THE BUZZ

THE NEWSLETTER OF THE INVERNESS-SHIRE BEEKEEPERS' ASSOCIATION

Pollen traps fitted to the Knocknagael hives for an experiment – see more inside this issue of the Buzz!!!

Inside This Issue:

Editor's Note:

The Buzz is slightly different this time around. This edition includes a report I wrote for university last semester looking at pollen variety in urban and rural environments. My degree is Environmental Science and I try and involve the bees whenever I can in my assignments. This report was a real passion project for me and so I hope the Buzz readers find it interesting! Many thanks to Fred Millwood for letting me use his hives.

How is the variety of pollen collected by a honeybee (*Apis mellifera*) colony affected by urban and rural environments?

Figure 1- (Russell, 2019), Honeybees

Module: Research Project and Skills

Student No. 16000624

Contents:

1. Aim:

The aim of this report is to investigate how the variety of pollen collected by a honeybee (*Apis mellifera*) colony changes between an urban and rural environment.

2. Introduction:

2.1 Breakdown of the Honeybee Colony.

At the height of summer, a healthy, vibrant honeybee (*Apis mellifera*) colony can contain 20,000-50,000 individual honeybees, of which there are 3 types; the workers, the drones and the queen (Jones, Sweeney-Lynch and Waring, 2010).

Honeybee colonies can be regarded as a superorganism, which is defined as "a collection of agents which can act in concert to produce phenomena governed by the collective" (Waring and Waring, 2015). In this context, the word phenomena refers to activities that the superorganism requires to survive, in the case of honeybees; foraging and storing food or searching for a new nesting site. It is only through the combined activities of all the individuals in the hive that a colony can function- an individual bee would not survive for long on its own (Waring and Waring, 2015).

Workers represent 95% of the colony (Aston and Bucknall, 2010), these are infertile females who carry out most of the tasks required for the colony's survival. These tasks are various and include:

- collecting pollen, water and nectar,
- scouting new forage sources,
- receiving food from other workers at the hive entrance as they return,
- feeding the queen, brood and other workers,
- storing food in honey cells,
- building new comb and clearing out debris – includes dead bees or unwanted drones,
- challenging incoming bees at the entrance,
- defending against honey and brood thieves,
- fanning to cool the combs,
- and swarming with the queen and creating a new nesting site.

It was originally thought that the division of this labour between the workers was instinctive and fixed (depending on the age and condition of an individual bee); with each insect progressing through the various tasks inexorably from hatching to death. However, research has shown that the career path of a worker is less fixed than originally thought and bees of any age can complete any task depending on the requirements of the colony (Jones, Sweeney-Lynch and Waring, 2010). For example, if there is an increase in egg laying and there are insufficient numbers of young bees to nurse the brood, older bees will revert to their previous role and begin producing brood food from their hypopharyngeal glands to feed the larva (Aston and Bucknall, 2010). However, there is a typical progression that most bees follow- shown in table 1.

Time after Hatching	Activities
0-6 days	Cell and general hive cleaning
3-9 days	Feeding brood and producing brood food
3-15 days	Attending the Queen
6-18 days	Nectar and Honey Processing
12-20 days	Wax production and comb building
15-25 days	Hive ventilation
18-35 days	Guard duty- defending the colony
20 days- death	Nectar collection
20 days- death	Pollen collection
20 days- death	Water and propolis collection

Table 1 - (Aston and Bucknall, 2010), typical activity progression of most honeybees during Summer months

Drones are the only males in the colony and are stockier, more robust and more densely pubescent than the females. Their sole role within the colony is to mate with a virgin queen. They have large compound eyes which they use find and mate with the queen during her 'nuptial' flight (Jones, Sweeney-Lynch and Waring, 2010). The mating act kills the drone, which falls away, and his place is taken by the next drone. The queen will mate with 10-20 drones during this flight and store the sperm in a small organ in her abdomen known as the spermatheca. At the end of the active season drones become a drain on resources so they are forcible evicted or killed by the workers (Waring and Waring, 2015).

The final type of bee in the colony is the queen. A colony will usually only have one queen and she is the only bee capable of laying both fertilised and unfertilised eggs. (Fertilised eggs produce workers; unfertilised eggs produce drones). A queen is relatively long-lived (4-5 years) and uses the sperm she received while mating throughout her lifetime. Her role within the superorganism is simply to produce the next generation of workers and drones. She also maintains colony cohesion by emitting various pheromones which are carried around the colony by the other bees (Waring and Waring, 2015).

2.2. <u>The importance of pollen.</u>

Pollen is produced by the anther of flowers and is vital to the survival of a honeybee colony. It is the colonies primary source of protein; containing approximately 6-28% protein, as well as 1-20% fats, together with sterols, sugars, starches, vitamins and minerals in small quantities, (Kirk and Howes, 2012). Protein is synthesised from amino acids within the pollen and is required by the colony for brood rearing, tissue development and brood food and egg production (Aston and Bucknall, 2010). Adult bees themselves do not require much protein but it has been estimated that a single worker larva will require 125-145mg of pollen (containing 30mg of protein) per year which is secreted by workers as brood food (Kirk and Howes, 2012).

