



Biological Studies on the Japanese Bees (II) : Study on the Nesting Behaviour of *Bombus ardens* SMITH

Taniguchi, Setsu

(Citation)

兵庫農科大学研究報告. 農学編, 2(1):89-96

(Issue Date)

1955-12

(Resource Type)

departmental bulletin paper

(Version)

Version of Record

(JaLCOI)

<https://doi.org/10.24546/81006500>

(URL)

<https://hdl.handle.net/20.500.14094/81006500>



BIOLOGICAL STUDIES ON THE JAPANESE BEES. II.

Study on the Nesting Behaviour of *Bombus ardens* SMITH

Setsu TANIGUCHI

INTRODUCTION

Bombus ardens SMITH is an interesting species which appears only from the beginning of spring to the beginning of summer in Sasayama. The queen appears early in April, the workers in May, and new females and males in June. Their nesting life ends early in July.

My observations were made from June 15 to July 4 on the nest discovered by Dr. Iwata, at Okano, Province of Tamba. In this article, I concerned mostly on the behaviours of foragers, especially on their returns to the nest. Some workers were marked with water colors on the abdomen or thorax to distinguish individually. The times of foraging trips and the types of load-collection in these marked individuals were accurately observed. The behaviours of the new females were also observed. Further, the brief accounts of the general characters of this species are added from the field data since 1952. The nest was dug out on July 6, but as it contained many doubtful features, its data were omitted here.

Before going further, it is my pleasant duty to express my sincere appreciation to Dr. K. Iwata, for his constant kindness and helpful guidance. I am indebted to Messrs. Iwata, T. Okutani and E. Fujita for their helps in digging nest. My hearty thanks are also due to Okutani for photographing.

I. THE BEHAVIOURS OF FORAGERS

1). The time of beginning and end of foraging trip.

In the former half period of my observation on June 18, at 4:55 in the morning it was very quiet in the nest, suddenly the first forager departed the nest at 5:00 and was followed by 3 foragers. At that time buzzing was heard in the nest and it became more and more large in union, lasting till 5:15. From 5:00 to 5:13, 10 foragers went out. At 5:14 one forager returned. After that the numbers of departure and return in every 30 min. became almost equal. In the later half period of my observation on June 25, the first forager departed the nest at 4:43, being followed by 3 foragers up to 5:00. During from 5:00 to 5:30, 4 departed and 2 returned, and from 5:30 to 6:00, 9 departed and 6 returned. After 6:00 both numbers of departure and return, in every 30

min. became almost equal. As for the end time of foraging, it was observed on June 18 that the times of departure and return of the last forager were 19:05 and 19:10 respectively. From 19:00 it became so dark that an electric torch was necessary to recognize the color marking. After the last forager returned, buzzing in union lasted for a time up to 19:30 when the nest fell in deep silence. On June 25, the last departure was 18:51 and the last return 19:14. From other observation records, it was considered that the foraging trips were made during from 5:00 up to 19:30. The temperature at the time of departure of the first forager was 19.6°C and 21.2°C on June 18 and 25 respectively, and at the end time of foraging it was 21.3°C and 22.0°C. It was fairly so dark at both terminal times of the foraging to recognize the nest entrance.

2) The behaviour in departure and return.

When departing the nest almost all the new females made a long orientation flight, but in foragers only few did it. On June 18 and 25, about several hundred foragers flew away very quickly from the nest entrance without orientation flight, except only two individuals.

In further observations of early days, it was found frequently that a returning forager did not enter the nest soon but after a short loitering about the nest entrance went away again. This disorientation seems to be due to the change of the circumstances near the entrance, no matter how small it is.

3) The density variation of foraging trips in a day time.

Many continuous observations on departure and return of foragers were recorded from June 15 to 25 as shown in Table 1. After June 25, only new females were observed in activity, but not a single forager. On two series of observations throughout the daylong on June 18 and on June 25 together with other days' fragmental records, the following considerations were made. In Fig. 1, the number of returns of foragers in every 30 min. on June 18 and 25 are plotted. Here the number is called density. On June 18, 720 returns from foraging trips were timed. It was almost cloudy or frequently rained and became fine only a short time in the afternoon. On June 25, 134 returns were timed. It was fine weather this day. From Fig.

Table 1. The observation hours on foragers.

