, N	45.30a	21.57b	25.03b	19.48b	22.72b
Shannon-Wiener function, H′	1.92a	1.99a	2.01a	2.12a	1.78b
Equitability, J	0.64ns	0.65ns	0.68ns	0.72ns	0.61ns
Species richness, r_{MA}	4.98c	6.51a	5.59bc	6.06ab	5.44bc

S1 = mungbean monoculture, S2 = mungbean/upland rice,
S3 = mungbean/maize, S4 = mungbean/sesame, S5 = mungbean/sorghum.
[1] Treatment means within a row followed by different letter are significantly different (P<0.01).
ns = not significant as determined by the F-test.

Table 2. The seasonal abundance of herbivorous insects on mungbean throughout the mungbean growing season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of herbivorous insects caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	10.00	35.75	60.25	74.50	63.75	27.25	9.50	40.14±9.97a
MB/upland rice	3.50	18.25	25.25	43.50	38.50	6.00	8.50	20.50±6.03b
MB/maize	8.25	24.50	34.25	54.00	28.25	14.50	6.75	24.38±6.29b
MB/sesame	3.00	15.50	23.50	24.50	29.50	7.00	4.25	15.32±4.07b
MB/sorghum	6.50	20.50	29.50	37.75	17.25	7.00	2.75	17.32±4.91b

* Mean of four replicates.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different ($P<0.01$).
MB = Mungbean.

The mean density of bean fly, Ophiomyia phaseoli Tyron (Diptera: Agromyziidae) counted per 25 sweeps was summarized in Table 3. The results indicated that there were statistically significant differences between the mean densities of bean flies in both mungbean monoculture and mixed culture cropping systems ($P<0.01$). The highest number of bean flies was 10.46±1.77 caught in the mungbean monoculture. The lowest number of bean flies was 2.25±0.61 caught in the mungbean/upland rice system. There was an observed pattern of seasonal abundance of bean fly increased with the time. The peak of seasonal abundance as indicated by insects per 25 sweeps was reached on the sixth week after planting in all cropping systems. The population density of bean flies increased from 5.50, 0.00, 3.75, 0.75 and 4.75 bean flies on the fourth week to 32.50, 5.25, 14.75, 7.75 and 20.25 bean flies on the sixth week in the mungbean monoculture, mungbean/upland rice, mungbean/maize, mungbeansesame and mungbean/sorghum systems, respectively. However, the trend of population density of bean flies decreased sharply from 13.25, 1.75, 4.25, 2.25 and 11.00 bean flies on the seventh week to 0.50, 1.00, 1.75, 0.75 and 1.50 bean flies on the tenth week. Very few insects were caught during the tenth week after planting.

Adults of green stink bug, Nezara viridula Linneaus (Hemiptera: Pentatomidae) were first collected during the pod formation stage of mungbean (sixth week after planting). The highest incidence of mature insects was 5.39±2.28 and occurred in the mungbean monoculture compared to the lowest with 0.71±0.17 insects caught in the mungbean/sorghum system (Table 4). The mean number of insect was significantly different

between each of the systems tested ($P<0.05$). The population fluctuations of the green stink bug were observed in all cropping systems. The highest peak of seasonal abundance of green stink bug occurred on the eighth week after planting. The population density of green stink bug increased from 2.60, 2.25, 2.00, 0.00 and 1.00 insects during the sixth week after planting to 18.00, 0.75, 10.50, 6.00 and 2.50 insects during the eighth week in the mungbean monoculture, mungbean/upland rice, mungbean/maize, mungbean/sesame, and the mungbean/sorghum systems, respectively. The population was fairy low from the ninth week to the tenth week in all cropping systems.

It was readily apparent that the mean density of Riptortus sp. in mungbean monoculture was not appreciably higher than those in the mungbean mixed culture (Table 5). The highest peak of seasonal abundance of Riptortus sp. was found on the seventh week after planting. The population density of insects increased from 0.50, 0.25, 0.50, 0.25 insects during the fifth week to 5.50, 2.75, 1.50 and 1.75 insects on the eighth week in the mungbean monoculture, mungbean/upland rice, mungbean/maize, and the mungbean/sorghum systems. Thereafter, the population density of insects declined to 0.25, 0.25, 0.00 and 0.75 insect on the tenth week in the mungbean monoculture, mungbean/upland rice, mungbean/sorghum systems, respectively. In the mungbean/sesame system population density of insects increased from 1.00 insect on the fifth week to 1.50 insects on the sixth week but decreased afterward. There were no significant differences between the mean numbers of Riptortus sp. caught in all mungbean cropping systems ($P>0.05$).

Table 3. Mean densities of Ophiomyia phaseoli Tyron (Diptera: Agromyzidae) on mungbean in various mungbean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of O. phaseoli counted per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	5.50	18.25	32.50	13.25	1.75	1.50	0.50	10.46±1.77a
MB/upland rice	0.00	2.50	5.25	1.75	4.00	1.25	1.00	2.25±0.61c
MB/maize	3.75	9.75	14.75	4.25	0.25	0.75	1.75	5.03±1.48bc
MB/sesame	0.75	4.25	7.75	2.25	3.25	0.50	0.75	2.78±0.56bc
MB/sorghum	4.75	11.75	20.25	11.00	0.50	1.75	1.50	7.35±0.21ab

* Mean of four replicates.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different ($P<0.01$).
MB = Mungbean.

