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Faunal Survey of Insects and Spiders Killed by Protein Hydrolysate Insecticide Bait for Control of Melon Fly

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INTRODUCTION

HAGEN and FINNEY (1950) found in nutritional studies that yeast hydrolysate contains dietary elements essential for the development of the oriental fruit fly. When newly emerged, it is also known that some species of insects have immature ovarian eggs. For ovarian development, it appears indispensable for these insects to consume proteinaceous food. Also, the intake of such food apparently prolongs the longevity of both males and females. Hence, like the fruit flies, it is hypothesized that a considerable number of species of insects will be attracted to protein hydrolysate bait.

Poison bait containing protein hydrolysate, sprayed from the ground into abundantly bushy feral host plants, was used in a pilot melon fly eradication program carried out at Kumejima (an off island located approximately 100 km west of Naha, Okinawa) from June 1974 to January 1975 (IWAHASHI *et al.*, 1975).

It is envisioned for the near future that this same bait spray will be broadly applied throughout the Ryukyu Islands and adjacent Amami Islands to the north. In past programs on fruit flies, only the advantages gained by eliminating the fly were mainly emphasized (MCPHAIL, 1939; STEINER, 1952). The simultaneous killing of other insect life appeared incidental.

Could a food attractant, recognizably not as specific as a sex attractant, when used during a preparatory suppression stage, prior to eradication now earmarked for the future, possibly interfere with and distrub the life and order of the insect community? There is a need to know. Hence, our interest is in determining what insects are attracted to proteinaceous bait. We wish to focus attention to the varieties of insects killed during such an experiment.

MATERIALS AND METHODS

This experiment was performed for ten months mainly at Ishiki, situated in the suburbs of Itoman City and for a month at Gushiken, Motobu Municipality. A shrubby forest of about 90 m^2, surrounded by sugar cane field, was selected at Ishiki. The area, rich in vegetation with a varied assortment of vegetation, had *Psidium guajava* and *Ficus microcarpa*. As evidenced, the insect fauna at Ishiki was relatively complex.

The insecticide bait containing protein hydrolysate was first made by diluting Amber BYF 100 powder into a 140-time aqueous solution. A malathion component was also prepared and mixed into this solution, resulting in an 800-time dilution. Along a narrow path in the shrubby forest, a total of 10 conical saran nets (9 test nets and 1

control net), each measuring 90 cm in diameter and 80 cm in depth were placed below the treated foliage. These were set at a height of 1.5 m in order to catch the baited insects. Using a hand spray, about 0.1 *l* of bait was sprayed from the ground to foliage above the test nets. A separate 800-time solution diluted only with malathion was applied to foliage above the control net. Before spraying the insects on foliage were beaten away.

The following procedure was used for survey. Bait was sprayed early in week. The recovery of poisoned insects on nets was made during two successive days that followed. These were recorded by species and number of individuals. A total of 26 recovery weeks were scheduled from May 1975 to March 1976.

RESULTS AND DISCUSSION

A number of insects may have been accidentally trapped. These were treated as bait attracted. The following list, however, does not include the total membership of attracted insects. A prevailing high wind may have caused many infected insects to fall outside the net area. Unidientified insects, mainly flies, were also excluded from the list.

Table 1 shows the species and individual number of insects caught. As expected, a wide variety of insects were caught and the experiment verified an attractant's value. Representative examples of killed insects are described below:

Of 99 species in 48 families collected, the Diptera was the most abundant group. The Blattaria, Homoptera and Orthoptera were also numerous. In Blattaria, a total of 565 cockroaches (*Onychostylus pallidiolus*) were attracted, indicating that the bait is an effective lure for the cockroach. Restless bush crickets (*Hapithus agitator*) in Orthoptera, now a new pest of citrus orchard in Yamaguchi Prefecture, Japan, numbering 46 individuals, mostly females, were also collected. In Psocoptera, a number of *Psococerasyis ryukyuensis* were attracted. In Homoptera, relatively many were the globular treehopper (*Gargara genistae*), a leafhopper (*Tartessus ferrugineus*), or the green broad-winged planthopper (*Geisha distinctissima*). The bait spray was also effective for lacewings in Neuroptera, of significant importance as large numbers of aphids and coccids are consumed by lacewings. The Lepidoptera was very few in numbers. The traps were most effective in catching flies. The tephritids, lauxaniids, muscids and chloropids were mainly attracted. The melon fly is included in this catch attracting more females than males.