Day	Time
15-VI	9 : 35 ~ 11 : 10
	13 : 35 ~ 15 : 20
16-VI	14 : 00 ~ 17 : 00
17-VI	10 : 00 ~ 11 : 45
	18 : 25 ~ 18 : 40
18-VI	4 : 55 ~ 19 : 30
20-VI	11 : 10 ~ 12 : 40
	16 : 00 ~ 18 : 35
22-VI	10 : 10 ~ 12 : 20
	13 : 40 ~ 19 : 40
23-VI	10 : 10 ~ 11 : 00
	13 : 20 ~ 15 : 40
	18 : 00 ~ 18 : 40
24-VI	15 : 10 ~ 17 : 30
25-VI	4 : 35 ~ 19 : 50

1 the following inferences may be deduced. First, on June 18, the return density increased largely from about 17:30 and attained maximum at about 18:00. Moreover the departure density also increased very much at that time. Second, during from 13:00 to 14:00 the return density showed a slight decrease, and the departure density also decreased. The number of returns in fore- and afternoon of this day were 271 and 449 respectively, showing a striking increase in the afternoon. In contrast to such a tendency of June 18, on June 25 the maximum density appeared at the time between 7:00 and 8:00, and after about 10:30 the return density decreased monotonously showing no trace of increase such as the case of June 18. The number of returns in fore- and afternoon of June 25 were 94 and 40 respectively, indicating decrease in the afternoon in opposition to the case of June 18. Comparing with other day's records, it may be considered that two different features are not merely accidental but shows two different phases of the process of nidification : in other words, from the beginning of my observation up to June 20 the density curves showed a tendency alike to the curve of June 18 which gave a great maximum of the return density at about 17:30, but after June 22 on they lowered down their maximum values gradually and get nearer the curve of June 25. The more interpretation of this phenomenon shall be made in the following chapters.

By the way in the former half period of my observations, it rained frequently, but the foraging trip

was not prevented by ordinary rain, although in heavy rain it was stopped for a time.

4). The behaviours of marked foragers.

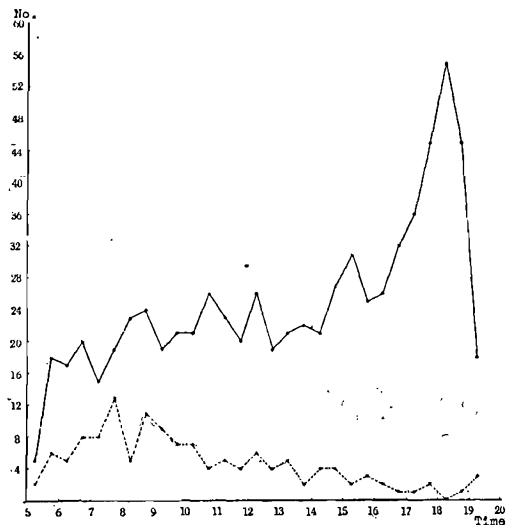
Foraging trips were observed and studied in detail by marked individuals as follows.

a) The foraging period.

The time between two successive returns of an individual, i.e. the time during from an return to the next return which contains the time spent in the nest and the time for one foraging trip, is called here a foraging period and discussed on the basis of the following data. The reason for using the return time but not the departing time as initial and final point is as follows : the foragers flew away often very quickly when departing, so there was a fear of mistaking the marks. In Fig. 2 is shown the variation of foraging period of marked individuals on June 18, a nectar-collector *G*, and pollen-collectors *D* and *F*. (*G*, *D*, *F*, etc. show marked individuals.) Marked foragers *A*, *B*, *C*, *D* and *E* were mainly pollen-collectors, and their foraging periods were longer during from 13:00 to 14:00 than in other times. A pollen-collector *F* collected nectar and not pollen in this time. The forager which returned without pollen-load was assumed as a nectar-collector. The times when the foraging period was prolonged were indicated as follows : *A* 13:25, *B* 13:10, *C* 13:40, *D* 13:10, *E* 13:20, and *F* 13:25. As for a nectar collector *G*, the change in the foraging period was scarcely found at about this time. If these were not facts accidentally occurred only in marked foragers, the return density at about this time should show a slight decrease. This is in fact the case which is seen in Fig. 1 : the return density decreases slightly during 13:00 to 14:00.

Fig. 1. The variation of the number of returning foragers in every 30 min..

Full line : June 18, dotted : June 25.