Table 4. Mean densities of Nezara viridula Linneaus on mungbean in various mungbean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of N. viridula caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.00	0.00	2.50	7.00	18.00	9.00	1.25	5.39±2.28a
MB/upland rice	0.00	0.00	2.25	3.00	0.75	0.00	0.75	0.96±0.26c
MB/maize	0.00	0.00	2.00	7.00	10.50	6.00	2.00	3.92±1.33ab
MB/sesame	0.00	0.00	0.00	1.50	6.00	2.50	0.00	1.42±0.62bc
MB/sorghum	0.00	0.00	1.00	0.50	2.50	1.00	0.00	0.71±0.17c

* Mean of four replicates.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different (P<0.05).
MB = Mungbean.

Table 5. Mean densities of Riptortus sp. on mungbean various mungbean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of Riptortus sp. caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.00	0.50	3.50	5.50	2.75	1.50	0.25	2.00±0.78ns
MB/upland rice	0.00	0.25	1.25	2.75	1.50	0.50	0.25	0.82±0.58ns
MB/maize	0.00	0.00	0.50	1.00	0.25	0.00	0.00	0.25±0.12ns
MB/sesame	0.00	1.00	1.50	0.75	0.50	0.25	0.25	0.60±0.28ns
MB/sorghum	0.00	0.25	1.50	1.75	0.75	1.00	0.75	0.85±0.34ns

* Mean of four replicates.
S.E. = The standard error associated with the means.
ns = Not significant as determined by the F-test.
MB = Mungbean.

4.2 Estimation of Natural Enemy Species Diversity

The mean density of individual natural enemy counted per 25 sweeps in the mixed culture was fairly high for all four systems of measurement (Table 6). The highest value of H′ was 2.81 observed in the mungbean/upland rice system. The lowest value of H′ was 2.34 observed in the mungbean/sesame system compared to H′ of 2.54, 2.55 and 2.75 estimated from the mungbean monoculture, mungbean/maize, and mungbean/sorghum systems respectively. Equitability (J) was also observed in all mungbean cropping systems. The mungbean/upland rice system with a J of 0.90 was 0.02 higher than the mungbean monoculture with a J of 0.88. The mungbean/sorghum system with a J of 0.88 was not different from the mungbean monoculture, but the mungbean/maize and the mungbean/sesame systems with a J of 0.80 and 0.86 were slightly lower by 0.08 and 0.02 than the mungbean monoculture. However, neither H′ nor J were significantly influenced by the designed cropping systems. The species richness (r_{MA}) was also observed in all mungbean cropping systems. There were statistically significant differences among the values of species richness as determined by the F-test. A difference of 5.24 was found between the mungbean/upland rice system, with a r_{MA} of 22.61, and the mungbean monoculture, with a r_{MA} of 17.37 ($P<0.01$). Similarly, the mungbean/maize system with a r_{MA} of 23.60, and mungbean/sorghum system with a r_{MA} of 22.45, were 6.23 and 5.08 higher than in the mungbean monoculture.

The mean of natural enemies (predators plus parasitoids) per 25 sweeps throughout the sampling period from 4 to 10 weeks after planting was summarized in Table 7. The peak of seasonal abundance of natural enemies was reached on the seventh to the eighth week after planting. There were statistically significant differences between the mean densities of natural enemies counted in the designed cropping systems ($P<0.01$). The highest mean density of natural enemies was 10.88±2.83 per 25 sweeps in the mungbean/upland rice and the mungbean/maize systems. The lowest mean density of natural enemies was 4.07±1.20 per 25 sweeps in the mungbean monoculture. The pattern of natural enemy density changed with time. The least density was observed during the fourth week after planting for all cropping systems.

There were significant differences between the total number of predators ($P<0.05$). The highest total number of predators was 8.56 found in the mungbean/maize system. Whereas the lowest total number of predators was 2.86 found in the mungbean monoculture (Table 8).

The mean number of predators (insects plus spiders) was summarized in Table 9 and indicated that there were statistically significant differences between the mean densities of predators in all cropping systems ($P<0.01$). The highest mean density was 8.57±1.82 per 25 sweeps counted in the mungbean/maize system and the lowest mean was 2.89±0.70 per 25 sweeps counted in the mungbean monoculture. The highest peak of seasonal abundance of predators was reached on the eighth to the

ninth week after planting. In the mungbean monoculture the population of predators increased from 0.25 predator on the fourth week to 5.25 predators on the seventh week after planting but declined on the eighth week till the end of mungbean growing season. In the mungbean/upland rice system, the population density increased from 2.25 predators on the fifth week after planting to 11.75 predators on the eighth week. In the mungbean/maize system the population density also increased from 0.50 predator on the fourth week after planting to 14.25 predators on the tenth week. In the mungbean/sesame system the population density increased from 4.25 predators on the fourth week after planting to 10.25 predators on the eighth week. Likewise, in the mungbean/sorghum system the population density also increased from 0.5 predator on the fourth week after planting to 6.25 predator on the eighth week for all systems tested. The peak of seasonal abundance of predators was reached on the eighth to the ninth week after planting and declined afterward.