A healthy honeybee colony requires 20-30kg of pollen per year, which takes approximately 20 million foraging flights to collect (Aston and Bucknall, 2010). However, bees must have access to a variety of pollen sources as no one species of flower can provide the range of amino acids required by the colony (Davis and Cullum-kenyon, 2016). Without access to this variety the colony would suffer from protein and amino acid deficiencies and malnutrition, which compromises the bee's immune system and results in increased risk of poor colony development, ill health and leaves the colony more vulnerable to disease (Kirk and Howes, 2012).

2.3. <u>The value of different plant groups.</u>

Honeybee colonies may utilise many different plant sources. Different plant species can be found in different environment (urban and rural) and can be broken down into several categories. Some of these categories are discussed below:

Annual plants may produce high levels of both pollen and nectar but cannot assist the early build-up of colonies as they flower later in the season.

Perennials can be very useful to honeybees as they often have storage structures such as bulbs, corns or tubers that allow them to flower every early in the season and are a good food source in the Spring as colonies are emerging from hibernation. Many trees may also fall into this category and are able to produce large amount of nectar due to their extensive root systems. The recent trend of planting large flowering trees such as lime (*Tilia* species) in towns and cities has led to increased success for many suburban and urban beekeepers. However, due to 'health and safety' reasons many mature trees are being felled and replaced with smaller trees that provide significantly less food for bees (Kirk and Howes, 2012).

Wild flowers are another important plant category; prior to the development of man these would have been the only food source for bees.

Ornamental plants are often of very little use to bees as they are bred specifically for select visual characteristics, scent or other factors such as temperature resistance. Many species do not yield pollen or nectar at all even if their relatives do so profusely. Structural changes also occur such as the addition of petals in 'double' flowers which may make the pollen and nectar completely inaccessible to bees.

Finally, arable and horticultural crops vary in usefulness to bees (Kirk and Howes, 2012), however, many arable areas lack the plant variety required by bees (mentioned previously) and are less suitable for honeybees (Waring and Waring, 2015).

3. Rational:

The importance of honeybees to both the environment and to human society cannot be overstated. Honeybees carry out pollination of many agricultural and horticultural crops, as well as, wild flowers, shrubs and trees. Pollination is vital to the development of fruits, seeds and nuts, which are a key part of food chains and so are vital to support ecosystems and maintain biodiversity (Kirk and Howes, 2012). In the UK is it estimated that honeybees are worth £825 million to the agriculture economy and that a third of the food we eat is only available because of the honeybee (Waring and Waring, 2015). Bees are also are our only source of honey and beeswax which are used in many pharmaceutical and cosmetic products as well as having many industrial uses (Kirk and Howes, 2012).

However, there has been a significant decline in honeybee colonies around the world resulting from several primary drivers: the use of agrichemicals and pesticides, the parasitic Varroa *destructor* mite and other pests and diseases, and the spread of monocultures and the loss of a wide range of forage plants due to the use of agrichemicals and pesticides. In the United States, honeybee colonies have experienced a decline of 59% between 1947 and 2005, and since 2006, beekeepers have lost nearly 30% of their managed colonies every year (Durant, 2019).

In response to their decline, however, awareness of the importance of honeybees has increased considerably and many people have taken up beekeeping in an effort to help them (Kirk and Howes, 2012). The number of British Beekeepers Association members has increased from 13,000 members in 2007 to 25,000 in 2014 (Davis and Cullum-kenyon, 2016).

With this in mind, the first step for every new beekeeper is to find an area to site their colony. Given the importance of pollen variety to the health of a honeybee colony, this report aims to help new beekeepers site their hive by investigating how the variety of pollen collected by a colony is affected urban and rural environments. This leads to the research question…

4. Research Question:

How is the variety of pollen collected by a honeybee (*Apis mellifera*) colony affected by urban and rural environments?

5. Hypothesis:

Null hypothesis (H_0) – Variety of pollen collected is the same in an urban and rural environment.

Alternative hypothesis (H_1) – Variety of pollen collected is greater in an urban environment than in a rural environment

Alternative hypothesis (H_2) – Variety of pollen collected is greater in a rural environment than in an urban environment.

6. Method:

6.1. Data Gathering.

During this investigation pollen was collected from both urban and rural colonies, the various types of pollen were identified and the number of pollen grains of each type was also counted.

Pollen was be collected using a pollen trap fitted to the entrance of both hives. This device brushes the pollen from returning foraging bees as they fly through a metal grate and into the hive. The pollen then falls through a mesh and into a plastic drawer for collection. Enough pollen was collected after 24 hours and the traps were removed.

Pollen will be identified using the official SBA (Scottish Beekeepers Association) pollen colour chart. (See appendix 1).

Data collection took place on 05/04/19 (urban) and 06/04/19 (rural).

6.2. Resources.

Access to:

- a computer with internet access
- peer-reviewed, scientific journals and books
- 2 healthy honeybee colonies (rural and urban)
- a pollen trap
- SBA (Scottish Beekeepers Association) pollen colour chart.
- PPE- beekeeping suit, wellies, gloves, hive tool

6.3 Location.

Figures 2 and 3 show satellite views of the areas surrounding both hives used.