The causes of this fact may be weather conditions : the latter affect the behaviour of visiting flower of foragers indirectly through their influence on the pollen production of flowers. Temperature, humidity and cloudiness during 13:00~14:00 were compared with those of the other times as follows. The temperature during 5:00~12:15 was 19.2~22.7°C, but from 12:35 it began to rise gradually, at 13:00 rose rapidly to 26°C, the maximum temperature of this day, at 14:30 fell to 23°C and from 15:00 to 19:00 it kept 23~21.3°C. The relative humidity was 95~100% throughout the day, but it fell to 81% at 13:00~14:00. The cloudiness was 10 throughout the day, but only at 13:00~14:00 it changed into 9, 6, 7. Thus the change of weather conditions that occurred suddenly only at this time seems to be the causes of prolongation of their foraging trip. A. D. BRIAN ('52)* also observed that the load is collected faster by *Bombus agrorum* in damp weather than in dry. Here it is necessary to be noted that the indoor time between a return and the next departure is not changed in practice by weather conditions and that the prolongation of the foraging period corresponds to that of the foraging trip.

b) *The difference in the foraging periods of pollen- and nectar-collectors.*

A remarkable difference was observed in the foraging period between marked pollen- and nectar-collectors. A nectar-collector G required about 10 min. always for each foraging period, while pollen-collectors A, B, C, D, E and F required considerably longer period, more than 30 min., in the case of pollen-load collection than of only nectar. Moreover, the periods for pollen-collection somewhat varies in wide range according to time.

In Fig. 3 is shown the frequency distribution of the foraging periods with and without pollen load of the marked foragers during from June 16 to June 25. The foraging periods for pollen were in most cases 15~25 min., while the most periods only for nectar were 5~10 min.. The average time of foraging periods for pollen was 37.9 min., and that for nectar only 20.5 min..

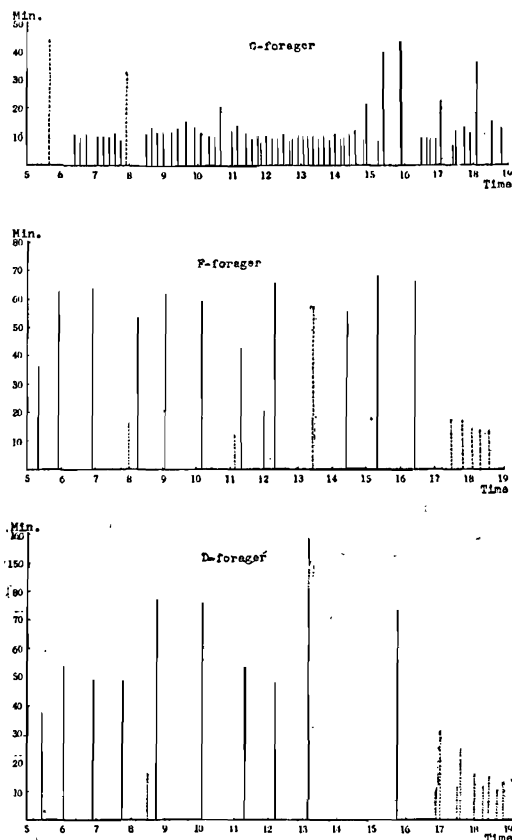
According to Fig. 2, there is a considerable variation with individuals in the foraging period even for the same type of load, so it has little meaning to average these periods. As mentioned above, the time of foraging period of a nectar-collector was kept on about 10 min. throughout a day while another took of considerably wide range. In general the foraging periods for nectar, however, are more uniform in length than those for pollen.

c) *The sojourn period.*

The time from return to departure, that is, the

Fig. 2. The variation of foraging periods on June 18.

G : mainly nectar collector,
F and D : mainly pollen collector,
dotted lines in G : the cases of pollen-collection,
in F and D : cases of nectar collection