The mean number of coccinellid beetle, Menochelus sexmaculatus Fabricius (Coleoptera: Coccinellidae) in various mungbean cropping systems was summarized in Table 10. There were statistically significant differences ($P<0.01$). The highest mean density of coccinellid beetle was 2.21±0.47 obtained from the mungbean/maize system. Whereas the lowest mean density of coccinellid beetle was 0.86±0.21 obtained from mungbean monoculture. The highest peak of seasonal abundance of coccinellid beetle was reached on the seventh week after planting for all cropping

systems. The population density of coccinellid beetle increased from 0.25, 0.00, 0.25, 0.00, and 0.25 beetles on the fourth week in the mungbean monoculture, mungbean/rice, mungbean/maize, mungbean/sesame and the mungbean/sorghum systems to 2.5, 4.00, 7.25, 3.50 and 2.00 beetles on the seventh week, respectively. Thereafter, the population increased from 0.75, 2.00, 3.50, 0.50, and 1.00 beetles on the eighth week in the mungbean monoculture, mungbean/upland rice, mungbean/maize, mungbean/sesame and mungbean/sorghum systems to 0.00, 0.50, 0.75, 1.00, and 0.50 beetles on the tenth week, respectively.

The mean number of coccinellid beetle, Micraspis discolor Farbricius (Coleoptera: Coccinellidae) in the mungbean monoculture was lower than that in the mungbean mixed cultures (Table 11). There were significant differences between the means of coccinellid beetle ($P<0.01$). The highest mean number of coccinellid beetle was 2.25±0.47 obtained from the mungbean/maize system, whereas the lowest mean number of coccinellid beetle was 0.42±0.15 obtained from the mungbean monoculture. The highest peak of seasonal abundance of coccinellid beetle was found on the ninth week after planting. The population density of coccinellid beetle increased from 1.00, 1.00 beetles on the fifth week to 1.50, 1.25 beetles on the fourth week in the mungbean monoculture, mungbean/rice systems, but thereafter the population density of coccinellid beetle declined from 0.50, 0.75 beetles on the seventh week to 0.00 and 2.50 beetles on the eighth week. Particularly, in the mungbean/upland rice system the population density of coccinellid

beetle increased on the ninth week with 4.00 beetles, and declined on the tenth week. The fluctuation of population density of coccinellid beetle was also observed in the mungbean/maize, mungbean/sesame and mungbean/sorghum systems. The population density increased from 2.25 beetles on the fourth week to 2.25 beetles on the sixth week, and then declined on the seventh week in the mungbean/maize system. However, the population density increased again from 3.25 beetles on the eighth week to 5.75 beetles on the ninth week and declined on the tenth week. In the mungbean/sesame system the population density of coccinellid beetle reached its first peak with 1.75 beetles on the fifth week, but declined from 1.00 beetle on the sixth week to 0.25 beetle on the seventh week. Thereafter, the population density of coccinellid beetle increased again from 1.50 beetles on the eighth week to 2.50 beetles on the ninth week and declined on the tenth week. A similar trend of population fluctuation of coccinellid beetle was found in the mungbean/sorghum system. The population density of coccinellid beetle increased from 0.25 beetle on the fourth week to 1.25 beetles on the fifth week, but declined from 0.75 beetle on the sixth week to 0.00 beetle, and then appeared again with 1.00 beetle on the eight week and disappeared on the ninth week.

The mean number of the spider, Oxyopes sp. caught per 25 sweeps throughout the sampling period of 4 to 10 weeks after planting was summarized in Table 12. The highest peak of seasonal abundance of this spider was reached on the tenth week after planting.

Table 6. Natural enemy species diversity measures in various mungbean cropping systems at the Multiple Cropping Center Experimental Farm Chiang Mai (1992)[1].

Diversity measures	Cropping systems				
	S1	S2	S3	S4	S5
Total number of morphospecies, S	18	23	24	15	23
	Mean density (individuals per 25 sweeps)				
Icaria sp.	0.14	0.43	0.07	0.29	0.00
Polistes stigma Fab.	0.14	0.43	0.64	0.18	0.07
Hadrocryptus sp.	0.00	0.07	0.07	0.07	0.07
Campsomeria sp.	0.00	0.11	0.32	0.04	0.00
Trogaspidia amans oryzae Pagden	0.07	0.20	0.10	0.00	0.14
Brachymeria sp.	0.42	0.00	0.32	0.07	0.07
Caconeura sp.	0.00	0.00	0.07	0.00	0.00
Pichitis smaragdula Fab.	0.07	0.04	0.04	0.00	0.04
Diplacodes trivialis (Ramb)	0.10	0.07	0.04	0.00	0.07
Menochelus sexmaculatus Fab.	0.86	1.21	2.21	1.18	0.96
Micraspis discolor Fab.	0.42	1.50	2.25	1.00	0.53
Coelophora sp.	0.00	0.00	0.14	0.00	0.00
Micraspis lineata Thunb.	0.18	0.18	0.71	0.32	0.29
Colliuris indica Thunb.	0.00	0.36	0.00	0.00	0.39
Peaderus intermedius Boh.	0.00	0.00	0.00	0.00	0.04
Sarcophaga sp.	0.10	0.50	0.18	1.21	0.39
Oxyopes sp.	0.92	1.35	1.46	0.92	0.50
Phidipus sp.	0.17	0.89	1.25	0.71	0.42
Sphecid	0.00	0.00	0.21	0.00	0.25
Formicid	0.00	0.00	0.18	0.00	0.11
Hymenopteran	0.00	0.61	0.18	0.00	0.00
Chrysidids	0.36	0.14	0.07	0.18	0.04
Sciomyzid	0.21	0.57	0.00	1.54	0.25
Dolichopid	0.11	1.07	0.64	0.00	0.07
Vespid	0.00	0.32	0.00	0.00	0.00
Ichneumonid	0.00	0.18	0.00	0.00	0.07
Braconids	0.14	1.25	0.07	0.21	0.86
Multillid	0.04	0.14	0.00	0.00	0.14
Chalcids	0.39	0.96	0.64	0.50	0.39
Coccinellid	0.00	0.00	0.25	0.00	0.00
Total number of individuals, N	4.84b	12.90a	12.11a	8.42b	6.16b
Shannon-Wiener function, H′	2.54ns	2.81ns	2.55ns	2.34ns	2.75ns
Equitability, J	0.88ns	0.90ns	0.80ns	0.86ns	0.88ns
Species richness, r_{MA}	17.37b	22.61a	23.60a	14.53b	22.45a

S1 = mungbean monoculture, S2 = mungbean/upland rice, S3 = mungbean/maize, S4 = mungbean/sesame, S5 = mungbean/sorghum.

