Behaviour of Ants Observed using different techniques

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February 27, 2024

Contents

§1 Aim

1. To identify all individuals uniquely using their color codes

2. To quantify the proportion of active/inactive individuals using scan sampling

3. To quantify the work-load of leaders during tandem-run using focal sampling

§2 Theory

We are undertaking the project of observing behavioural observations of ants *Diacamma Indicum*. *Dicamma Indicum* is type of ant found in India, Sri Lanka and Japan. We define **behaviour** as an action or a series of actions exhibited by an organism in response to a particular environment or a change. In this experiment we observe Tandem running. **Tandem Run** is pairwise coordinated movement observed in ants and termites. Ants use tandem runs for social learning. An ant leads another native ant from the nest to the new source it has found. A tandem run consists of a leader and a follower. The follower ant maintains contact with the leader ant by frequently touching the leader's legs and abdomen with its antennae.

§3 Methods

Behavioural sampling can be done in multiple ways namely,

- **Ad Libitum** We note whatever is visible at a certain time. The data is not taken systematically.

- **Scan Sampling** Here we break the entire time interval of observations into smaller timeframes. In each timeframe we observe the activity of individuals.

- **Focal Sampling** Here we focus on a certain indivual or unit or a certain behaviour. We can have focal animal samling where a particular individual is fcused on during the whoe observation time to see its behaviour. We also hav focal behaviour sampling where we observe a certain behaviour of the individuals throughout the observation time.

First we will go through the whole video to identify all the ants uniquely using their given color codes. This is done ad libitum, as we watch through the whole video. For this experiment, we have a video of 41 mins and 19 seconds. We will use scan sampling to see what the ants are doing at intervals of 3 mins, so around 13-14 samplings. We will record using scan sampling the activity of the ants i.e. if they are running or stationary during the scan samples and where they are located namely in the nest, around the door to the nest or on the track. We will then use focus sampling to identify tandem runs and their frequency corresponding to the ants. Then we will see if those ants have heavy or light workload, as per the average number tandem runs as the threshold.

§3.1 Coloring

The ants are coloured in three places, the head, the thorax and the abdomen. If any one of these three is uncolored, we put a blank(-) there. The colors are y for yellow, b for blue, r for red and w for white. For example if we write 'y-b', we mean yellow on the head, no paint on the thorax, and blue on the abdomen.

§3.2 Scan sampling

We will identify what the ants are doing using scan sampling. We break the video in 3min chunks and then identify what the ants are doing. They are classified into active vs inactive ants. We move 1 second back and front. If they are not moving in that time interval, they will be classified

as inactive. Otherwise they will be classified as active. They are then classified based on location, on whether they are on the track, near the nest door, or inside the nest.

§4 Observations

§4.1 List of Unique ants

We observed the entire video and noted all ants we saw(ad libitum) throughout the video. Then the total ants are run through a python program to select all the unique ones. We obtain a total of **34 unique individuals**. Some colours were not properly visible and unclear individuals were noted twice throughtout the video. Along with the **34 unique individuals**, we also have **2 unclear instances** of ants. So we have atleast **35 unique individuals**.

Sl No.	Unique individuals
1	y-y
2	b-y
3	-y-
4	yww
5	-yy
6	wy-
7	w-w
8	-wy
9	by-
10	--y
11	-yb
12	-ww
13	yyw
14	--r
15	yy-
16	yw-
17	wyy
18	-bb
19	-yw
20	wwy
21	ww-
22	w--
23	-w-
24	w-y
25	www
26	--b
27	-wr
28	--w
29	y-w
30	yyy
31	wyw
32	yyb
33	y-b

§4.2 Scan Sampling

We classify scan sampled ants into active or inactive ants. The way we classify ants into active and inactive ants have been detailed out in the Methods. We also identify where the ants are present while taking the scans. The locations are labelled into **1. Track 2. Near the nest door 3. In the nest**. We also take some special behaviours into concern while taking scans.