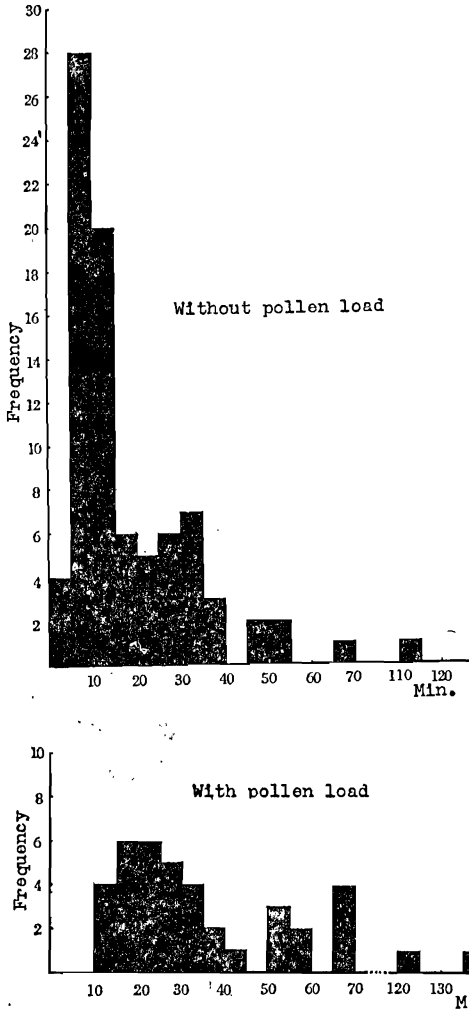
time spent by a returning forager in the nest is called here a sojourn period. This period varies according to their load types. The frequency distribution of the sojourn periods of pollen- and nectar-collectors timed in marked foragers is shown in Fig. 4. In this figure, it may be seen that the sojourn period of nectar-collectors is mostly 2~4 min. and of pollen-collectors 5~7 min.. It is also indicated that the variation of this period is smaller in nectar-collector than in pollen-collector. In the latter, the sojourn period ranged widely and in one case it was 46 min. long. The average values of this time were 14.1 min. and 6 min. for pollen-collectors and nectar-collectors respectively. These values are, however, not so meaningful because of the same reason as in the case of foraging period.

d) *The variation of the type of load-collection.*

There were two types of foragers with regards to the manner of load-collection : the one collected

* J. Anim. Ecol. 21, 223-240 ('52)

Fig. 3. The frequency distribution of the foraging periods.

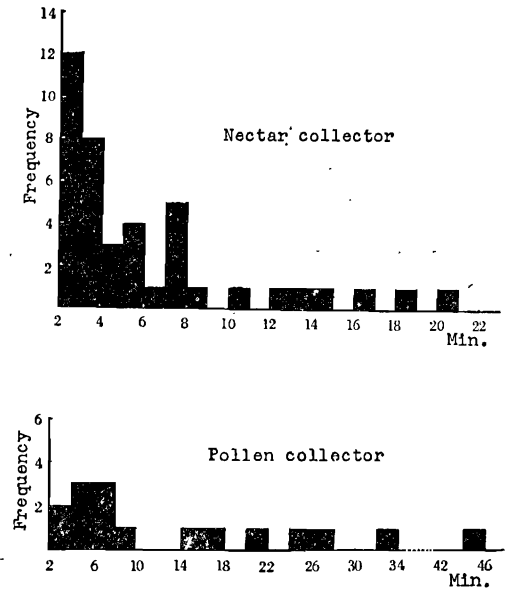


consistently only pollen (or only nectar), the other collected either pollen or nectar from time to time irregularly.

d 1. Change of pollen-collector to nectar-collector.

As seen in Fig. 2, in the evening all pollen-collectors changed to nectar-collectors and coincidentally reduced the time of foraging trip. Every individual of various foraging period became to have uniform period with her change into nectar-collector. Observations on June 18 represented partly in Fig. 2 may indicate that the marked foragers changed their load type at 17:30~18:00. As the result, the number of trips became large. It follows then that the foraging density should increase at this changing time. In fact, the variation of foraging density on June 18 (see Fig. 1) showed rapid increase at 17:30~18:00, and it reached maximum at 18:00~18:30. On the other hand, the ratio of returning foragers with pollen to the total

Fig. 4. The frequency distribution of the sojourn period.



returns decreased rapidly at 17:30~18:00, which may be accounted by the change from pollen- to nectar-collector at that time. The activity of foragers before or after this changing time is shown in Table. 2.

Table. 2. The activity of foragers at the time of load change on June 18.

TR : total No. of return,

PR : No. of return of pollen collectors.

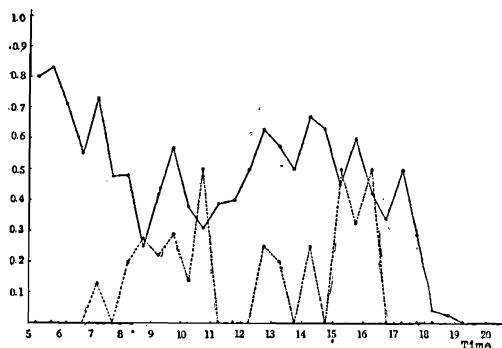
Time	TR	PR	PR/TR
17:00~17:30	36	18	0.50
17:30~18:00	45	13	0.29
18:00~18:30	55	2	0.04
18:30~19:00	45	1	0.02
19:00~19:30	18	0	0

d 2. Transition of pollen-collection in the course of a day.

