2.4.5 Laboratory : Insect Physiology

Member:	Professor	Masayuki, Sakuma, D. Agric.Sci.
	Assistant Professor	Masao, Fukui, D.Agric.Sci.
	Doctor's program	2
	Master's Program	1
	Undergraduate	1

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Spatial orientation mechanisms of insects

Sensori-motor context in insects' resource finding behavior is our main research subject. To manupulate enviornmental cues without disturbing insects' locomotional activity, we have developed computer-aided locomotion-compensators, including a digital servospere and a micro locomotion compensator (MLC). By means of these instuments, we have analysed orientation algorisms that insects use. This year we investigated residence of the mould mite in odor patches in relation to their scale, as well as the escape behavior of the spider mites from UV light in an MLC. In a servosphere apparatus, we have conducted a sort of vertual reality experiment where odor cue presentation to the German cockroach is controlled in a way of negative feed back to its locomotion.

b) Study on insects' semiochemicals

We have been engaged in natural products chemistry of insect semiochemicals, in particular Dictyopteran (cockroach) phromones, since our laboratory founded. Now we are trying to isolate and identify the aggregation pheromone of the American cockroach, which is not only a world notorious hygiene pest but a type animal of neuroethology. The mass rearing system for the pheromone production and the purification procedure of raw materials has been established.

c) Study on the evolution of signals relevant to sexual selection

Female preferences for “calling songs” in the crickets of genus Teleogryllus were examined. The songs of Teleogryllus yezoemma (T-y), T. emma (T-e), and T. taiwanemma (T-t) were effective for species recognition and pre-mating isolation. Males of two allopatric species (T-y, T-t) with very similar songs were preferred by females of other species. T-e males were

discriminated by females of the two species. The male crickets produce “courtship songs” when mating. Playback trials with courtship songs revealed that T-y females are attracted to the songs of partially sympatric species T-e and its allopatric species T-t. These results suggest that the courtship songs contribute little to species recognition at least by T-y, and phylogenic relationship between T-y and T-t is very close. Male rice planthoppers of Nephotettix produce substrate-borne calling signals to communicate with a female on their host plants. After receiving a vibrational reply from a female responding to the signals, the calling male continues in a duet with the female. The function of the duet influencing pair formation has been studied from a perspective of sexual selection.

A-2.Publications and presentations

a) Publications

Original Papers

- Okada K. and Sakuma M. : An odor stimulator controlling odor temporal pattern applicable in insect olfaction study. Chem. Senses, 34: 425-433 ,2009.

- Nakajima, Y., Sakuma, M., Sasaki, R. and Fujisaki, K., Adaptive traits of Riptortus pedestris nymphs (Heteroptera: Alydidae) for locating host plants. Ann. Entomol. Soc. Am. 103: 439 - 448, 2010.

Reports

- Sakuma, M.: The analysis of chemo-orientation behavior of aviatory insects in an insect-flight simulator. Report for grant-in-aid for scientific research (Cat. Basic Res. C - 17580046)

- Sakuma, M.; Developement of dust-mite attractants and the evaluation of their trapping-performance. Subsidies for creative enterprises in smaller industry (100091000069). Report for the trustee researches.

b) Conference and seminar papers presented

- The 54th annual meeting of the Japanese Society of Applied Entomoloty and Zoology: 4 Presentations

- The 5th animal sonar symposium (Doshisha Univ. Kyoto. Japan): 1 presentation

A-3.Off-campus activities

Membership in academic societies

- Masayuki Sakuma, D.Agric.Sci : The Japanese Society of Applied Entomology and

Zoology, Japan Society for Bioscience, Biotechnology, and Agrochemistry, The Zoological Society of Japan, Japan Ethological Society

- Masao Fukui, D.Agric.Sci. : The Japanese Society of Applied Entomology and Zoology, Japan Ethological Society, The Entomological Society of Japan, The Acoustic Society of Japan

Research grants

2.Other Research Grants

- Subsidies for creative enterprises in smaller industry : Sakuma, M. : Developement of dust-mite attractants and the evaluation of their trapping-performance.

A-4.International cooperation and overseas activities

Membership in academic societies

- Masayuki Sakuma, D.Agric.Sci. : Asia-Pacific Association of Chemical Ecologists

B.Educational Activities(2009.4-2010.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level :	Animal Physiology(Sakuma et al.), Outline of Bio-production Science IV(Sakuma), Insect Physiology(Sakuma), Laboratory in Bioscience I, II (Sakuma and Fukui), Introducttion to Foreign Literature in Bioresource Science IV (Sakuma), Seminar in Plant Protection (Sakuma and Fukui)
- Graduate level :	Seminar in Insect Physiology (Sakuma and Fukui), Research in Insect Physiology (Sakuma and Fukui),Insect Physiology Advanced Course (Sakuma, biennially), Applied Bioscience I (Sakuma et al.)

B-2.Off-campus teaching etc.

Part-time lecturer

- Masao Fukui: Faculty of Engineering, Kyoto Sangyo University, (Fundamentals of Biological Experiments)

B-3.Overseas teaching

International students

- International students : Research Students 1 (China)