Attraction Activity of Mushroom Water Extracts for Aquatic Animals[*1, *2]

Taiko Miyasaki[*3] and Katsuhiko Harada[*3]

Attraction activities of 30 breeds from 22 species of mushroom for the black abalone *Haliotis discus*, the oriental weatherfish *Misgurnus anguillicaudatus*, and the yellowtail *Seriola quinqueradiata* were examined with an attraction index a or gr of a logistic curve $y = g / \{1 + \exp[-r(x-a)]\}$, statistically. The aqueous extractions of mushroom tested were to some extent attractive for the shell- and fin-fishes. Three kinds of mushrooms, ningyoutake *Albatrellus confluens*, kishimeji *Tricholoma flavovirens*, and matsutake *T. matsutake* attracted all the shell- and fin-fishes, and the highest activity was observed in kuritake *Naematoloma sublateritium* (breed-I) for the abalone, *N. sublateritium* (breed-III) for the oriental weatherfish, and tsukuriake *Agaricus bisporus* for the yellowtail. The attraction activities of these mushrooms clearly depended on the concentrations tested.

1. Introduction

We have examined the attraction activities of terrestrial food substances such as spices, herbal drugs, fruits, and vegetables, which are foreign to aquatic environments, toward black abalone *Haliotis discus*, oriental weatherfish *Misgurnus anguillicaudatus*, and yellowtail *Seriola quinqueradiata* by behavioral experiments.[1-4] The efficacy of several substances has been proved to induce an exploratory and feeding behavior by tank tests for the three aquatic animals described above.[1-7] Glycoside such as stevioside[5] and essential oil such as β-elemene[6] obtained from respective herbal drug and spice are found to attract strongly the aquatic animals.

To find feeding attractants from easily available mushrooms, similar experiments using the mushrooms were conducted, and the results are described in the present paper.

2. Materials and Methods

2. 1. Test animals

Young black abalone of 1.2cm average shell length were supplied by the Yamaguchi Prefecture Gaikai Fisheries Experimental Station. Fifty individuals were used for each test. Adult oriental weatherfish of 10.0cm average body length were obtained from a private aquaculture farm in Shiga prefecture and 60 individuals were used for each test. Juvenile yellowtail of 4.9 cm average fork length were obtained from an aquaculture farm of Senzaki Cooperative in Yamaguchi prefecture. One hundred fish were accommodated in a test tank and the experiments were performed with the same fish. During the experimental period, 72 individuals were successively removed as they grew too big for testing in the test tank. Abalone were fed with green laver *Ulva pertusa*, and oriental weather-fish and yellowtail were fed with formulated feed

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*2 Studies on the Feeding Attractants for Fishes and Shellfishes-XII.

*3 Department of Food Science and Technology, National Fisheries University, Shimonoseki, Yamaguchi 759-6595, Japan（宮崎泰幸・原田勝彦：水産大学校食品化学科）.

(Nihon Haigoshiryo Co. Ltd.). Maintenance of the test animals and the procedures for the experiments were the same as described in previous papers.[7-9]

2.2. Test samples

Thirty breeds from 22 kinds of natural mushrooms tested and their description containing habitat are listed in Table 1. The breed of mushroom was expressed as Roman figures in a parenthesis, and each test sample was prepared as follows. Edible portions of the mushroom were thoroughly chopped into small pieces and homogenized with a food processor and an Ultra-Turrax homogenizer (Janke & Kunkel GmbH & Co., KG. Germany) in an equivolume of deionized water. The homogenate was then cen-