The ratio of the returning pollen-collectors to the total returning foragers in every 30 min. is considered here. Fig. 5 shows the variation of this ratio in the daytime of June 18 and June 25. On June 18, the value reached maximum soon after start of foraging, at 7:00~8:00 and 14:00~16:00 increased comparably, and after 17:00 decreased down rapidly. On June 25, on the other hand, no pollen-collector was observed during from start of foraging up to 7:00 and maximum value appeared two times at 10:00~11:00 and 15:00~17:00. After 17:00 also no pollen-collector was observed. These curves do not show any resemblance at all.

Fig. 5. The variation of the number of pollen-collectors (ratio of returns of pollen collectors to the total returns per 30 min.)

Full line : June 18, dotted : June 25.



d 3. Decrease of pollen-collectors in the later period.

Till June 22, the time of rapid decrease of the number of pollen-collectors was 18:00, but after then this time was 16:30. As for the weather it was cloudy and often rainy till June 22, but it became fine on and after June 23. As above-mentioned and also shown in Fig. 5, the load change from pollen to nectar was found at 16:30 on June 24 and 25 as on June 18. But the rate of the rapid increase of the total returning foragers caused by load change was small in the later period of my observation, decreased day by day and eventually disappeared in June 25 (see Fig. 1) This may be interpreted as follows. The total foragers were 720 and 134 on June 18 and June 25 respectively, that is, the number on June 25 was 1/5.4 of that on June 18. At the same time the percentage of pollen-collectors to total foragers became smaller as mentioned below. Accordingly, the load change from pollen to nectar in the evening, as the number was small, could not affect so much the foraging density at that time.

The percentage of pollen-collectors to total foragers may be indicated roughly by the ratio of returning pollen-collectors to the total returning foragers throughout a day except that of the time of load change. This ratio is 0.49 and 0.14 on June 18 and June 25 respectively, which shows the decrease of pollen-collectors on June 25. The decrease of the total foragers and pollen-collectors should probably suggest the end stage of the nest.

It is interesting that three foragers were observed to go out with pollen-load in the morning of June 25, which seems to be due to diminution of need for pollen in the nest, showing the last days of the nest.

d 4. Load change in the last days.

A forager *F* marked on June 16 worked as a pollen-collector up to June 21, but she collected pollen and nectar alternately on the morning of 22nd and

only nectar on that afternoon. Later she collected only nectar and finally disappeared on June 25. Other marked foragers *A*, *B*, *C* etc. also showed the same tendency, and the former pollen-collectors changed into nectar-collectors in a few days before they disappeared. In this manner, if a new forager is not produced more, the pollen-collectors may decrease day by day.

5). The pollen-load

The kinds of pollens brought back by foragers on June 18 were recorded according to their colors. From my previous field notes on this species, it is clear that a forager has a tendency to visit only a species of flower through a single trip. Accordingly it is natural that a pollen load is tinged with a single color probably gathered from the same kind of flower. Each 296 pollen-load observed on June 18 were monochrom except for one case consisted of two colored pollens.

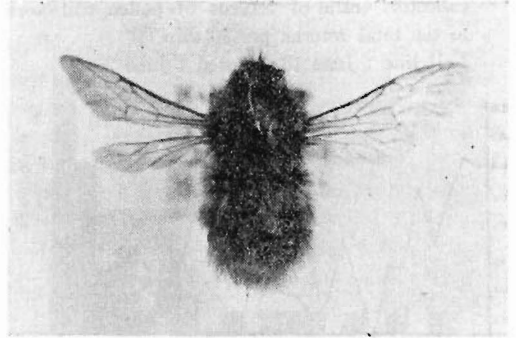
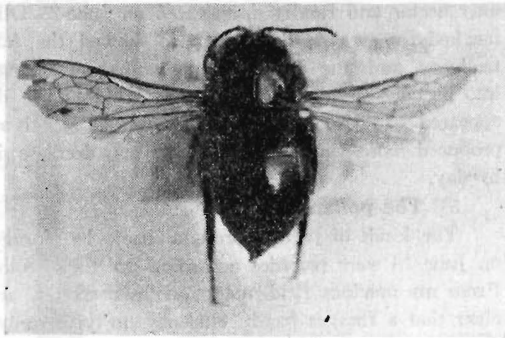
Five colors of pollen-load were distinguished clearly; bright yellow (*b*), dark yellow (*d*), orange (*o*), whitish yellow (*w*) and light blue (*l*). They were collected not at the same time; *b*-pollen was observed exclusively at 5:00~7:00 except only once *l*, *d* by 7:30 and by 8:30 *o*-pollen was observed. In such manner the kinds of pollen increased with the lapse of time, and after 11:30 *b*-, *d*-, *o*- and *w*-pollens were found brought back till 17:30. Three kinds of pollens *b*, *d* and *o* were collected till 18:00 that is the time of load change, but *l* was stopped to collect by 14:00. Among these 5 kinds of pollens, *b* was most plentiful amounting to 40% of total load. The percentage of *d*-, *w*-, *o*- and *l*-load to total load were 25%, 23%, 11% and 1% respectively.