[1] Treatment means within a row followed by different letter are significantly different ($P<0.01$).

ns = Not significant different as determined by the F-test.

Table 7. Abundance of natural enemies caught in sweep samples in various mungbean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1982).

Cropping systems	Number of natural enemies caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.25	2.25	9.25	6.75	5.00	3.75	1.25	4.07±1.20b
MB/upland rice	0.00	3.00	9.25	20.00	18.25	14.75	11.00	10.88±2.83a
MB/maize	0.50	3.50	8.50	15.25	15.00	15.00	12.50	10.04±2.28a
MB/sesame	0.00	12.50	8.50	5.25	10.75	9.25	2.25	6.93±1.72b
MB/sorghum	0.50	5.00	10.50	7.00	6.75	6.00	6.00	6.00±1.12b

* Mean of four replicates.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different ($P<0.05$).
MB = Mungbean.

Table 8. Mean densities of insect predators on mungbean in various mungbean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Predator species	Cropping systems				
	S1	S2	S3	S4	S5
	Mean density (individual per 25 sweeps)(1)				
Caconeura sp.	0.00	0.00	0.07	0.00	0.00
Diplacodes trivialis (Ramb)	0.10	0.07	0.04	0.00	0.07
Menochelus sexmaculatus Fab.	0.86	1.21	2.21	1.18	0.86
Micraspis discolor Fab.	0.42	1.50	2.25	1.00	0.53
Coelophora sp.	0.00	0.00	0.14	0.00	0.00
Micraspis lineata Thunb.	0.18	0.18	0.71	0.32	0.29
Colliuris indica Thunb.	0.00	0.36	0.00	0.00	0.39
Peaderus intermedius Boh.	0.00	0.00	0.00	0.00	0.04
Oxyopes sp.	0.92	1.35	1.46	0.92	0.50
Phidipus sp.	0.17	0.89	1.25	0.71	0.42
Formicid	0.00	0.00	0.18	0.00	0.11
Sciomyzid	0.21	0.57	0.00	1.54	0.25
Coccinellid	0.00	0.00	0.25	0.00	0.00
Total number of individuals (2)	2.86b	6.13ab	8.58a	5.67ab	3.56b

S1 = mungbean monoculture, S2 = mungbean/upland rice, S3 = mungbean/maize, S4 = mungbean/sesame, S5 = mungbean/sorghum.

(1) Means are averages of seven sampling dates (4,5,6,7,8,9,10 weeks) after planting.

(2) Treatment means within a row followed by the different letter are significantly different (P<0.05).

Table 9. The seasonal abundance of predators on mungbean throughout the mungbean growing season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of predators on mungbean caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.25	3.75	4.75	5.25	3.25	1.75	1.25	2.89±0.70c
MB/upland rice	0.00	2.25	6.00	11.50	11.75	8.00	5.75	6.46±1.66ab
MB/maize	0.50	5.25	7.75	10.50	13.75	14.25	8.00	8.57±1.82a
MB/sesame	0.00	4.25	8.25	3.75	10.25	7.00	3.25	5.25±1.04abc
MB/sorghum	0.50	2.75	5.00	4.00	6.50	2.25	3.25	3.46±0.73bc

* Mean of four replicates.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different ($P<0.01$).
MB = Mungbean.

Table 10. Mean densities of Menochelus sexmaculatus Farbricius. on mungbean in various mungbean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of M. sexmaculatus caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.25	1.00	1.50	2.50	0.75	0.00	0.00	0.86±0.21b
MB/upland rice	0.00	0.25	1.75	4.00	2.00	0.00	0.50	1.21±0.23b
MB/maize	0.25	1.00	2.25	7.25	3.50	0.50	0.75	2.21±0.47a
MB/sesame	0.00	0.75	2.00	3.50	0.50	0.50	1.00	1.18±0.41b
MB/sorghum	0.25	0.25	1.50	2.00	1.00	1.25	0.50	0.96±0.09b

* Mean of four replicates.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different (P<0.01).
MB = Mungbean.

Table 11. Mean densities of Micraspis discolor Farbricius on mungbean in various mungbean cropping at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of M. discolor caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.00	1.00	1.50	0.50	0.00	0.00	0.00	0.42±0.15c
MB/upland rice	0.00	1.00	1.25	0.75	2.50	4.00	1.00	1.50±0.50ab
MB/maize	0.25	1.50	2.25	1.00	3.25	5.75	1.75	2.25±0.47a
MB/sesame	0.00	1.75	1.00	0.25	1.50	2.50	0.00	1.00±0.19bc
MB/sorghum	0.25	1.25	0.75	0.00	1.00	0.00	0.50	0.53±0.14c

* Mean of four replicates.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different (P<0.01).
MB = Mungbean.

