# Extended essay cover



Diploma Programme subject in which this extended essay is registered: <u>Biology</u>
(For an extended essay in the area of languages, state the language and whether it is group 1 or group 2.)
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# Candidate's declaration

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The extended essay I am submitting is my own work (apart from guidance allowed by the International Baccalaureate).

I have acknowledged each use of the words, graphics or ideas of another person, whether written, oral or visual.

I am aware that the word limit for all extended essays is 4000 words and that examiners are not required to read beyond this limit.

This is the final version of my extended essay.

Candidate's signature:		_ Date:	04.03.	2009
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initiative Avanthika took the to do the pilot to check the feasibility of the topic during Summer vacation and was ready with all the of schedule. background work ahead Originally, she did all her experiment in was not able to acheive school but level of sterility required to get accurate readings, as did not have a laminar airflow chambler. So, School experiment was repeated in a nearby research lab had a laminar air flow chamber! Throughout the research Avanthika d the maturity with impressed me with ability to which she rodically lituations all

I have read the final version of the extended essay that will be submitted to the examiner.

To the best of my knowledge, the extended essay is the authentic work of the candidate.

I spent Ohrs hours with the candidate discussing the progress of the extended essay.

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Supervisor's	signature:
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#### INTERNATIONAL BACCALAUREATE EXTENDED ESSAY BIOLOGY

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# TOPIC: To study the antimicrobial property of different plant extracts

**RESEARCH** QUESTION: Do the plant extracts of *Allium sativum*(Garlic) and *Catharanthus roseus*(Vinca rosea) reduce the growth of *Bacillus subtilis* and *Escherchia coli* and do they show a similar effect as antibiotics(Gentamicin)?

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# Acknowledgements:

First, I would like to thank Ms. Sonia Matthews, my Extended Essay supervisor for her support and guidance. I would also like to thank my school – The International School Bangalore (TISB) for letting me use the Biology laboratory for my entire experiment. I would also like to thank Dr. Azra Begum, the IB co-ordinator of TISB for all her encouragement. In addition, I would like to thank Professor Balachander, Tamil Nadu Agricultural University, Coimbatore for his constant support.

# ABSTRACT:

An experiment was conducted to inspect the antimicrobial effects of plant extracts. The research question was thus formulated as: Do the plant extracts of Allium sativum (Garlic) and Catharanthus roseus (Vinca rosea) reduce the growth of Bacillus subtilis and E.coli and do they have a similar effect as the antibiotic Gentamicin?

The extracts of *Allium sativum* and *Catharanthus roseus* were prepared in 100% ethanol using a pestle and mortar. The cultures were grown in a nutrient broth after which they were introduced to the Petri dishes using micropipettes. Paper discs soaked with different concentrations of the plant extracts were placed on the bacterial cultures spread in the Petri dishes and the set up was incubated at 37°C overnight. Readymade Gentamicin discs were also placed along with this. The zone of inhibition around each paper disc was measured the next day using a ruler. The data collected was subjected to two-tailed t-test under 98 degree of freedom.

The comparison of the 't' values of the extracts of Garlic and Vinca rosea with the control resulted in a higher value than the table value at 98 degree of freedom. The hypothesis was accepted that the extracts reduced the growth of *E.coli* and *Bacillus subtilis*. Comparison of the 't' values of the extracts of Vinca rosea and Garlic with Gentamicin resulted in a 't' value lower than table value at 98 degree of freedom so the hypothesis was accepted that there was no difference in the effect shown between Gentamicin and the extracts on both the cultures.

The results indicated that both extracts of Garlic and Vinca rosea reduced the growth of *Escherchia coli* and *Bacillus subtilis* and that the plant extracts showed a same effect as the antibiotic Gentamicin. Also, both the plant extracts had a similar antimicrobial effect on both the cultures.

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an effect by itself? I hope a central of ethanol is used.