Table 1. Natural mushrooms tested in the present study

Botanical name	Japanese name	Habitat
Agaricaceae	Haratakeka	
Agaricus bisporus	Tsukuritake†	Nara, Nara
Boletaceae	Iguchika	
Suillus bovinus	Amitake	Nakatsugawa, Gifu
S. grevillei	Hanaiguchi (I)*1	Matsumoto, Nagano
S. grevillei	Hanaiguchi (II)*1	Kitakoma, Yamanashi
S. luteus	Numeriiguchi	Ena, Gifu
Cortinariaceae	Fuusentakeka	
Cortinarius elatior	Aburashimeji	Ena, Gifu
Rozites caperata	Shougenji	Nakatsugawa, Gifu
Hygrophoraceae	Numerigasaka	
Hygrophorus russula	Sakurashimeji	Nakatsugawa, Gifu
Pleurotaceae	Hiratakeka	
Preurotus ostreatus	Hiratakeka (I)*2†	Nagano, Nagano
P. ostreatus	Hiratakeka (II)*2	Nagano, Nagano
P. ostreatus	Hiratakeka (III)*2	Nara, Nara
Polyporaceae	Takoukinka	
Albatrellus confluens	Ningyoutake	Ena, Gifu
Ramariaceae	Houkitakeka	
Ramaria botrytis	Houkitake (I)*3	Nakatsugawa, Gifu
R. botrytis	Houkitake (II)*3	Suwa, Nagano
Rhodophyllaceae	Ipponshimejika	
Rhodophyllus crassipes	Urabenihoteishimeji	Ena, Gifu
Strophariaceae	Moegitakeka	
Naematoloma sublateritium	Kuritake (I)*4	Matsumoto, Nagano
N. sublateritium	Kuritake (II)*4	Suwa, Nagano
N. sublateritium	Kuritake (III)*4	Nagano, Nagano
Pholiata nameko	Nameko (I)*5	Matsumoto, Nagano
P. nameko	Nameko (II)*5	Nagano, Nagano
Thelephoraceae	Ibotakeka	
Polyozellus multiplex	Karasutake (I)*6	Suwa, Nagano
P. multiplex	Karasutake (II)*6	Ena, Gifu
Sarcodon aspratus	Koutake	Ena, Gifu
Tricholomataceae	Kishimejika	
Lentinus edodes	Shiitake†	Nara, Nara
Lepista nuda	Murasakishimeji	Matsumoto, Nagano
Lyophyllum shimeji	Honshimeji	Nakatsugawa, Gifu
Pleurocybella porrigens	Sugihiratake	Ena, Gifu
Tricholoma flavovirens	Kishimeji	Ena, Gifu
T. matsutake	Matsutake	Nara, Nara
T. portentosum	Shimofurishimeji	Suwa, Nagano

† Artificial cultivation, *1–*6 Product of different districts.

trifuged for 15 min at 8,000×g below 5 ℃ and the supernatant was filtered through a filterpaper (Advantec Toyo No. 2). The filtrate was, if necessary, adjusted to pH 6.5 by a dilute sodium hydroxide solution and stored at -40℃ until use.

2.3. Estimation of attraction indexes

Attraction indexes, the a for both abalone and oriental weatherfish and the gr for yellowtail, were estimated by the methods described in the previous papers.[7-9] Briefly, the estimation of a and gr was based on applying the entered, the remained or the left time-courses obtained from behavioral experiment to a logistic curve $y = g/\{1+exp[-r(x-a)]\}$. The y show the number of individuals which entered, left or remained the test compartment at x time after start of experiment. The parameters g, r and a of the general expression of a logistic curve, indicate locomotion (entering, leaving or remaining) number in infinite time, slope at a and average locomotion time, respectively. In each test, three test samples were chosen from the 30 ones, and set in the test compartments of three channels arranged arbitrarily out of the four in the test tank (one channel being left as a dummy) according to a design to the Latin square method. Four series obtained by the Latin square of numbers counted every one (for oriental weatherfish and yellowtail) or two minutes (for abalone) in each test sample were summed. The numbers summed were integrated successively with time. The integrated numbers were used as the time-course data to estimate a and gr. The attraction index can be presented as the coefficient a and the product of coefficients g and r of the logistic curve. Where the calculation method of the logistic curve $Yx = \Sigma yx$ is as follows. The yx shows the number of individuals entered, remained or left the test compartment from $x-1$ to x (one or two minutes interval) after the start of the experiment. The r was estimated from the coefficient of the regression of reciprocal of Yx on reciprocal of $Yx-1$, while the a and the g were estimated from the coefficient and constant of the regression line reciprocal of Yx on $[-rx]$ ($x = 1$ to 10). Statistical significance was evaluated through chi-square test of the recorded Yx with estimated one through the logistic curve adopting the estimated 3 coefficients. This experiment was conducted for at least three series for each. Among them, the data of series showing the most active exploratory and feeding behavior were adopted. The a and gr correspond to the average remained time (min) and the number of locomotive fish at the coefficient a, respectively. A crumpled gauze (a sheet of 25×25cm) in which 7.5ml of test sample was absorbed was set in each of the four compartments in the test tank to observe the behavior of the animals. Attraction activities of three arbitrary test samples and a dummy were measured at a time.