There were only three oriental fruit flies. A methly eugenol trap in conjunction with the experiment was set at the same time to determine the oriental fruit fly population. A scarcity of the fly in the vicinity was therefore revealed. It has been confirmed by our experiments, however, that proteinaceous bait is equaly effective against both the oriental fruit fly and the melon fly. The lauxaniids were rather numerous. Although positive identification of the species is not known, the larvae of these feed mostly on dead leaves. The chloropids and anthomyids are also essentially herbivorous. The larvae of the hover fly (*Epistrophe bateata*), however, is carnivorous, predaciously feeding on aphids and the nymphs of other Homoptera. In Hymenoptera, several species of ants were attracted. Ichneumon flies and braconid wasps were few. In Coleoptera, *Dicraeosis*

TABLE 1. List of baited insect species and their number

Species	Month*				Total number
	M—M	J—S	O—N	D—F	
BLATTARIA					
Blattidae					
Neostylopyga rhombifolia	5	1	6	2	14
Blattellidae					
Onychostylus pallidiolus	76	322	135	32	565
ORTHOPTERA					
Mogoplistidae					
Ornebius kanetataki	12	10	16	8	46
PSOCOPTERA					
Psocidae					
Psococerastis ryukyuensis	101	30	17		148
HEMIPTERA					
Coreidae					
Riptortus sp.			1		1
Lygaeidae					
Eucosmetus sp.		1			1
Largidae					
Dysdercus cingulatus	1	1		1	3
HOMOPTERA					
Membracidae					
Gargara genistae	16	1	2		19
Tartessidae					
Tartessus ferrugineus	2	7	13	4	26
Penthimiidae					
Penthimia nitida				1	1
Flatidae					
Geisha distinctissima		16			16
Plataspidae					
Coptosoma cribrarium		1			1
Tropiduchidae					
Mesepora onukii		1	1	1	3
NEUROPTERA					
Hemerobiidae					
Eumicromus sp.	3	1		6	10
Chrysopidae					
Chrysopa formosana	1	16	4	2	23
C. furcifera	2			1	3
LEPIDOPTERA					
Tortricidae					
Adoxopyes orana	1				1
Olethreutidae					
Acroclita sp.	1				1
Pyralidae					
Cirrhochirista kosemnialis		1			1
Coleophoridae					
Coleophora sp.			1		1
DIPTERA					
Stratiomyidae					
Gen. et sp. A	5	1	1		7
Gen. et sp. B		3	11		14
SYRPHIDAE					
Epistrophe bateata				12	12
Chrysotoxum japonicum	1				1
Baccha apicalis			1		1

Species	Month*				Total number
	M—M	J—S	O—N	D—F	
Tephritidae					
Dacus dorsalis		1	2		3
D. cucurbitae	4	57	100	22	183
D. scutellatus	2		1		3
Paratridacus expandens			1	1	2
Lauxaniidae					
Formosonia cineta	117	153	27	21	318
Rhodesiella scutellata	5	13	6	6	30
Gampsocera sp.		11	4	3	18
Chlorophidae					
Formosonia cincta	45	5	9	9	68
Rhodesiella scutellata		6	2		8
Gampsocera sp.	3	3	4		10
Anthomyiidae					
Anthomyia sp.	15				15
Muscidae					
Ophyra nigra	84	24	10	16	134
O. chalcogaster	1		2		3
Dichaetomyia bibax		22	5	9	36
Musca conducens	1				1
Atherigona sp.	8	1	1	5	15
Calliphoridae					
Chrysomya rufifacies	1				1
Stomorhina obsoleta	1				1
Sarcophagidae					
Sarcophaga sp.				1	1
Boettcherisca peregina	1	2			3
Pierretia josephi	1	12	1		14
Tachinidae					
Winthemia sp.	1	5			6
COLEOPTERA					
Harpalidae					
Callida spendidu	1				1
Sacrabaeidae					
Apogonia bicarinata		2			2
Maladera cariniceps	1			2	3
Helodidae					
Scirtes elongatus				1	1
Ptilodactylidae					
Ptilodactyla amamioshimana	28	1			29
P. takahasii	15				15
Buprestidae					
Paratrachys hedarae	1				1
Elateridae					
Silesis okinawaensis	1	4			5
Lampyridae					
Curtos okinawana		3			3
Coccinellidae					
Harmonia axyridis	1				1
Illeis koebelei				1	1
Cryptogonus orbiculus	1				1
Tenebrionidae					
Pseudonautes purpurivittatus	1				1
Dicraeosis carinatus		26	3		29
Mordellidae					
Falsmordellina euteoloides	5				5
Oedemeridae					
Asclera subrugosa	1				1
Anthicidae					
Anthicus monstrosicornis	1				1