However, a high fluctuation of population density of the spider was found throughout the mungbean growing season for all cropping systems. The highest mean density of the spider was 1.46±0.51 observed in the mungbean/maize system. Whereas the least mean density of spider was 0.50±0.18 observed in the mungbean/sorghum system. The population density of Oxyopes sp. increased from 0.00, 0.00 spider on the fourth week to 1.75, 2.00 spiders on the fifth week after planting in the mungbean monoculture and the mungbean/maize systems. Thereafter, the population density of Oxyopes sp. decreased from 0.75, 1.00 spiders on the sixth week in the mungbean monoculture and the mungbean/maize system to 0.50 and 0.00 spider on the seventh week. In the mungbean monoculture the population of Oxyopes sp. increased again up to 1.50 spiders on the eighth week and then declined on the tenth week. It is interesting to note that the population density of Oxyopes sp. increased sharply from 1.50 spiders on the eighth week to 4.00 spiders on the ninth week in the mungbean/maize system but after that population density of spider declined on the tenth week. The mungbean/upland rice, mungbean/sesame and mungbean/sorghum systems the population of Oxyopes sp. increased from 0.00, 0.00, 0.00 spider on the fourth week to 1.50, 1.25, 1.00 spiders on the sixth week, respectively. Thereafter, the population density of Oxyopes sp. decreased from 0.50, 0.25 spiders on the seventh week to 0.75 and 0.00 spider on the ninth week in the mungbean/sesame and mungbean/sorghum systems. The population density of Oxyopes sp. increased again from 0.75, 0.00 spider to 2.00 and 1.25 spiders on the tenth week in the mungbean/sesame and mungbean/sorghum systems. The

fluctuation of population density of spider was also found in the mungbean/upland rice system. The population density of Oxyopes sp. declined from 1.00 spider on the seventh week but slightly increased again on the eighth week with 1.50 spiders. Thereafter, the population density of Oxyopes sp. decreased on the ninth week with 1.00 spider, but increased on the tenth week with 3.00 spiders. However, there were no significant differences among the mean densities of spider in all cropping systems.

The number of the spider, Phidipus sp. caught per 25 sweeps was summarized in Table 13, and the results reveal that there were statistically significant differences between the mean densities of spider in all cropping systems ($P<0.01$). The mean densities of spider in the mungbean mixed culture were significantly higher than that in the mungbean monoculture. The highest mean density of the spider was 1.25±1.04 obtained from mungbean/maize system. Whereas the lowest mean density of the spider was 0.17±0.18 obtained from mungbean monoculture. The highest peak of seasonal abundance of the spider was reached on the ninth week after planting. In the mungbean/maize system, the population of the Phidipus sp. increased from 0.00 spider on the fourth week to 1.75 spiders on the sixth week. Then the population slightly declined from 0.75 spiders on the seventh week to 0.50 spiders on the eighthweek. But the population density of Phidipus sp. increased sharply to 3.00 spiders on the ninth week, and then declined on the tenth week. In the mungbean/upland rice system, the population density of Phidipus sp. increased from 1.00 spider on the sixth week to 1.50 spiders on the

seventh week and slightly declined on the eighth week with 1.25 spiders, but the population density of Phidipus sp. increased again to 1.75 spiders on the ninth week and decreased on the tenth week with 0.75 spider. In the mungbean/sorghum system, the population of Phidipus sp. also increased from 0.00 spider on the fourth week to 0.75 spider on the sixth week, and then the population gradually decreased from 0.50 spider on the seventh week to 0.25 spider on the eight week. The population density of Phidipus sp. increased again from 0.25 spider on the eight week to 0.75 spider on the ninth week, and declined on the tenth week. For mungbean/sesame system the population density of Phidipus sp. increased from 0.00 spider on the fourth week to 1.50 spiders on the seventh, but decreased from 1.00 spider on the eighth week to 0.00 spider on the tenth week. In the mungbean monoculture the population density of Phidipus sp. increased from 0.25 spider on the sixth week to 0.50 spider on the seventh week and declined on the tenth week.

Mean densities of insect parasitoids on mungbean in various cropping systems were summarized in Table 14. There were significant differences among the number of parasitoids. Noticeably, the highest total number of parasitoids was 6.45 found in the mungbean/upland rice system. Whereas the lowest total number of parasitoids was 1.98 found in the mungbean monoculture. However, the total numbers of parasitoids in mungbean/maize, mungbean/sesame and mungbean/sorghum were not significantly different in comparison with mungbean monoculture.

Table 12. Mean densities of Oxyopes sp. on mungbean in various mungbean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of Oxyopes sp. caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.00	1.75	0.75	0.50	1.50	1.00	1.00	0.92±0.22ns
MB/upland rice	0.00	1.00	1.50	1.00	1.50	1.00	3.50	1.35±0.40ns
MB/maize	0.00	2.00	1.00	0.00	1.50	4.00	1.75	1.46±0.51ns
MB/sesame	0.00	1.00	1.25	0.50	1.00	0.75	2.00	0.92±0.23ns
MB/sorghum	0.00	0.50	1.00	0.25	0.50	0.00	1.25	0.50±0.18ns

* Mean of four replicates.
S.E. = The standard error associated with the means.
ns = not significant as determined by F-test.
MB = Mungbean.

Table 13. The mean densities of Phidipus sp. on mungbean in various mungbean cropping systems at the Multiple Cropping Center Experimental farm, Chiang Mai (1992).