Rural Hive- Inverness Beekeeping Association Apiary, Knocknagael, IV2 6AJ

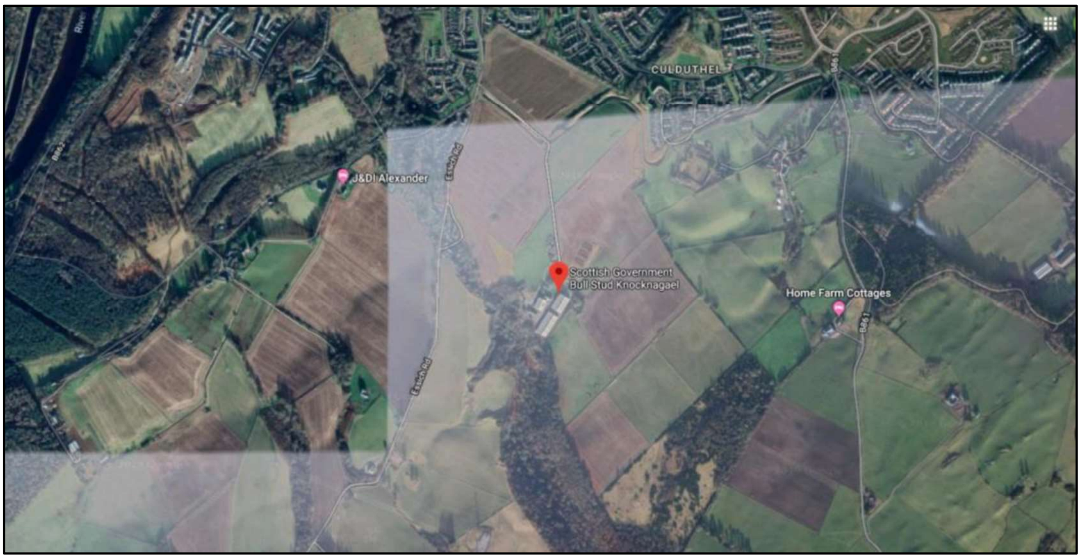

Figure 2– satellite view of the area surrounding the rural hive (Google Maps, 2019a)

Urban Hive- 39 Old Mill Lane, Inverness, IV2 3XP

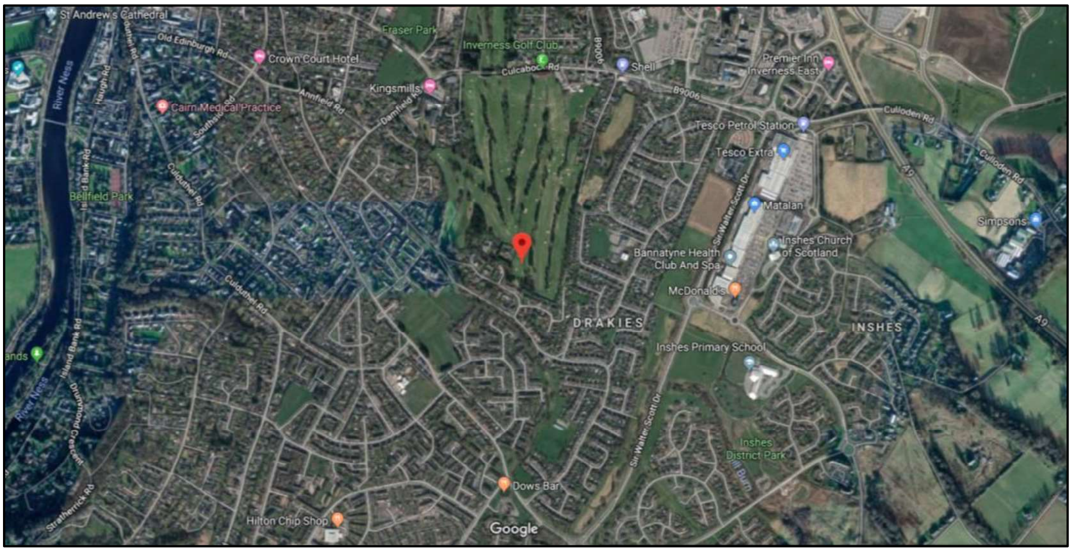

Figure 3– satellite view of the area surrounding the urban hive (Google Maps, 2019b)

6.4. Determining the statistical analysis method.

The method of statistical analysis will be the χ^2 test for association. This was selected because:

1. The analysis is concerned with association between the types of pollen collected and urban and rural environments,
2. There are 2 sets of categorical measurements that are independent from each other,
3. And the expected frequencies under the null hypothesis of no association are greater than 5.

This test was selected using the flow chart in the OS project guide book (see appendix 2).

7. Results:

		Pollen Types Collected				
		Field Bean (*Vicia faba*)	Apple (*Malus pumila*)	Dandelion (*Taraxacum officinale*)	Mountain Ash or Rowan (*Sorbus aucuparia*)	Flowering Currant (*Ribes* species)
Frequency	Rural Hive	59	40	5	0	0
	Urban Hive	0	0	7	90	33

Table 2- (Russell, 2018), Table showing raw pollen data collected

Figures 4 and 5 show the original pollen sample separated into individual constituents.