From observations on marked pollen-collectors, it was known that, although their kind and quantity varies in every individual, every forager brings 3 or 4 kinds, not collected at random but transitly with the lapse of time. For example, *F*-forager collected only *b*-pollen in her early foraging, only *w*-pollen after 9:00 and only *o*-pollen after 12:30 up to the time of load change. *o*- and *w*-pollen loads were equally collected in toto. The order of collection of pollen were *b*→*w*→*o* in *F*-forager, *b*→*l*→*w* in *A* and *l*→*b*→*c*→*w* in *C*.

6). The last days of workers

As time went on, depilation on thorax of foragers became more and more conspicuous. In the evening of June 20, a worker with no hair on thorax and few on abdomen, staggered out of the nest. She could scarcely fly and disappeared in the bush near the nest. The outer margin of her wings was wore seriously. (Fig. 6) Since then, in every evening, such depilated foragers came out and wandered, not on the wing, away in the bush.

On June 25, the half of foragers were depilated ones, which made only low flights of short interval

Fig. 6. A depilated worker in her last days (left) and a normal worker (right).

and after a little loitering on the near bush started for foraging trip.

II. THE BEHAVIOURS OF NEW FEMALES

D). The active time in the field.

New females were seen during a half month of my observation from June 16 to July 2. After extinction of worker on July 3, no new female was observed, except a new female found only once returning on the afternoon of July 6. On June 18 in the former period of observation, a new female left the nest for trip firstly at 5:58, and at 6:37 the followers began to start for trip. The number of departures and returns in every 30 min. in this early morning are shown in Table 3 in comparison with that of foragers. On June 25 in the later half period of observation, first departure of new female I observed was at 5:30, while that of forager was 4:42, although 3 new females returned at 4:38. It was not clear

whether these three had departed earlier in the dawn or had spent night out of the nest. The number of trips early in the morning of June 25 similar to that of June 18, are shown in Table 4.

As for the close of trips on June 18, the last departure and return of new females were at 17:46 and 18:36 respectively; while those of foragers on that day were at 18:05 and 18:10; that is, the new female ends her trip a little earlier than the forager. The numbers of trips near sunset are shown in Table 5. On June 25 the last departure and return of new females were at 19:21 and 19:28 respectively, while those of foragers at 18:51 and 19:14. In contrast to June 18, new females made longer field-work than foragers. The activity near sunset similar to Table 5 is shown in Table 6.

Table 3. The activity about the starting time of trip on June 18.

Time	Foragers		New females	
	Depart	Return	Depart	Return
5:00~5:30	19	5	0	0
5:30~6:00	18	18	1	0
6:00~6:30	18	17	0	1
6:30~7:00	21	20	13	6

Table 4. The activity about the starting time of trip on June 25.

Time	Foragers		New females	
	Depart	Return	Depart	Return
4:35~5:30	3	0	0	1
5:00~5:30	4	2	0	0
5:30~6:00	9	6	1	3

Table 5. The activity about the ending time of trip on June 18.

Time	Foragers		New females	
	Depart	Return	Depart	Return
17:00~17:30	37	36	3	5
17:30~18:00	43	45	1	4
18:00~18:30	51	55	0	1
18:30~19:00	44	45	0	2
19:00~19:30	4	18	0	0

Table 6. The activity about the ending time of trip on June 25.