Cropping systems	Mean number of Phidipus sp. caught per 25 sweeps *							
	Sampling date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.00	0.00	0.25	0.50	0.25	0.25	0.00	0.17±0.09c
MB/upland rice	0.00	0.00	1.00	1.50	1.25	1.75	0.75	0.89±0.32ab
MB/maize	0.00	0.75	1.75	0.75	0.50	3.00	2.00	1.25±0.33a
MB/sesame	0.00	0.75	1.00	1.50	1.00	0.75	0.00	0.71±0.18abc
MB/sorghum	0.00	0.25	0.75	0.50	0.25	0.75	0.50	0.42±0.34bc

* Mean of four replicates.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different ($P<0.01$).
MB = Mungbean.

Throughout the mungbean growing season the mean number of parasitoids on mungbean was the data summarized in Table 15, and the results indicated that there were significant differences between the mean densities of parasitoids in all cropping systems ($P<0.01$). The highest mean density of parasitoids was 6.36±1.30 fouund in the mungbean/maize system and the least density was 2.00±0.33 found in the mungbean monoculture. Throughout the sampling period, the population densities of parasitoids were heavily fluctuated over time. In mungbean monoculture, parasitoids increased from 0.00 insect on the fifth week after planting to 5.75 insects on the sixth week but declined on the seventh week; and continuously increased to 2.75 insects on the ninth week but declined to 1.25 insects on the tenth week. The population density of parasitoids increased from 0.00 insect on the fourth week after planting to 10.75 insects on the seventh week but decreased to 7.50 insects on the ninth week; and increased again up to 12.75 insects on the tenth week for the mungbean/upland rice system. The population of parasitoids in the mungbean/sesame system increased from 0.00 insect on the fourth week after planting to 1.75 insects on the seventh week but decreased to 1.25 insects on the eighth week and increased again up to 3.50 insects on the ninth week, then decreased on the tenth week. In the mungbean/sorghum system population density of parasitoids increased from 0.00 insect on the fourth week after planting to 4.00 insects on the sixth week but decreased to 0.75 insect on the eighth, and increased again to 5.00 insects on the tenth week.

Table 14. Mean densities of insect parasitoids on mungbean in various mungbean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Parasitoid species	Cropping systems				
	S1	S2	S3	S4	S5
	Mean density (individual per 25 sweeps)(1)				
Icaria sp.	0.14	0.43	0.07	0.29	0.00
Polistes stigma Fab.	0.14	0.43	0.64	0.18	0.07
Hadrocryptus sp.	0.00	0.07	0.07	0.07	0.07
Campsomeria sp.	0.00	0.11	0.32	0.04	0.00
Trogaspidia amans oryzae Pagden	0.07	0.20	0.10	0.00	0.14
Brachymeria sp.	0.42	0.00	0.32	0.07	0.07
Pichitis smaragdula Fab.	0.07	0.04	0.04	0.00	0.04
Sarcophaga sp.	0.10	0.50	0.18	1.21	0.39
Ichneumonid	0.00	0.18	0.00	0.00	0.07
Sphecid	0.00	0.00	0.21	0.00	0.25
Braconids	0.14	1.25	0.07	0.21	0.86
Hymenopteran	0.00	0.61	0.18	0.00	0.00
Multillid	0.04	0.14	0.00	0.00	0.14
Chrysidids	0.36	0.14	0.07	0.18	0.04
Chalcids	0.39	0.96	0.64	0.50	0.39
Dolichopid	0.11	1.07	0.64	0.00	0.07
Vespid	0.00	0.32	0.00	0.00	0.00
Total number of individuals (2)	1.98b	6.45a	3.55b	2.75b	2.6b

S1 = mungbean monoculture, S2 = mungbean/upland rice, S3 = mungbean/maize, S4 = mungbean/sesame, S5 = mungbean/sorghum.

(1) Means are averages of seven sampling dates (4,5,6,7,8,9,10 weeks) after planting.

(2) Treatment means within a row followed by the different letter are significantly different ($P<0.05$).

Table 15. The seasonal abundance of parasitoids on mungbean throughout the mungbean growing season at Multiple Cropping Center Experimental Farm, Chiang Mai (1992).

Cropping systems	Number of parasitoids caught per 25 sweeps *							
	Sampling Date (weeks after planting)							
	4	5	6	7	8	9	10	Mean±S.E.
MB monoculture	0.00	0.25	5.75	1.50	2.50	2.75	1.25	2.00±0.33b
MB/upland rice	0.00	1.75	4.00	10.75	7.75	7.50	12.75	6.36±1.29a
MB/maize	0.25	0.50	1.75	4.50	2.25	4.75	10.75	3.54±0.44b
MB/sesame	0.00	9.25	1.25	1.75	1.25	3.50	1.00	2.57±0.30b
MB/sorghum	0.00	2.75	4.00	3.25	0.75	4.25	5.00	2.86±0.24b

* Average of four replications.
S.E. = The standard error associated with the means.
Treatment means within a column followed by different letter are significantly different ($P<0.01$).
MB = Mungbean.