3. Results and Discussion

The calculated values of the attraction indexes of mushroom samples for the three test animals are listed in Table 2. Comparison of the attractivity of the test samples is valid only among the 3 of them in the same series, because those of other test samples than them were not tested, exactly speaking, at the same conditions. Test samples with a lower value of attraction index than that of the dummy were not regarded to be effective in repellency. Because only the attraction activity can be estimated in the present method.[7-9] However the case may be possibility of the repellency effect. On the other hand, test samples with a higher value of attraction index

Table 2. Attraction activity of mushrooms for three kinds of shell-and fin-fishes

Expt. No.	Mushrooms (Species-Japanese name)	Attraction activity* Abalone (*a*)	Oriental weatherfish (*a*)	Yellowtail (*gr*)
1	Dummy	2.9	2.1	99.2
	Polyozellus multiplex-Karasutake (Ⅱ)	2.5	2.0	94.6
	Naematoloma sublateritium-Kuritake (Ⅱ)	2.6	1.9	91.6
	Ramaria botrytis-Houkitake (Ⅱ)	2.2	3.6	97.1
2	Dummy	7.2	1.3	58.0
	Tricholoma matsutake-Matsutake	7.9	1.9	73.9
	Lentinus edodes-Shiitake	6.2	2.0	41.8
	Lepista nuda-Murasakishimeji	5.7	0.2	45.4
3	Dummy	4.4	1.2	67.3
	Tricholoma portentosum-Shimofurishimeji	2.8	1.2	58.8
	Rozites caperata-Shougenji	3.6	1.2	86.1
	Lyophyllum shimeji-Honshimeji	4.6	0.7	94.0
4	Dummy	4.6	1.9	62.3
	Pholiota nameko-Nameko (Ⅰ)	7.1	1.1	48.9
	Naematoloma sublateritium-Kuritake (Ⅰ)	7.1	1.7	40.0
	Suillus grevillei-Hanaiguchi (Ⅰ)	5.6	1.0	56.0
5	Dummy	4.3	1.7	64.8
	Hygrophorus russula-Sakurashimeji	3.7	1.8	89.9
	Suillus grevillei-Hanaiguchi (Ⅱ)	3.3	2.0	79.0
	Ramaria botrytis-Houkitake (Ⅰ)	3.0	1.8	79.9
6	Dummy	3.1	3.4	35.7
	Tricholama flavovirens-Kishimeji	3.5	3.9	68.3
	Pleurocybella porrigens-Sugihiratake	3.7	3.3	127.1
	Rhodophyllus crassipes-Urabenihoteishimeji	3.0	3.4	213.6
7	Dummy	3.4	1.4	89.8
	Naematoloma sublateritium-Kuritake (Ⅲ)	4.4	2.3	72.3
	Pholiota nameko-Nameko (Ⅱ)	5.2	1.3	115.6
	Agaricus bisporus-Tsukuritake	8.4	1.1	228.1
8	Dummy	4.2	3.2	55.7
	Polyozellus multiplex-Karasutake (Ⅰ)	4.3	3.5	77.0
	Sarcodon aspratus-Koutake	6.3	3.0	53.4
	Albatrellus confluens-Ningyoutake	5.3	4.2	68.1
9	Dummy	4.1	1.5	75.5
	Pleurotus ostreatus-Hiratake (Ⅰ)	7.0	1.9	53.3
	Pleurotus ostreatus-Hiratake (Ⅱ)	1.2	1.4	46.0
	Pleurotus ostreatus-Hiratake (Ⅲ)	3.4	1.4	55.6
10	Dummy	5.2	6.0	58.2
	Suillus luteus-Numeriiguchi	3.8	4.7	112.2
	Suillus bovinus-Amitake	6.1	3.1	68.7
	Cortinarius elatior-Aburashimeji	5.1	3.4	104.0