Species	Month*				Total number
	M—M	J—S	O—N	D—F	
Cerambycidae					
Miaenia hirashimai		1			1
Exocentrus lineatus	2				2
Sybra loochooana		2			2
S. pascoei		1			1
S. baculina		1			1
Ropica honesta			2		2
Stenhomalus taiwanus	3				3
Chrysomellidae					
Cassida versicolor	1			1	2
Basilepta davidi	1				1
Abirus fortunei	1				1
Scelodonta lewisii	1				1
Anthribidae					
Exillis sp.	3	1			4
Curculionidae					
Phyllobius sp.	1				1
Coeliodes sp.		1			1
Oedophyrus sp.			1		1
Macrocorynus sp.	2				2
Desmidphorus aureolus	2				2
HYMENOPTERA					
Ichneumonidae					
Torbda sp.		1			1
Venturia sp.		1			1
Braconidae					
Doryctes sp.	1			1	2
Bracon sp.				1	1
Apanteles sp.	1				1
Chelonus sp.	1				1
Formicidae					
Pheidole indica	1				1
Crematogaster sp.		6	2		8
Pristomyrmex pungens		7	1		8
Tetramorium guineense		3	1		4
Technomyrmex albipes	2	24	9		35
Camponotus devestivus	11	10			21
C. sp. A	10	24	8		42
C. sp. B	2	19	13		34
C. sp. C		2			2
Polyrhachis myrmhopla		5			5
Prenolepis longicornis	10				10
Paratrechina sp.		5	3		8

* M—M: Spring J—S: Summer O—N: Autumn D—F: Winter

carinatus and ptilodactylids were numerous.

Besides insects, spiders and pill-bugs (Armadillidae) were caught, the former being of significance in the insect community because of their predatory activity. Spiders are listed in Table 2. As all were dry specimens, individual identification was difficult and some of these were excluded from the list. Yet, a total of 17 species belonging to 9 families, were collected and identified. Listed are 9 snarers and 8 hunters with the latter more in individual numbers caught. It appears that caught spiders were not lured by bait. Instead, it is assumed they were killed while preying on poisoned insects. Body fragments of individual cockroaches, flies and Homoptera were observed in nets.

TABLE 2. List of spiders and their number

Species	Month*				Total number
	M—M	J—S	O—N	D—F	
ARANEINA					
Uloboridae					
Uloborus varians		1	1		2
Theridiidae					
Conopistha sp.		4			4
Chrysso sp.			1		1
Theridion sterninotatum		5	6		13
Anelosimus crassipes	1	2	4		7
Argiopidae					
Araneus sp.			1		1
Cyclosa sp.	1				1
Tetragnathidae					
Leucauge blanda		1	2		3
Agelenidae					
Agelena sp.			2		2
Thomisidae					
Xysticus sp.		1			1
Tmarus piger	1		3	2	6
Philodromus sp.	2			1	3
Salticidae					
Rhena atrata			8		8
Myrmarachne sp.		5			5
Clubionidae					
Chiracanthium sp.		8	9		17
Clubiona sp.		3	5	1	9
Heteropodidae					
Micrommata sp.		1		1	2

* M—M: Spring J—S: Summer O—N: Autumn D—F: Winter

SASABA *et al.* (1970) reported that spiders prey most on Homoptera and Diptera. In the control net, for duration of the survey, only a total of 10 ants and 2 cockroaches were killed.

As far as the investigation revealed, it is clearly evident from results that proteinaceous bait is effective against fruit flies and also against many insects belonging to Diptera, Blattaria, Orthoptera, Homoptera and Psocoptera. We have no information on population density of each of the above species. Therefore, a conclusion is premature at this stage of the study. However, the survey renders weight in effective use of such bait, particularly in controlling fruit flies with minimal destruction of the so-called beneficial insects and spiders.

SUMMARY

A survey was conducted on the insect and spider fauna killed by protein hydrolysate insecticide bait used in a suppression stage of melon fly eradication program. Of 99 species in 48 families of insects collected, the Diptera was the most abundant and Blattaria, Orthoptera, Homoptera and Psocoptera were also numerous. A total of 17 species belonging to 9 families of spiders were killed. Of these, nine and eight were snarer and hunter, respectively. The caught spiders were not attracted to bait, but

preyed on poisoned insects. The experiment using proteinaceous bait substantiates the value of an attractant for a wide variety of insects. It seems the bait is especially useful in controlling fruit flies with little destruction of beneficial insects and spiders.

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摘　　要

ウリミバエ防除用プロテイン剤によって殺された昆虫及びクモ類

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ウリミバエの抑圧防除に用いられるプロテイン剤によって殺される昆虫相及びクモ相とその個体数を調査した。

48科99種の昆虫が記録され，個体数の多かったのは双翅目，ゴギブリ目，直翅目，同翅目及びチャタテムシ目であった。クモ類は9科17種が採集され，そのうち9種は造網性，8種は徘徊性のクモであった。クモ類は蛋白加水分解物に誘引されたのではなく，プロテイン剤を摂食した昆虫を捕食して死亡したものと思われる。プロテイン剤はミバエを含む多くの種の昆虫を誘引したが，特にミバエ類に対して顕著な誘引効果を示し，プロテイン剤で殺された益虫は少なかった。