4.3 Arthropod Species Diversity Assessment

The relative arthropod abundance in treatment plots with 25 sweeps of a 38 cm diameter net while walking the length and width of each plot. Sampling took place 4, 5, 6, 7, 8, 9, 10 weeks after planting. The mean number of individuals was summarized in Table 16. The result of assessment of arthropod species diversity showed that the values of H′ in the mungbean mixed cultures were higher than that in the mungbean monoculture. This can be seen that the mungbean/upland rice system with an H′ of 3.16 was 0.57 higher than the mungbean monoculture with an H′ of 2.59. The mungbean/maize system with an H′ of 3.01 was 0.42 higher than the mungbean monoculture with a H′ of 2.59. The mungbean/sesame system with a H′ of 3.04 was 0.45 higher than the mungbean monoculture. And the mungbean/sorghum system with a H′ of 2.80 was 0.21 higher than the mungbean monoculture with a H′ of 2.59. However, there were no statistically significant differences among the values of H ′index species diversity in all mungbean cropping systems. The equitability (J) was also observed in all mungbean cropping systems. The value of equitability (J) was high for the mungbean mixed cultures as compared to the mungbean monoculture. Apparently, the mungbean/sesame system with a J of 0.80 was 0.15 significantly higher than the monoculture with a J of 0.65 ($P<0.05$). However, the values of evenness (J) of the mungbean/upland rice, mungbean/maize and the mungbean/sorghum systems were not significantly different as compared with the mungbean monoculture. There were statistically significant differences between

the values of species richness (r_{MA}) in all mungbean cropping systems ($P<0.01$), especially, the mungbean/upland rice system with a r_{MA} of 15.06 was 3.24 higher than the mungbean monoculture with a r_{MA} of 11.82. The mungbean/maize and the mungbean/sorghum systems with a r_{MA} of 13.17 and 13.16 was 1.35 and 1.34 higher than that the mungbean monoculture. However, except the mungbean/sesame system the species richness r_{MA} of 11.41 was slightly lower by 0.41 than the mungbean monoculture with a r_{MA} of 11.82.

Table 16. Arthropod species diversity associated with mungbean grown in monoculture and mixed cultures.

Diversity measures			Cropping systems				
			S1	S2	S3	S4	S5
Species	Order	Family	Mean density (individual per 25 sweeps)				
Oxyopes sp.	Araneae	Oxyopidae	0.92	1.35	1.46	0.92	0.50
Phidipus sp.	Araneae	Scalidae	0.17	0.89	1.25	0.71	0.42
Coccinellids	Coleoptera	Coccinellidae	0.00	0.00	0.25	0.00	0.00
Chrysomelid	Coleoptera	Chrysomelidae	0.00	0.11	0.21	0.00	0.00
Langurid	Coleoptera	Ranguridae	0.00	0.07	0.00	0.00	0.00
Menochelus sexmaculatus Fab.	Coleoptera	Coccinellidae	0.86	1.21	2.21	1.18	0.96
Micraspis discolor Fab.	Coleoptera	Coccinellidae	0.42	1.50	2.25	1.00	0.53
Coelophora sp.	Coleoptera	Coccinellidae	0.00	0.00	0.14	0.00	0.00
Micraspis lineata Thunb.	Coleoptera	Coccinellidae	0.18	0.50	0.71	0.32	0.29
Cleyphus sp.	Coleoptera	Celyphidae	0.00	0.00	0.00	0.04	0.04
Dicladispa sp.	Coleoptera	Chrysomelidae	0.00	0.53	0.00	0.35	0.14
Coliuris indica Thunb.	Coleoptera	Carabidae	0.00	0.36	0.00	0.00	0.39
Monolepta signata Oliv.	Coleoptera	Chrysomelidae	0.11	0.29	0.57	0.14	0.11
Paradiscodon sp.	Coleoptera	Cantharidae	0.00	0.00	0.00	0.11	0.00
Alcidodes sp.	Coleoptera	Curculionidae	0.07	0.00	0.00	0.00	0.00
Bruchus chinensis Linn.	Coleoptera	Bruchidae	0.21	0.00	0.00	0.00	0.00
Aulacophora similis Oliv.	Coleoptera	Chrysomelidae	0.00	0.04	0.00	0.00	0.00
Paederus intermedius Boh.	Coleoptera	Staphylidae	0.00	0.00	0.00	0.00	0.04
Ophiomyia phaseoli Tyron.	Diptera	Agromyziidae	10.46	2.25	5.03	2.78	7.35
Dacus cucurbitae Coquil.	Diptera	Tripetidae	0.00	0.04	0.00	0.00	0.00
Amata sp.	Diptera	Syntomidae	0.14	0.00	0.00	0.00	0.00
Sciarid	Diptera	Sciaridae	0.11	0.00	0.29	0.46	0.46
Tephritid	Diptera	Tephritidae	0.00	0.00	0.64	0.00	0.00
Muscid	Diptera	Muscidae	0.32	0.50	0.00	0.04	0.21
Chrysidid	Diptera	Chrysididae	0.00	0.07	0.04	0.18	0.00
Dolichopid	Diptera	Dolichopidae	0.11	1.07	0.64	0.00	0.07
Dipteran	Diptera		0.11	0.18	0.18	0.00	0.07
Agromyzid	Diptera	Agromyziidae	0.00	2.86	2.18	0.79	0.21
Chrysidid	Diptera	Chrysididae	0.36	0.07	0.04	0.00	0.04
Sciomyzid	Diptera	Sciomyzidae	0.21	0.57	0.00	1.54	0.25
Drosophilid	Diptera	Drosophilidae	0.39	0.54	0.00	1.80	0.04
Drosophilid	Diptera	Drosophilidae	2.54	0.14	0.71	3.46	6.57
Sciarid	Diptera	Sciaridae	0.00	0.00	0.21	0.07	0.00
Chironomid	Diptera	Chironomidae	0.50	2.25	5.07	1.00	3.29
Nezara viridula Linn.	Hemiptera	Pentatomidae	5.39	0.96	3.92	1.42	0.71
Riptortus sp.	Hemiptera	Coreidae	2.00	0.92	0.25	0.60	0.85
Cletus sp.	Hemiptera	Coreidae	1.18	0.61	0.54	0.32	0.68
Paramius vincta Say	Hemiptera	Lygaeidae	0.64	0.50	0.46	0.21	0.32
Nysius sp.	Hemiptera	Lygaeidae	0.21	0.29	0.14	1.00	0.00
Mirid	Hemiptera	Miridae	0.14	0.46	0.25	0.00	0.04
Nabid	Hemiptera	Nabidae	0.00	0.04	0.04	0.07	0.00
Jassid	Homoptera	Jassidae	0.00	0.18	0.00	0.18	0.21
Bothrogonia sp.	Homoptera	Cicadellidae	0.00	0.00	0.07	0.00	0.07
Cofana spectra (Distant)	Homoptera	Cicadellidae	0.18	0.46	0.35	0.18	0.10