Time	Foragers		New females	
	Depart	Return	Depart	Return
17:00~17:30	3	1	1	2
17:30~18:00	1	2	3	1
18:30~18:30	1	0	2	2
18:30~19:00	1	1	3	2
19:00~19:30	0	3	2	3

As stated above, the times of beginning and ending of trip of the new females are opposed to those of the foragers on June 18 and 25; namely, on June 18, new females began trip later and ended earlier than foragers, while on June 25, new females began earlier and ended later than foragers. On the other hand, while the total number of trips of foragers on June 25 decreased considerably than those of June 18, those of new females were kept almost constant for both days. All these facts seems to show the ruin process of the nest.

2). The behaviour in departure and return.

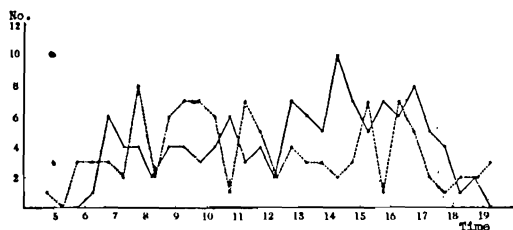
In the former period of observation, all new females who departed for trip made very carefully an orientation flight. At the first starting on June 18, almost all new females came backward out of the entrance and made an orientation flight. In one case, they flew slowly at low altitude their heads towards the nest, gradually rising up, enlarging the circles in the sky and flew away, while in another case they flew several times from one side to side against the nest and flew away. After 15:00 in the afternoon, almost all new females came out the entrance directing their head forward, and flew straight to their destinations without orientation flight. In such cases, when returned, they did not loiter about but entered straight into the nest. On June 25 in later period of observation, although with few exceptions, they flew out directly and entered into the nest without hesitation. In the evening, their action became more and more quick in general.

3). The density variation of trips in a day time.

In parallel to that of foragers, the time of departure and return of new females was recorded in succession. The observations in the day time of June 18 and 25 are illustrated in Fig. 7. In these figures the

Fig. 7. The variation of the number of returning new females in every 30 min.

Full line : June 18, dotted : June 25.



number of returning new females in every 30 min., which are similar to those of foragers, are illustrated. The total number of returns were 120 and 108 on June 18 and 25 respectively. There was not a considerable difference in these two days as in the case of foragers. The total number may be divided into

two parts according to the fore- and afternoon. They were 45 and 75 on June 18, and 60 and 47 on June 25. In the two the activity in the fore- and afternoon was opposed. In the curve of June 18 (Fig. 7) a remarkable peak is not found as in the case of foragers. A small maximum value is seen at 14:00~15:00 and there are some low peaks in the afternoon, but the curve shows no resemblance with foragers. On June 25, the maximum peak occurs at 7:30~8:00 and many low peaks distribute in the forenoon except that of 15:00~17:00.

It is unreasonable to expect the meaning in the increase of number of trips and the regularity of the latter, because object of their trip differ from that of foragers in principle.

The weather change of June 18 affected foragers sensibly, while new females showed no response to it. Only in heavy rain, their trip was stopped for a time.

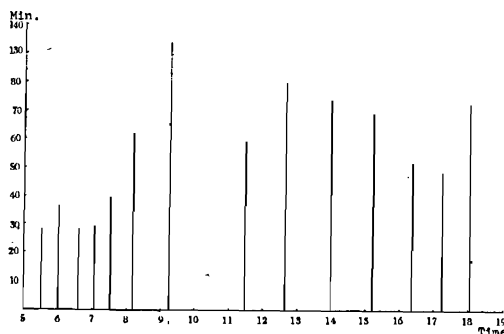
4). The trip of a marked new female

As only one marked new female was observed for a long period of time, it is difficult to deduce general conclusions on the trip. The new female in question was marked with white color on the afternoon of June 23, and observed till July 2.

a) The trip period.

As in the case of foragers, the time from one return to the next return is called trip period here. The trip periods of the present new female on June 25 varied from 14.5 min. to 133.7 min. and the variation is shown in Fig. 8. Generally speaking, the trip

Fig. 8. The variation of trip periods of a marked new female on June 25.



periods so long as 30 min. were observed till about 8:00 in the forenoon, from then 50 min. or longer period occurred randomly. The trip periods in other days varied also between 40 and 90 min.. The frequency of each trip period recorded during from June 25 to July 1 shows its wide range as shown in Table 7.

b) The time between a return and the following departure.

Most of the times between return and departure were 4~11 min. in the data of June 25. In rare

Table 7. The frequency of trip periods of a marked new female.