*See in details "Estimation of attraction indexes" in the text.

than that of the dummy were regarded to be effective in attraction. Furthermore test samples with beyond 1.0 (for abalone), 0.4 (oriental weatherfish) and 25 (yellowtail) of attraction index than that of dummy were confirmed to be more active in an exploratory and feeding. Accordingly they were regarded to be more attractive. For abalone, the following 12 mushrooms were effective in attraction : tsukuritake *Agaricus bisporus*, amitake *Suillus bovinus*, hanaiguchi *S. grevillei* (I), hiratake *Pleurotus ostreatus* (I), ningyoutake *Albatrellus confluens*, kuritake *Naematoloma sublateritium* (I, III), nameko *Pholiota nameko* (I, II), koutake *Sarcodon aspratus*, honshimeji *Lyophyllum shimeji*, sugihiratake *Pleurocybella porrigens*, kishimeji *Tricholoma flavovirens*, and matsutake *T. matsutake*. Among them, *Agaricus bisporus*, *Sillus grevillei* (I), *Pleurotus ostreatus* (I), *Albatrellus confluens*, *Naematoloma sublateritium* (I, III), *Pholiota nameko* (I, II), and *Sarcodon aspratus* were more attractive.

For oriental weatherfish, the following 9 mushrooms were attractive in attraction: *Suillus grevillei* (II), *Pleurotus ostreatus* (I), *Albatrellus confluens*, houkitake *Ramaria botrytis* (II), *Naematoloma sublateritium* (III), karasutake *Polyozellus multiplex* (I), shiitake *Lentinus edodes*, *Tricholoma flavovirens*, and *T. matsutake*. Among them, *Albatrellus confluens*, *Ramaria botrytis* (II), *Naematoloma sublateritium* (III), *Lentinus edodes*, *Tricholoma flavovirens*, and *T. matsutake* were more attractive.

For yellowtail, the following 16 mushrooms were attractive in attraction: *Agaricus bisporus*, *Suillus bovinus*, *S. grevillei* (II), numeriiguchi *S. luteus*, aburashimeji *Cortinarius elatior*, shougenji *Rozites caperata*, sakurashimeji *Hygrophorus russula*, *Albatrellus confluens*, *Ramaria botrytis* (I), urabenihoteishimeji *Rhodophyllus crassipes*, *Pholiota nameko* (II), *Polyozellus multiplex* (I), *Lyophyllum shimeji*, *Pleurocybella porrigens*, *Tricholoma flavovirens*, and *T. matsutake*. Among them *Agaricus bisporus*, *Suillus luteus*, *Cortinarius elatior*, *Hygrophorus russula*, *Rhodophyllus crassipes*, *Pholiota nameko* (II), *Lyophyllum shimeji*, *Pleurocybella porrigens*, and *Tricholoma flavovirens* were more attractive.

The mushrooms that were effective in attraction did not induce any unusual behavior pattern during the experiment, and the test individuals swam into and away from the test compartment as in the test of attractants previously reported.[1-9]

Furthermore, to determine the most attractive mushrooms for each test animal, 7 or 9 mushrooms which mainly showed strongest effects in the same series in Table 2 were arbitrarily selected, and tests were repeated using the same method as the previous one, *i.e.*, for combinations of 3 ones. As the results of the final selection test (Nos. 14, 17, and 20 in Table 3) on the basis of intermediate selection test (Nos. 11-13, 15, 16, 18, and 19 in Table 3), it was found that *Naematoloma sublateritium* (I), *N. sublateritium* (III), and *Agaricus bisporus* were the most active for abalone, oriental weatherfish, and yellowtail, respectively. The effect of concentration of the three mushroom extracts on attraction activity was tested for corresponding animals (Fig. 1). Attraction activity of the three concentrations of each mushroom extract with the dummy were measured at a time. Attraction activities for all the three extracts increased with increasing concentration over the concentration range tested. The results of the experiments are summarized together with the organoleptic taste of the mushroom extracts in Table 4, which indicate that attractant mushrooms for all the three animals were *Albatrellus confluens*, *Tricholoma flavovirens*, and *T. matsutake*. The relationship between