Figure 4- (Russell, 2018), Rural hive pollen constituents

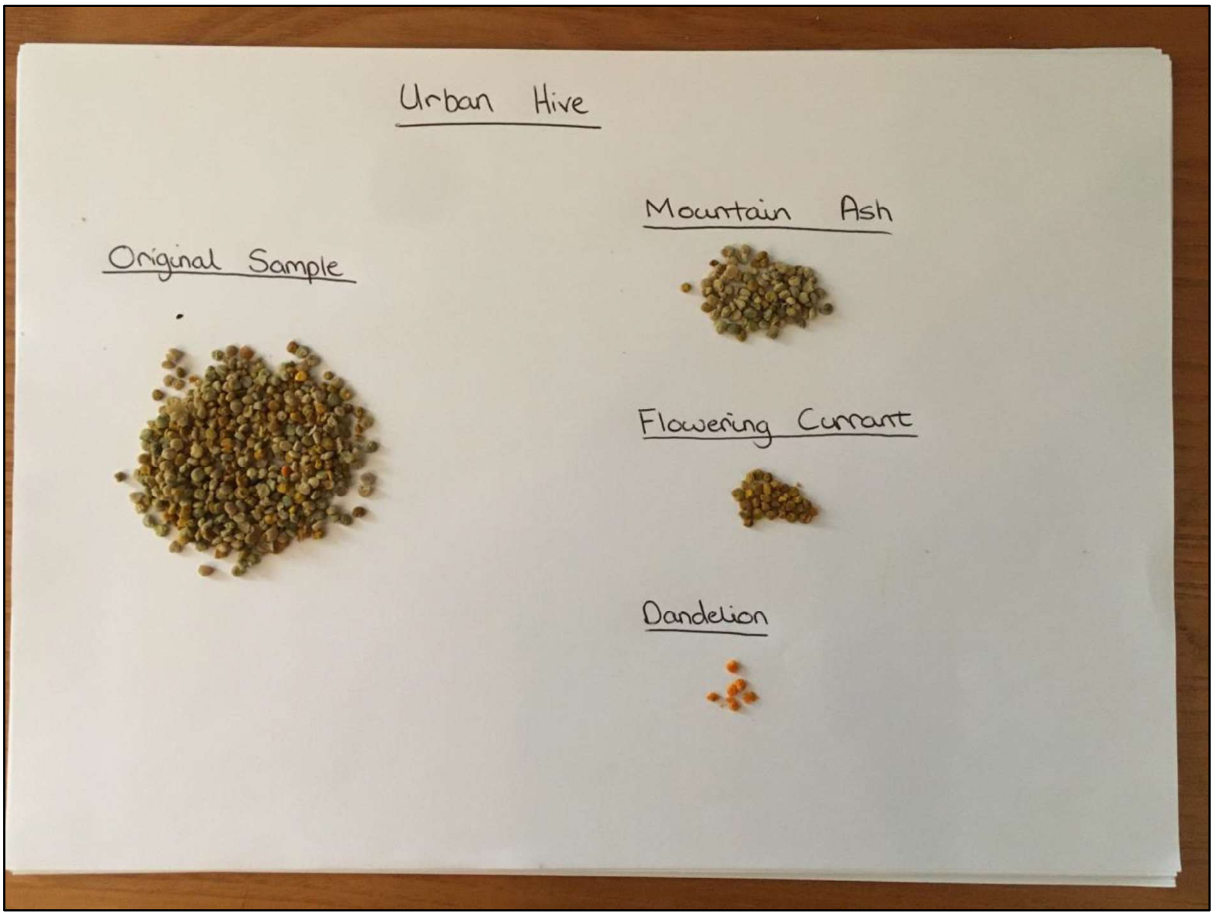

Figure 5- (Russell, 2018), Urban hive pollen constituents

8. Statistical Analysis:

The χ^2 test for association will be used to test whether there is an association between the types of pollen collected and an urban or rural environment.

The first step is to calculate the number of pollen grains that would be expected to be collected if the null hypothesis is true- the expected values (E), (as opposed to the 'observed values' (O) which are the number of pollen grains actually collected). Expected values can be calculated using the following steps (Chalmers et al., 1989).

1. Divide the total for the column that contains the first observed value by the grand total (eg. 59/234=0.2521367521)
2. Multiply the result by the total for the row that contains the observed value (eg. 0.2521367521 x 104 = 26.2222222222222)
3. Repeat these steps for each O value
4. Answers can be checked by adding up the expected values in each column and row respectively- the result should be the same as the observed totals (Chalmers et al., 1989).

		Pollen Types Collected					
		Field Bean	Apple	Dandelion	Mountain Ash	Flowering Currant	Total
Frequency Collected	Rural Hive	59 (26)	40 (18)	5 (5)	0 (40)	0 (15)	104
	Urban Hive	0 (33)	0 (22)	7 (7)	90 (50)	33 (18)	130
	Total	59	40	12	90	33	234

Table 2- (Russell, 2018), Contingency table with the E values calculated and in brackets

Large discrepancies between observed and expected figures tend to indicate that the null hypothesis is unlikely to be true, however, a method of quantifying how big the discrepancy is is required. Simply subtracting the O and E values and adding up the difference would result in the value always being 0 so to overcome this problem the differences are squared (Chalmers et al., 1989).

Following this, one final refinement is required that will provide each difference with some perspective. Without perspective, a difference of 100 would appear much more extreme if the O and E values were 105 and 5 than if they were 1100 and 1000. Perspective is achieved by dividing each $(O-E)^2$ by the E value.

Adding each of the $(O-E)^2/E$ will provide a single number that indicates the overall discrepancy between the O and E values. This value is known as χ^2 (Chalmers et al., 1989).

These steps can be summarised using the formula below:

$$\chi^2 = \sum \frac{(0 - E)^2}{E}$$

The results of the calculation are detailed in table 3.