| Sl no	Time(in min)	Individual	Active/Inactive	Location	Special Behaviour
1	0	No ant	-	-	-
2	3	No ant	-	-	-
3	6	No ant	-	-	-
4	9	No ant	-	-	-
5	12	y-w	Active	Inside the Nest	Minimal movement in the nest
6	15	wwy	Inactive	Inside the Nest	-
7	18	No ant	-	-	-
8		-yy	Inactive	On Track	Very restricted movement
9		wwy	Inactive	On Track	-
10	21	-wy	Active	Nest Door	Entering the nest door
11		-y-	Active	Nest Door	Entering the nest door carrying an egg
12		Unclear	Inactive	Nest Door	-
13		y-w	Active	On track	Leader of a tandem run
14	24	-yb	Active	On track	Follower of the tandem run
15		Unclear	Active	Nest Door	Moving around the nest door
16		-yw	Active	Nest Door	Coming out of the nest
17	27	ww-	Inactive	Inside the Nest	-
18		b-y	Inactive	Inside the Nest	-
19	30	yww	Inactive	Nest Door	-
20		-yw	Active	On track	Moving away from the nest
21		-yy	Inactive	Nest Door	-
22	33	-w-	Active	Nest Door	Entering the nest
23		Unclear	Active	Track	Moving towards the nest
24	36	-yw	Active	Nest Door	Entering the nest door
25		yww	Active	Inside the Nest	Moving around inside the nest
26		www	Active	Inside the Nest	-
27	39	-yw	Inactive	Nest Door	Very restricted movement
28		-w-	Inactive	Nest Door	-
29		wwy	Active	Track	Very restricted movement towards the nest door
30	41	-y-	Inactive	Inside the Nest	-

§4.3 Tandem Runs

Here is a list of all tandem runs observed throughout the whole video.

| Sl No.	Leader	Follower	Comments
1	y-w	y-b	
2	y-w	wwy	
3	y-w	–y	
4	-wy	wy-	
5	wwy	Unclear	
6	-yw	wy-	
7	y-w	www	
8	w-y	y-y	
9	wwy	-yw	
10	-wy	-y-	
11	y-w	Unclear	
12	www	-yb	One single tandem runs with three ants
	www	-wy	
13	y-w	wyw	
14	www	ww-	
15	wwy	-bb	
16	y-w	-ww	
17	-wy	yyy	
	y-w	wy-	
18	wy-	www	Part of one tandem run with 4 ants
	www	-bb	
19	y-w	–b	
20	wwy	yyb	
21	-wy	w-w	
22	y-w	-yb	
23	www	–y	
24	wwy	–r	
25	yw-	w—	
26	www	b-y	
27	y-w	w-y	
28	wwy	–b	
29	-wy	wyy	
30	wwy	yw-	
31	y-w	-w-	
32	-wy	yyw	
33	www	by-	
34	yw-	yww	
35	-w-	y-b	
36	w-w	y-b	