Min.	Frequency	Min.	Frequency
10 ~ 20	1	60 ~ 70	3
20 ~ 30	3	70 ~ 80	3
30 ~ 40	2	80 ~ 90	1
40 ~ 50	2	90 ~ 130	0
50 ~ 60	1	130 ~ 140	1

cases, 48 and 100 min. of this time appeared each once. Their frequency recorded from June 25 to July 1 are shown in Table 8. In contrast to the trip periods with wide range, the times spent in the nest show no change.

Table 8. The frequency of the times spent in the nest by a marked new female.

Min.	Frequency	Min.	Frequency
0 ~ 10	6	40 ~ 50	1
10 ~ 20	4	50 ~ 60	0
20 ~ 30	0	60 ~ 100	0
30 ~ 70	0	100 ~ 110	1

5). The last days' activity of new females afield.

In general, the trip periods of new female became longer after June 27 and consequently the number of their trips decreased. The total number of departure and return during from 10:00 to 12:30 were 20 and 18 respectively on July 1, and 7 and 6 on July 2. Both these days, it was fine and weather conditions were alike. On July 3, it was also fine, but no new female appeared during from 9:00 to 11:30. On July 4, cloudy with frequent rain, also no new female appeared.

It is the question left unsolved how these new females tide over the following summer and winter.

6). The males and the copulation of new females.

On the basis of my field data since 1952, the present observation was in the season of appearance of the male *ardens* in this district and Dr. Iwata found many males visiting flowers of *Callicarpa japonica* THUNB. at the valley far apart from the nest in question. Notwithstanding I could not find even a single male among 2019 bodies that went out and entered into the nest through a half month's observation. Judging from this fact the male seems not to have been produced in this nest by some unknown reasons. I found a male only once at 11:45 on June 18, which entered into the nest in question being taken by a new female in copulation. But this male departed

the nest alone after 16 min. at 11:59, suggesting that he had not been produced in this nest.

III. THE FLOWERS VISITED BY *ARDENS*

The flowers visited by the present species have been observed as follows since 1952 at Sasayama and its suburbs. The workers visit flowers actively during 2 months from the middle of May to the middle of June. They were mainly those of Rosaceae (*Rosa multiflora* THUNB., *Rubus morifolius* SIEB., *Rubus parvifolius* L.) Leguminosae (*Trifolium repens* L., *Astragalus sinicus* L.) Caprifoliaceae (*Weigela coraeensis* THUNB., *Abelia serrata* SIEB. et ZUCC., *Weigela nikkoensis* MAKINO.), Ericaceae (*Rhododendron* 5 spp.) and Styracaceae (*Styrax japonica* SIEB. et ZUCC.).

This year, before the nest was discovered, many workers were found visiting on *Rosa multiflora* THUNB. and the above-mentioned flowers. Through my present observations many workers from the nest were found visiting *Rhododendron* sp., *Sapium japonicum* PAX et K. HOFFM. standing about 500~700 m. apart from the nest. Many flowers of *Houttuynia cordata* THUNB. were found near the nest, but no workers visited them although only few new females of this nest were found visiting. Many flowers of *Hosta* sp. (*undulata* BAILEY ?) were found around the nest and frequently visited by *Bombus diversus*, but not by *B. ardens*. A few new females of this nest were observed trying to suck nectar from *Hosta* flowers on June 25, but she failed, clearly due to her short tongue. *Cirsium japonicum* D. C., *Prunella vulgaris* L., and *Vicia unijuga* AL. BR. were also growing near the nest and visited by *B. diversus*, but never visited by the workers of this nest.

This species has a glossa of medium size, while *B. diversus* has the longest glossa (S. TANIGUCHI, '54)*. Consequently the flowers with long corolla-tube such as *Hosta*-flower may be preferably visited by the latter, but may exclude the former. Thus even though these two *Bombus* appear in the same season, *B. ardens* may be confined to narrower range of honey source than *B. diversus*.

As a single parasitoid of *B. ardens*, I found *Mutilla europaea micado* CAMERON. Only 6 females were collected in or near the nest entrance from June 22 to July 2. Four of them were dissected and were observed retaining several fullgrown egg in their ovaries. The life economy of this parasitoid was studied in detail by Mr. T. Shida in Tokyo.

(Entomological Laboratory, Received Aug. 25, 1955)

* Sc. Rep. Hyogo Univ. Agric., vol. 1, No. 2, (Series : Agric.) 81-89. ('54)