Pollen Types Collected	Hive Type	Observed – Expected (O-E)	(Observed – Expected)^2 $(O-E)^2$	(Observed – Expected)^2/Expected $(O-E)^2$
Field Bean	Rural	33	1089	41.88461538
	Urban	-33	1089	33
Apple	Rural	22	484	26.88888889
	Urban	-22	484	22
Dandelion	Rural	0	0	0
	Urban	0	0	0
Mountain Ash	Rural	-40	1600	40
	Urban	40	1600	32
Flowering Currant	Rural	-15	225	15
	Urban	15	225	12.5
	Total:	0	6796	223.2735043

Table 3– (Russell, 2018), Contingency table showing χ^2 test for association calculations

Before accepting or rejecting the null hypothesis, one final step must be taken- calculating the degrees of freedom. This is important because the number of rows and columns in the contingency table can affect the sampling distribution, which the χ^2 test relies on under the null hypothesis.

The degrees of freedom are the number of values in the final calculation that are free to vary and can be calculating using the following rule:

Degrees of Freedom= (Number of rows in the contingency table minus 1) x (number of columns in the contingency table) (Chalmers et al., 1989).

In this investigation the Degrees of Freedom= (5-1) x (2-1) = 4

Using the statistical table that give the critical value of in χ^2 at various degrees of freedom and significance levels in (Chalmers et al., 1989) (see appendix 3) it can be determined whether the null hypothesis is to be accepted or rejected.

Given that there are 4 degrees of freedom and using a significance level of 5% the critical value will be 9.488. Since the value of χ^2 (223.2735043) is larger than 9.488 the null hypothesis can be rejected in favour of one of the alternative hypotheses.

9. Discussion:

9.1. Reviewing the results

Although the result of the statistical analysis was unable to prove an alternative hypothesis, it was able to disprove the null hypothesis, stating that there is an association between the varieties of pollen collected in urban and rural environments.

This correlates well with a recent study carried out by researchers from Halloway University that compared the progress of bumblebee colonies in urban, village and rural environments and found that the bees in city environments were approximately 3 times healthier than those in village or rural areas. (Bumblebees and honeybees are both pollinating insects with very similar foraging requirements, so comparison of results is relevant).

(Samuelson et al., 2018) relocated 176 bumblebee colonies from Windsor Great Park and relocated them to 114 sites in and around London. Results found that the health of colonies in the city improved with increased amounts of pollen and nectar stores, more offspring and an increased ability to avoid parasites. The author states that “Reductions in forage availability in modern agricultural landscapes have been identified as a potential major driver of bee population declines”, but the report also suggests additional threats such as predation, agricultural pesticide use and intense arable farming as other factors that are driving bees to city gardens and other green spaces (Samuelson et al., 2018).

9.2. Pollen types collected

The types of pollen collected during this investigation were: field bean, apple, dandelion, mountain ash and flowering currant. There usefulness to a honeybee colony will be briefly discussed, with reference to section 2.3, below:

The field bean is by far the most important type of bean utilised by honeybees in the British Isles as it is an extensively grown arable crop. It is sewn in the Spring or Autumn and flowers between March and July. Honeybees are able to collect pollen easily from this crop but due to their short tongues struggle to reach the nectar which is stored in the nectarines deep in the flower. Some other short-tongued insects such as the buff-tailed bumblebee (*Bombus terrestris*) have developed the ability bite through the base of the flower to reach the nectar, although this is rarely seen in honeybees (Kirk and Howes, 2012).

Apple blossom, like many perennial food sources, is an excellent source of pollen and nectar early in the season (April to May) Honeybee colonies have been traditionally brought to apple orchards to encourage pollination (Kirk and Howes, 2012).

Dandelions, although considered by many to be a weed, are one of the most useful wild flowers to bees. This species is very common and flowers almost all through the year (from March to October) and is visited regularly for its pollen and nectar (Kirk and Howes, 2012).

Mountain Ash (or Rowan) is a characteristic wild tree of the north and west of the British Isles and is often planted as an ornamental tree. This species flowers between May and June but is not particularly useful, producing limited amounts of pollen and nectar, but is still sometimes visited by honeybees and bumblebees (Kirk and Howes, 2012).

Flowering currants are again useful to bees early in the season (April to May) producing good amounts of nectar and pollen. There are many different species of flowering currants and they are commonly found in gardens making them useful to urban beekeepers (Kirk and Howes, 2012).

10. Conclusion:

The aim of this report was to investigate how the variety of pollen collected by a honeybee (*Apis mellifera*) colony changes between an urban and rural environment with the aim of helping new beekeepers who are siting a new beehive. This investigation succeeded in disproving the null hypothesis, confirming that there is an association between the variety of pollen collected by a honeybee colony and urban and rural environments. However, the statistical analysis was unable to confirm an alternative hypothesis. Despite this the results obtained do correlate with a study recently carried out by (Samuelson et al., 2018) that found that bee colonies in urban, city environments not only have increased amounts of pollen and nectar stores but are also approximately 3 times healthier than those in rural environments. It is the opinion of the author of this report that although an alternative hypothesis could not be confirmed, these findings would be useful to a new beekeeper siting a hive and so this investigation can be considered a partial success.