Table 16 (continued)

Balclutha hebe (Mats)	Homoptera	Cicadellidae	12.93	10.00	8.92	5.03	4.64
Sogatella vibit (Haupt.)	Homoptera	Cicadellidae	0.04	0.04	0.04	0.18	0.11
Phenice maesta (Westwood)	Homoptera	Derbidae	0.00	0.00	0.00	6.86	0.14
Nephotettix sp.	Homoptera	Delphacidae	0.04	0.11	0.04	0.04	0.00
Icaria sp.	Hymenoptera	Vespidae	0.14	0.43	0.07	0.29	0.00
Polistes stigma Fab.	Hymenoptera	Vespidae	0.14	0.43	0.64	0.18	0.07
Hadrocryptus sp.	Hymenoptera	Ichneumonidae	0.00	0.07	0.07	0.07	0.07
Caesomeria sp.	Hymenoptera	Scoliidae	0.00	0.11	0.32	0.04	0.00
Trogaspidia aeans oryzae Pagden	Hymenoptera	Multillidae	0.07	0.20	0.10	0.00	0.14
Brachymeria sp.	Hymenoptera	Chalcididae	0.42	0.00	0.32	0.07	0.07
Pichitis smaragdula Fab.	Hymenoptera	Anthophoridae	0.07	0.04	0.04	0.00	0.04
Megachile sp.	Hymenoptera	Megachilidae	0.03	0.07	0.00	0.10	0.00
Apis indica Fab.	Hymenoptera	Apidae	5.93	5.36	5.14	3.36	4.71
Apis florea Fab.	Hymenoptera	Apidae	5.46	5.32	3.21	3.29	4.11
Sacrophaga sp.	Hymenoptera	Sarcophagidae	0.10	0.50	0.18	1.21	0.39
Chalcid	Hymenoptera	Chalcidae	0.07	0.00	0.07	0.00	0.04
Chalcid	Hymenoptera	Chalcidae	0.07	0.50	0.00	0.00	0.11
Formicid	Hymenoptera	Formicidae	0.00	0.00	0.18	0.00	0.11
Chalcid	Hymenoptera	Chalcidae	0.00	0.07	0.25	0.00	0.00
Braconid	Hymenoptera	Brachonidae	0.00	0.25	0.00	0.00	0.00
Hymenopteran	Hymenoptera		0.00	0.61	0.18	0.00	0.00
Chalcid	Hymenoptera	Chalcidae	0.07	0.07	0.07	0.14	0.00
Chalcid	Hymenoptera	Chalcidae	0.04	0.11	0.00	0.00	0.00
Chalcid	Hymenoptera	Chalcidae	0.14	0.18	0.25	0.36	0.25
Braconid	Hymenoptera	Chalcidae	0.04	0.07	0.00	0.00	0.00
Ichneumonids	Hymenoptera	Inchneumonidae	0.00	0.18	0.00	0.00	0.07
Braconid	Hymenoptera	Braconidae	0.11	0.89	0.07	0.21	0.89
Sphecid	Hymenoptera	Sphecidae	0.00	0.00	0.21	0.00	0.25
Vespids	Hymenoptera	Vespidae	0.00	0.32	0.00	0.00	0.00
Multillid	Hymenoptera	Multilidae	0.04	0.14	0.00	0.00	0.14
Pyralid	Lepidoptera	Pyralidae	0.25	0.14	0.21	0.00	0.07
Caconeura sp.	Odonata	Coenecgrionidae	0.00	0.00	0.07	0.00	0.00
Diplacodes trivialis (Ramb)	Odonata	Libellulidae	0.10	0.07	0.04	0.00	0.07
Tridactilus sp.	Orthoptera	Tridactylidae	0.50	2.25	5.07	1.00	3.29
Total No. of morphospecies, S			50	60	54	44	51
Total no. of individuals, N			63.19	50.35	55.87	43.32	44.72
Shannon-Wiener function, H'			2.59ns	3.16ns	3.01ns	3.04ns	2.80ns
Equitability, J (1)			0.65b	0.77ab	0.75ab	0.80a	0.71b
Species richness, r_{MA} (2)			11.82c	15.05a	13.17b	11.41d	13.16b

S1= Mungbean monoculture, S2= Mungbean/upland rice, S3= Mungbean/maize, S4= Mungbean/sesame
S5= Mungbean/sorghum.
(1) Treatment means within a row followed by different letter are significantly different (P<0.05)
(2) Treatment means within a row followed by different letter are significantly different (P<0.01).
ns= Not significant different as determined by the F-test.