Table 3. Comparison of selected mushrooms in their attraction activities for three kinds of shell-and fin-fishies

Expt. No.	Mushrooms (Species-Japanese name)	Attraction activity*
	(For abalone)	(*a*)
11	Dummy	2.5
	Naematoloma sublateritium-Kuritake (Ⅲ)	3.2
	Pleurotus ostreatus-Hiratake (Ⅰ)	5.3
	Agaricus bisporus-Tsukuritake	3.9
12	Dummy	–
	Tricholoma matsutake-Matsutake	3.5
	Pholiota nameko-Nameko (Ⅰ)	3.9
	Naematoloma sublateritium-Kuritake (Ⅰ)	3.6
13	Dummy	–
	Pleurocybella porrigens-Sugihiratake	3.1
	Sarcodon aspratus-Koutake	5.2
	Suillus bovinus-Amitake	3.3
14	Dummy	–
	Sarcodon aspratus-Koutake	3.0
	Pholiota nameko-Nameko (Ⅰ)	3.8
	Naematoloma sublateritium-Kuritake (Ⅰ)	4.0
	(For oriental weatherfish)	(*a*)
15	Dummy	1.4
	Pleurotus ostreatus-Hiratake (Ⅰ)	2.1
	Naematoloma sublateritium-Kuritake (Ⅲ)	3.0
	Lentinus edodes-Shiitake	2.6
16	Dummy	–
	Naematoloma sublateritium-Kuritake (Ⅲ)	5.1
	Suillus grevillei-Hanaiguchi (Ⅱ)	1.2
	Ramaria botrytis-Houkitake (Ⅱ)	1.7
17	Dummy	–
	Naematoloma sublateritium-Kuritake (Ⅲ)	3.7
	Tricholoma flavovirens-Kishimeji	3.5
	Albatrellus confluens-Ningyoutake	3.2
	(For yellowtail)	(*gr*)
18	Dummy	75.3
	Agaricus bisporus-Tsukuritake	151.5
	Tricholoma matsutake-Matsutaka	116.2
	Lyophyllum shimeji-Honshimeji	96.5
19	Dummy	50.8
	Rhodophyllus crassipes-Urabenihoteishimeji	72.6
	Polyozellus multiplex-Karasutake (Ⅰ)	61.5
	Suillus luteus-Numeriiguchi	46.8
20	Dummy	60.7
	Rhodophyllus crassipes-Urabenihoteishimeji	73.2
	Hygrophorus russula-Sakurashimeji	72.4
	Agaricus bisporus-Tsukuritake	88.5

*Legend in Table 2, – Can not continue the calculation because of the negative value of the regression coefficient of $1/Y_x$ on $1/Y_{x-1}$.

attraction and organoleptic taste was not observed.

There have been several studies on the attractive effect of constituents in food "plant" that is foreign to aquatic environments.[1-6] In the previous papers,[1-4] we have examined attraction activities of various spices, herbal drugs, fruits, and vegetables for the abalone, the oriental weatherfish, and yellowtail. Most of the samples were found to be effective to some extent for the test animals. In the present paper,

Table 4. Attraction magnitude and organoleptic taste and/or flavor of mushrooms tested