§5 Results

§5.1 Workload of Leaders
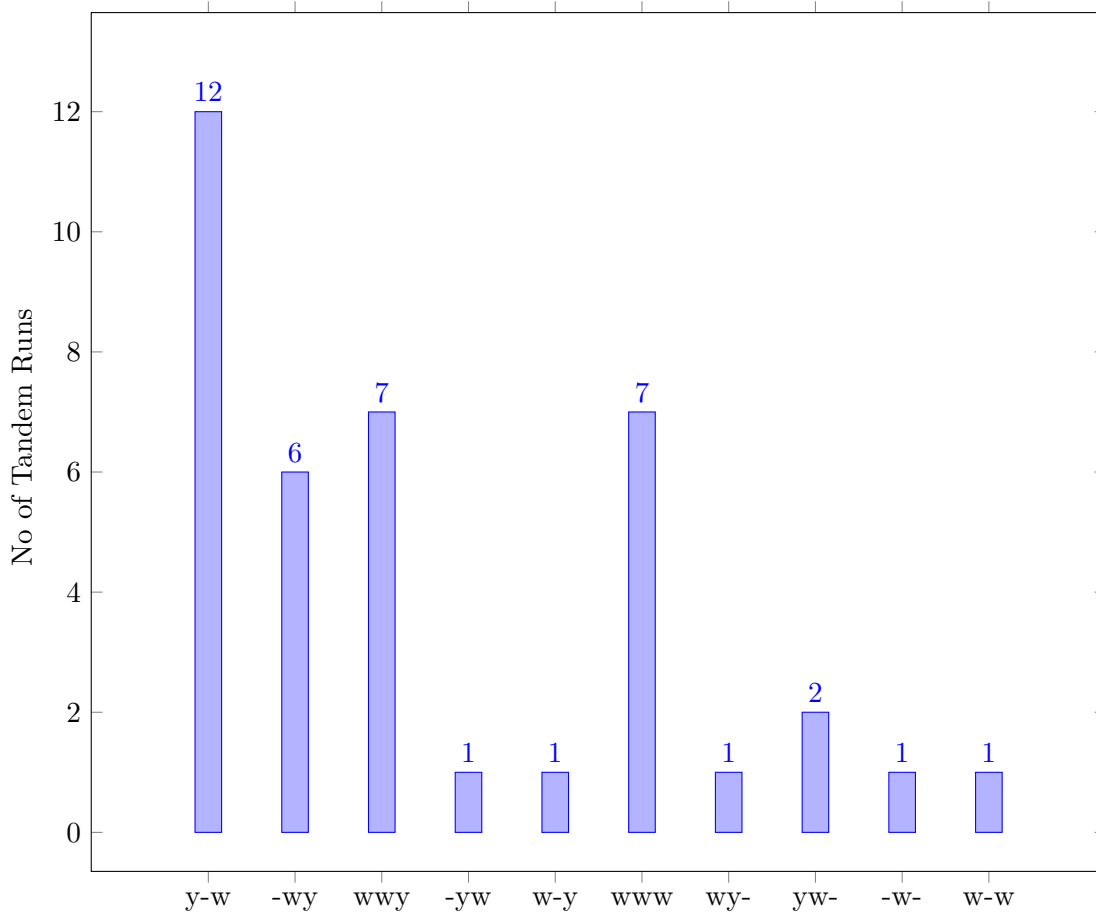
There have been 10 unique ants that have lead the 39 tandem runs(we break the long tandem runs into pairs of two). The distribution of tandem runs vs the leaders have been shown above. The average number of tandem runs is $\frac{39}{10} = 3.9$. **y-w, -wy, wwy, www** are the only ants that have done an above average no of tandem runs. Thus, they have a high workload. The other ants have a low workload. We can see that the **y-w** ant was the most effectuve at tandem runs with a total of 12 tandem runs as leader.

§5.2 Activity of Individuals

We have noted during scan sampling that the activity of individuals. Here we see the results. During scan sampling, 14 individuals were active and 11 were inactive.
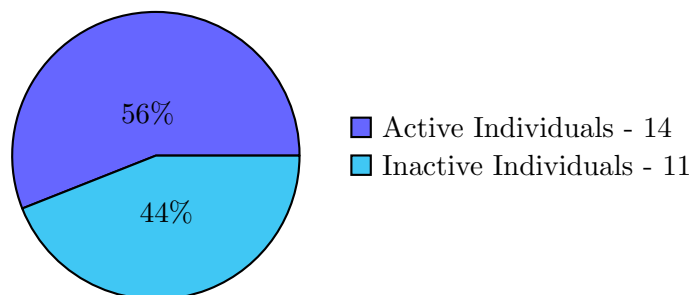
§5.3 Frequency of Tandem Runs

We will now see the frequency of tandem runs, in intervals of 5 mins.