11. References:

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12. Appendix 1: SBA (Scottish Beekeepers Association) pollen colour chart

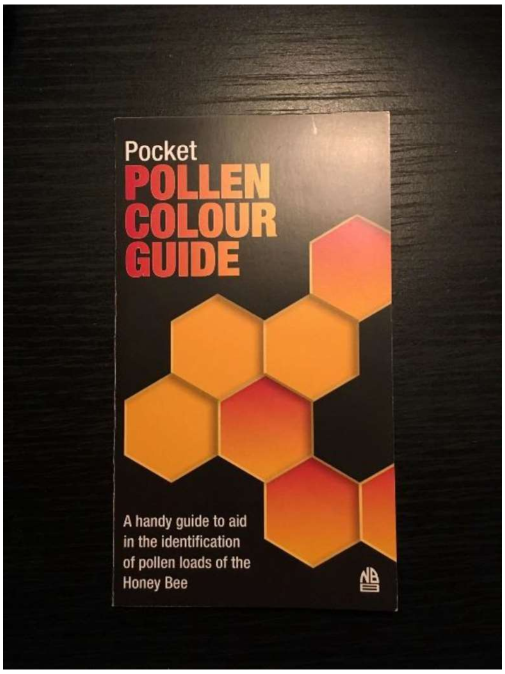

Figure 6- (Russell, 2019), Front cover

Figure 7- (Russell, 2019), Rear page

Figure 8- (Russell, 2019), Inside pages

13. Appendix 2: Flow Chart in 'The OU Project Guide' used to identify correct statistical text – Selection steps highlighted

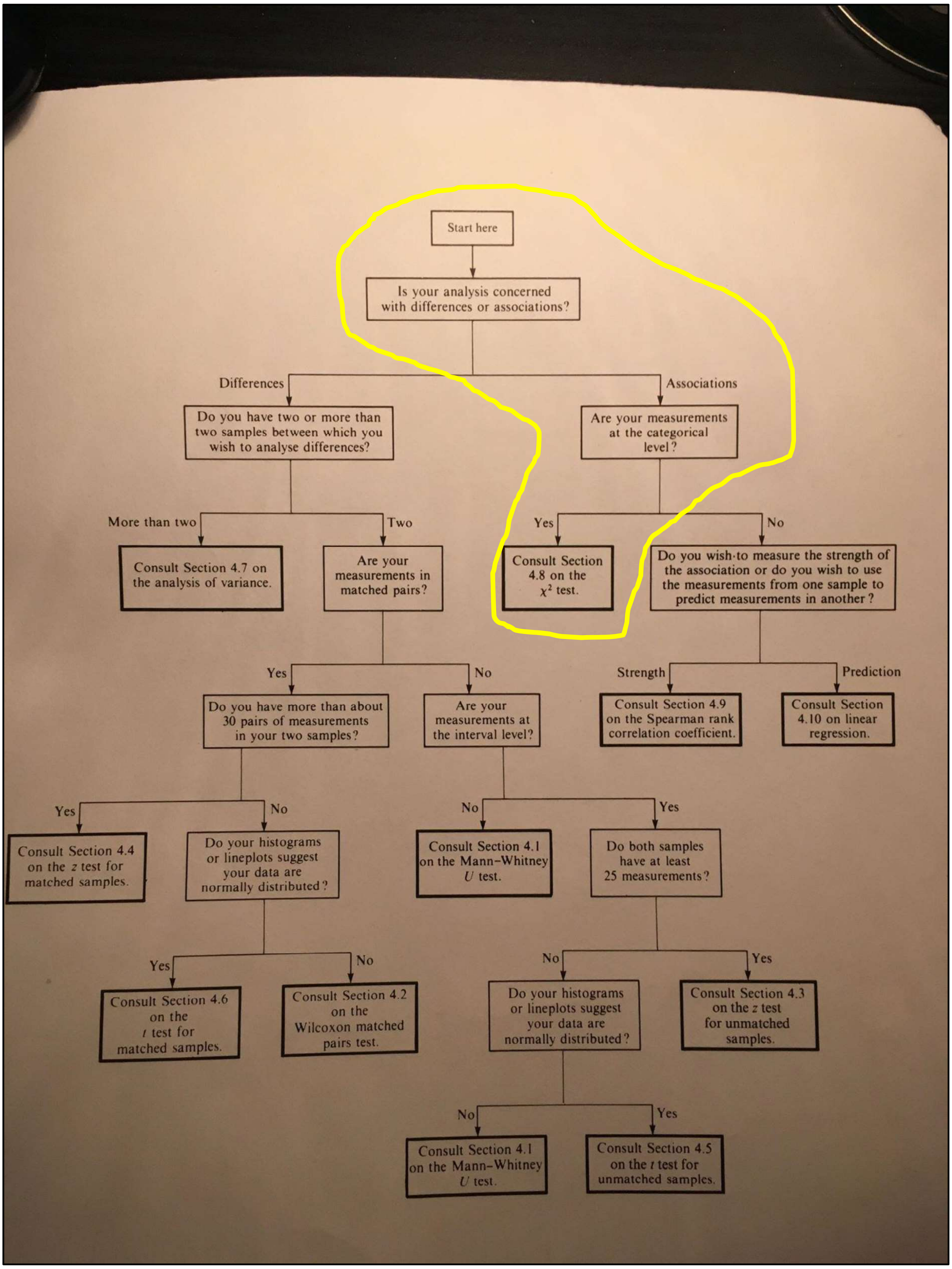

Figure 11- (Chalmers et al., 1989), (Russell, 2019)- Flow chart used to identify statistical test, Steps taken highlighted