Mushrooms (Species-japanese name)	Attracton magnitude*7			Flavor, tatse, pH
	A*8	O*8	Y*8	
Agaricaceae-Haratakeka				
Agaricus bisporus-Tsukuritake	++		++	Moldy, strongly sweet, pH7.1
Boletaceae-Iguchika				
Suillus bovinus-Amitake	+		+	Moldy, slightly bitter, pH5.1
S. grevillei-Hanaiguchi (I)*1	++			Muddy, slightly sweet, pH5.5
S. grevillei-Hanaiguchi (II)*1		+	+	Odorless, slightly sweet, pH4.9
S. luteus-Numeriiguchi			++	Mushroom odor, tasteless, pH5.9
Cortinariaceae-Fuusentakeka				
Cortinarius elatior-Aburashimeji			++	Rancid oil-like odor, tasteless, pH6.1
Rozites caperata-Shougenji			+	Odorless, tasteless, pH6.3
Hygrophoraceae-Numerigasaka				
Hygrophorus russula-Sakurashimeji			++	Grassy, strongly bitter, pH5.7
Pleurotaceae-Hiratakeka				
Pleurotus ostreatus-Hirata (I)*2	++	+		Sweetish odor, slightly sweet, pH6.3
P. ostreatus-Hirataka (II)*2				Flour-like odor, slightly sweet, pH6.4
P. ostreatus-Hirataka (III)*2				Moldy, sweet, pH6.4
Polyporaceae-Takoukinka				
Albatrellus confluens-Ningyoutake	++	++	+	Sweetish odor, tasteless, pH5.9
Ramariaceae-Houkitakeka				
Ramaria botrytis-Houkitake (I)*3			+	Mushroom odor, tasteless, pH5.4
R. *botrytis*-Houkitake (II)*3		++		Muddy, watery sweet, pH5.3
Rhodophyllaceae-Ipponshimejika				
Rhodophyllus crassipes-Urabenihoteishimeji			++	Detergent odor, tasteless, pH6.1
Strophariaceae-Moegitakeka				
Naematoloma sublateritium-Kuritate (I)*4	++			Muddy, slightly sweet, pH5.4
N. sublateritium-Kuritate (II)*4				Muddy, astringent, pH5.3
N. sublateritium-Kuritate (III)*4	++	++		Moldy, tasteless, pH6.0
Pholiota nameko-Nameko (I)*5	++			Muddy, bitter and sour, pH5.6
P. nameko-Nameko (II)*5	++		++	Moldy, slightly sweet, pH6.0
Thelephoraceae-Ibotakeka				
Polyozellus multiplex-Karasutake (I)*6		+	+	Muddy, ash taste, pH5.1
P. multiplex-Karasutake (II)*6				Mushroom odor, tasteless, pH5.1
Sarcodon aspratus-Koutake	++			Mushroom odor, bitter, pH6.0
Tricholomataceae-Kishimejika				
Lentinus edodes-Shiitake		++		Sweetish odor, strongly sweet, pH6.3
Lepista nuda-Murasakishimeji				Muddy, bitter, pH6.0
Lyophyllum shimeji-Honshimeji	+		++	Heated plastic-like odor, bitter, pH6.1
Pleurocybella porrigens-Sugihratake	+		++	Mushroom odor, tasteless, pH5.7
Tricholoma flavovirens-Kishimeji	+	++	++	Mushroom odor, tasteless, pH5.2
T. matsutake-Matsutake	+	++	+	Matsutake odor, watery sweet, pH6.3
T. portentosum-Shimofurishimeji				Muddy, astringent, pH6.4

*1−*6 Product of differrent districts, *7 + : Weak, ++;Strong, *8 A : Abalone, O ; Oriental weatherfish, Y ; Yellowtail.