Slno	Time Intervals	No of tandem runs
1	0-5	0
2	5-10	0
3	10-15	3
4	15-20	10
5	20-25	15
6	25-30	11
7	30-35	0
8	35-40	1
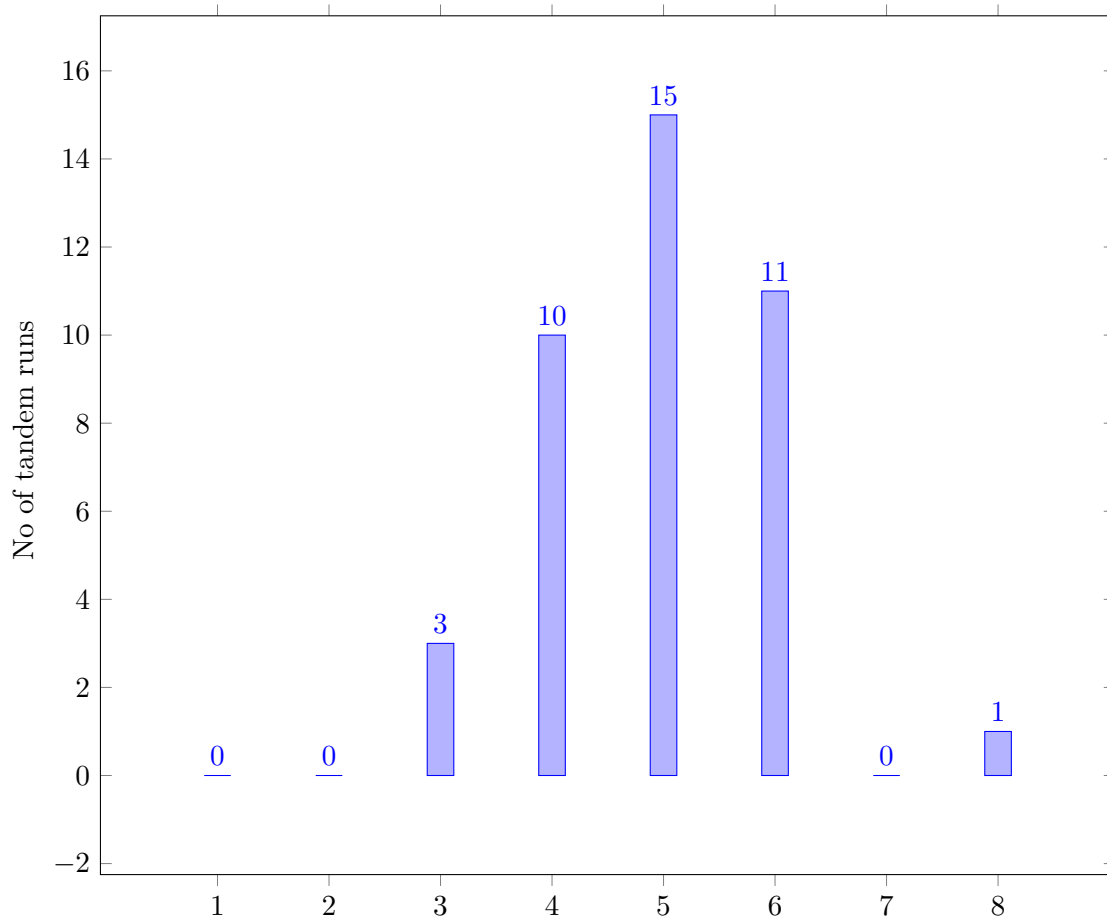
We can see that the bin with the highest no of tandem runs in 5 i.e. the 20-25 min window in the picture.

§6 Limitations

The limitations of this experiment are:

1. We observe the behaviour of ants from a pre recorded video. Here the colours of individual ants are not always distinguished properly. For example, the blue colour painted on the ant was very hard to distinguish from the natural exoskeleton of the ant, causing us to undercount the number of individuals.

2. The distinction betwen active and inactive individuals depends heavily on the person performing the experiment. I have chosen to take 1 second each back and forth to check if the ants are moving within that time frame. Someone may choose a larger time frame, and someone may choose a shorter time frame with varying results. Thus the distinction here between active and inactive individuals is very crude.

3. Sometimes, tandem runs can get complicated. Ther are atleast two instances throughout the whole video where there have been simultaneuos tandem runs. At around 23 mins, 4 ants perform a chain together and perform tandem runs. However, by definition, tandem runs are defined pairwise. So for those tandem runs that involve more than two ants, we have taken, that the ant immediately in front of some ant acts as the leader of that ant.

§7 Conclusions

We hereby conclude the experiment with the following results:

1. We have identified atleast **33 unique individuals** from the whole video.

2. There have been 10 leaders for all the tandem runs, with **y-w** being the most efficient ant with the highest no of tandem runs.

§8 Supplementary

The raw data collected is attached below.