14. Appendix 3: Table of critical values at various significance levels- used to reject null hypothesis.

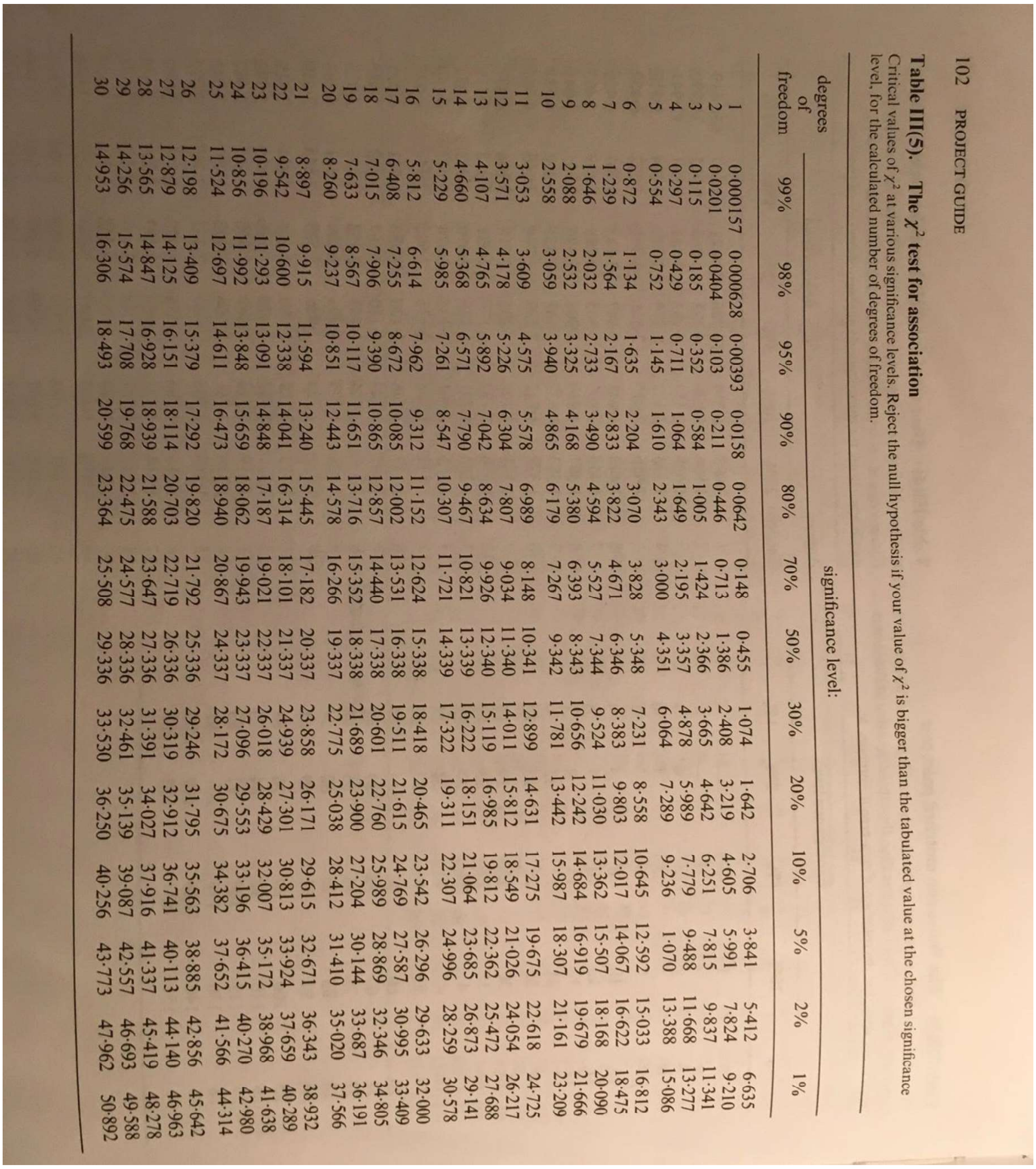

Table III(5). The χ^2 test for association

Critical values of χ^2 at various significance levels. Reject the null hypothesis if your value of χ^2 is bigger than the tabulated value at the chosen significance level, for the calculated number of degrees of freedom.