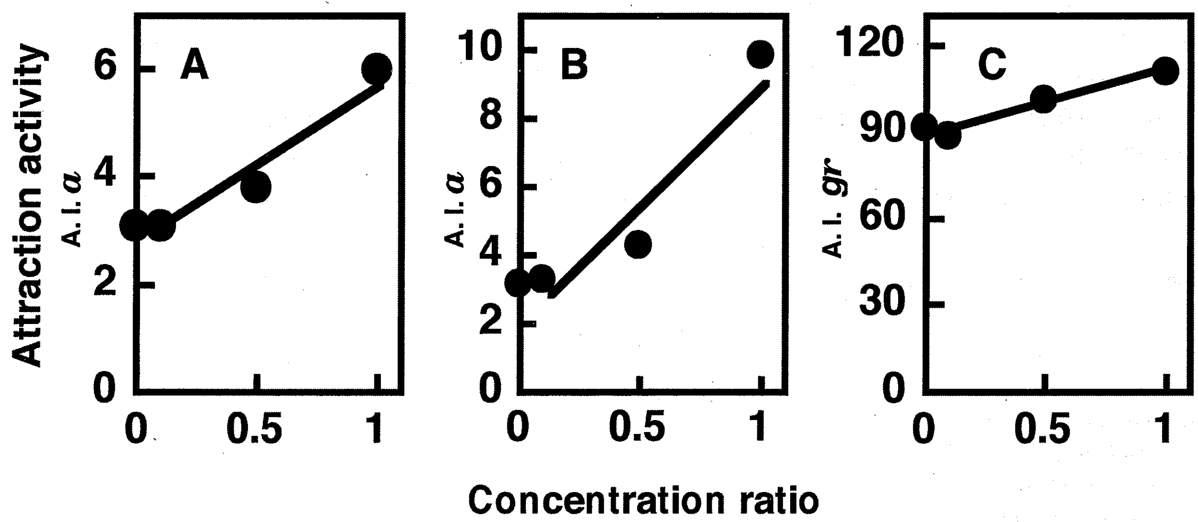

Fig. 1. Effect of concentrations on attraction activity of (A) *Naematoloma sublateritium* (I) for abalone, (B) *N. sublateritium* (Ⅲ) for oriental weatherfish, and (C) *Agaricus bisporus* for yellowtail. The attraction activity was examined for three relative concentration diluted from the original mushroom extract.

all the mushrooms tested except *Pleurotus ostreatus* (Ⅱ, Ⅲ), *Naematoloma sublateritium* (Ⅱ), *Polyozellus multiplex* (Ⅱ), *Lepista nuda*, and *Tricholoma portentosum* also showed to some extent attraction activities for more than one test animal (*cf.* Table 4). Meanwhile the attraction activity differed according to the habitat even among the same species of mushrooms. This finding reveals that the attraction effect of mushrooms is changed by substrate compositions as nutrient. In the vegetables, the attraction activity of Irish potato *Solanium tuberosum* for the oriental weatherfish and the abalone also depended on different habitats.[4] At present its reason was not pursued yet.

A kind of spice, anise *Pimpinella anis* attracted and stimulated rainbow trout *Salmo gairdneri.*[10] Furthermore, a kind of vegetable, lettuce *Lactuca sativa* var. *longifolia* stimulated herbivorous fish *Tilapia zillii,*[11, 12] snail *Australorbis glabratus*[13], and pond snail *Lymnaea stagnalis.*[14] From these results, it is fully possible that the organisms which are not distributed in aquatic environment contain effective constituents as feeding attractants or stimulants for the shell- and fin-fishes. In fact, stevioside from a kind of herbal drug, stevia *Stevia rebaudiana* attracted remarkably the three kinds of aquatic animals.[5] Similarly β-elemene from a kind of spice, allspice *Pimenta officinalis* attracted strongly the abalone.[6] These two compounds are not reported so far as aquatic animal attractants and furthermore a new novel attractants may also be detected from these attractive plant foods.

Certain mushroom contains a large amount of various amino acids[15] and nucleic acid related compounds such as adenosine monophosphate (AMP) and guanosine monophosphate (GMP) and so on.[16] Any of these compounds may be involved in the feeding attraction.

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水産動物に対するきのこの誘引活性

宮崎泰幸・原田勝彦

クロアワビ，ドジョウおよびブリに対するきのこ水抽出液の誘引活性を行動学的に求めた。その結果，22種30検体のうちクロアワビでは14検体，ドジョウでは9検体とブリでは16検体に誘引活性が認められた。3試験動物に共通して認められたキノコはキシメジ，ニンギョウタケおよびマツタケであったのに対して，まったく認められなかったのはカラスタケ（Ⅰ），クリタケ（Ⅱ），シモフリシメジおよびヒラタケ（Ⅱ）であった。特に強い誘引活性を示したきのこは，クロアワビでクリタケ（Ⅰ），ドジョウでクリタケ（Ⅲ）そしてブリでツクリタケであった。