degrees of freedom	significance level: 99%	98%	95%	90%	80%	70%	50%	30%	20%	10%	5%	2%	1%
1	0·000157	0·000628	0·00393	0·0158	0·0642	0·148	0·455	1·074	1·642	2·706	3·841	5·412	6·635
2	0·0201	0·0404	0·103	0·211	0·446	0·713	1·386	2·408	3·219	4·605	5·991	7·824	9·210
3	0·115	0·185	0·352	0·584	1·005	1·424	2·366	3·665	4·642	6·251	7·815	9·837	11·341
4	0·297	0·429	0·711	1·064	1·649	2·195	3·357	4·878	5·989	7·779	9·488	11·668	13·277
5	0·554	0·752	1·145	1·610	2·343	3·000	4·351	6·064	7·289	9·236	11·070	13·388	15·086
6	0·872	1·134	1·635	2·204	3·070	3·828	5·348	7·231	8·558	10·645	12·592	15·033	16·812
7	1·239	1·564	2·167	2·833	3·822	4·671	6·346	8·383	9·803	12·017	14·067	16·622	18·475
8	1·646	2·032	2·733	3·490	4·594	5·527	7·344	9·524	11·030	13·362	15·507	18·168	20·090
9	2·088	2·532	3·325	4·168	5·380	6·393	8·343	10·656	12·242	14·684	16·919	19·679	21·666
10	2·558	3·059	3·940	4·865	6·179	7·267	9·342	11·781	13·442	15·987	18·307	21·161	23·209
11	3·053	3·609	4·575	5·578	6·989	8·148	10·341	12·899	14·631	17·275	19·675	22·618	24·725
12	3·571	4·178	5·226	6·304	7·807	9·034	11·340	14·011	15·812	18·549	21·026	24·054	26·217
13	4·107	4·765	5·892	7·042	8·634	9·926	12·340	15·119	16·985	19·812	22·362	25·472	27·688
14	4·660	5·368	6·571	7·790	9·467	10·821	13·339	16·222	18·151	21·064	23·685	26·873	29·141
15	5·229	5·985	7·261	8·547	10·307	11·721	14·339	17·322	19·311	22·307	24·996	28·259	30·578
16	5·812	6·614	7·962	9·312	11·152	12·624	15·338	18·418	20·465	23·542	26·296	29·633	32·000
17	6·408	7·255	8·672	10·085	12·002	13·531	16·338	19·511	21·615	24·769	27·587	30·995	33·409
18	7·015	7·906	9·390	10·865	12·857	14·440	17·338	20·601	22·760	25·989	28·869	32·346	34·805
19	7·633	8·567	10·117	11·651	13·716	15·352	18·338	21·689	23·900	27·204	30·144	33·687	36·191
20	8·260	9·237	10·851	12·443	14·578	16·266	19·337	22·775	25·038	28·412	31·410	35·020	37·566
21	8·897	9·915	11·591	13·240	15·445	17·182	20·337	23·858	26·171	29·615	32·671	36·343	38·932
22	9·542	10·600	12·338	14·041	16·314	18·101	21·337	24·939	27·301	30·813	33·924	37·659	40·289
23	10·196	11·293	13·091	14·848	17·187	19·021	22·337	26·018	28·429	32·007	35·172	38·968	41·638
24	10·856	11·992	13·848	15·659	18·062	19·943	23·337	27·096	29·553	33·196	36·415	40·270	42·980
25	11·524	12·697	14·611	16·473	18·940	20·867	24·337	28·172	30·675	34·382	37·652	41·566	44·314
26	12·198	13·409	15·379	17·292	19·820	21·792	25·336	29·246	31·795	35·563	38·885	42·856	45·642
27	12·879	14·125	16·151	18·114	20·703	22·719	26·336	30·319	32·912	36·741	40·113	44·140	46·963
28	13·565	14·847	16·928	18·939	21·588	23·647	27·336	31·391	34·027	37·916	41·337	45·419	48·278
29	14·256	15·574	17·708	19·768	22·475	24·577	28·336	32·461	35·139	39·087	42·557	46·693	49·588
30	14·953	16·306	18·493	20·599	23·364	25·508	29·336	33·530	36·250	40·256	43·773	47·962	50·892

Figure 12- (Chalmers et al., 1989), (Russell, 2019), Table of critical values at various significance levels

Notice Board.

MONTHLY STRIM TEAM VOLUNTEERS WANTED

Charlie and Jed need your help!!!

Beginning in SUMMER 2019 - they are looking for volunteers to join their monthly maintenance team at the Knocknagael apiary.

TASK WILL INCLUDE:

- Strimming grass
- Clearing around existing planting
- Fencing repairs
- Planting new shrubs and bee-friendly plants

If you are interested, please contact:

CHARLIE MOIR - charliemoir@btinternet.com

Tel No. 01463 741618

Mob No. 07733362577

AT THE MOMENT OUR PRICES FOR JARS, AMBROSIA AND FONDANT ARE AS FOLLOWS:

Item	Price
Ambrosia (12kg, non-refundable container)	£15.00
Fondant (2.5kg pack)	£4.00
Fondant (full box – 5x 2.5kg packs)	£20.00
Jars (72 x 1lb jars with lids)	£30.00
Jars (96 x ½lb jars with lids)	£35.00
Spare lids (for both sizes of jars)	£2.00 per dozen

Please visit our website https://inverness-shirebeekeepers.org/

for more exciting information and resources such as:

- The beekeepers blog
- Beekeepers library catalogue
- Help with swarms
- Details of upcoming events and meetings
- Helpful beekeeping hints and tips
- Backdated issues of the Buzz

Don't forget to visit the exclusive **MEMBERS SECTION** for extra goodies!!!

EASY FUNDRAISING SUPPORT

The Inverness-Shire Beekeepers Association needs your help!!!

If you would like to help the association financially,

PLEASE VISIT: https://www.easyfundraising.org.uk/support-a-good-cause/step-1/?char=208763

YOUR SUPPORT WILL GO TOWARDS:

- **NEW TRAINING EQUIPMENT – USED TO TRAIN THE NEXT GENERATION OF BEEKEEPERS**
- **APIARY IMPROVMENTS AND REPAIRS – ENSURES ALL OUR FACILITIES ARE SAFE AND PLEASURABLE PLACES**
- **CLUB ADVERTISMENT – SPREADING THE BEEKEEPING WORD**

YOU CAN PUT AN ADVERT IN THE BUZZ!!!

Anyone wishing to advertise the sale of bees or beekeeping equipment can advertise in the Buzz.

The Buzz is distributed to every member of the Inverness Beekeeping Association.

If you are interested in filling this space with your advert contact Jed Russell via:

jed.k.russell@googlemail.com