WORD COUNT: 285

Candidate name. AVANTHIKA RAGHU

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#### **CHAPTER 1: INTRODUCTION**

#### 1.1 Research question:

Do the plant extracts of Allium sativum (Garlic) and Catharanthus roseus (Vinca rosea) reduce the growth of Bacillus subtilis and Escherchia coli and do they show a similar effect as the antibiotic Gentamicin?  $Q_{Q}$ 

#### 1.2 Genesis: ?

Infectious diseases have moved up from the 5<sup>th</sup> position in 1981 to the 3<sup>rd</sup> position in 1992 as the leading cause for death- an increase by 58%.<sup>1</sup>As diseases are spreading increasingly in today's world, people are treated with numerous allopathic medicines that sometimes have detrimental side effects. Having lived in India all my life where alternate forms of medicine like Ayurveda<sup>2</sup> are very much encouraged, I began to contemplate on the various alternatives to allopathic medicines. After some research, I realized that in such forms of medicine plant extracts are widely used. Certain plant extracts have shown to be effective even on serious diseases like Green tea constituent Epigallocatechin-3-Gallate<sup>3</sup> that arrests carcinoma cells by causing cell apoptosis and cell cycle arrest in them. Also, I learnt that according to WHO about 80% of individuals in developed countries use traditional medicines which contain plant extracts and other compounds derived from medicinal plants.<sup>4</sup> Therefore a thorough study of the efficacy of plant extracts on microbes should be done.

#### 1.3 Pilot survey:

During the summer of 2008, I performed a pilot survey prior to the main experiment at the Tamil Nadu Agricultural University, Coimbatore under the supervision of Professor Dr. Balachander The experiment was performed to test the antimicrobial effects of the extracts of Neem (Azadirachta indica), Onion (Allium cepa), Garlic (Allium sativum), Gymnema sylvestene, Ocimum basiliuma, Catharanthus roseus (Vinca Rosea) on the growth of the bacterial cultures of E.coli and Bacillus subtilis.

<sup>1</sup> Maurice M. Iwu, New Antimicrobials of Plant Origin, p 457

<sup>2</sup> 'Ayurveda is a traditional system of Hindu medicine which is based on the idea of balance in bodily systems and uses diet, herbal treatment and yogic breathing'

<sup>3</sup> Journal of the National Cancer Institute vol. 89, No. 24- Dec. 17 1997, p 1881-1886.

<sup>4</sup> Prusti, A, Antibacterial Activity of Some Indian Medicinal Plants, <u>Ethnobotanical Leaflets 12</u>, Issued 18 April 2008, pp227-230

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# The results of the experiment were:

# Escherichia coli

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Antimicrobial Agents	Plate I(measurement of the zone of inhibition)	Plate (measurement the zone inhibition)	II of of	
Ampicillin	34 mm	34 mm		
Gentamicin	30 mm	30 mm		
Azardirachta indica	Nil	Nil		= 0.0?
Allium cepa	Nil	Nil		
Allium sativum	24 mm	25 mm		
Gymnema sylvestne	Nil	Nil		
Oscimum basiliuma	Nil	Nil		
Catharanthus roseus	25 mm	25 mm		
Ethanol	Nil	Nil		10- 10-
Disc	Nil	Nil		

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Later your about about acot

# Bacillus subtilis.

Antimicrobial Agents	Plate I (measurement	Plate II (measurement of
	of the zone of inhibition)	the zone of inhibition)
Ampicillin	30 mm	30 mm
Gentamicin	28 mm	26 mm
Azardirachta indica	09 mm	07 mm
Allium cepa	Nil	Nil
Allium sativum	24 mm	22 mm
Gymnema sylvestne	Nil	Nil
Oscimum basiliuma	Nil	Nil
Catharanthus roseus	24 mm	24 mm
Ethanol	Nil	Nil
Disc	Nil	Nil

Disc size : 6mm

CONTROLS: Ampicillin and Gentamicin were the antibiotics used. Ethano) and the disc were used as controls.

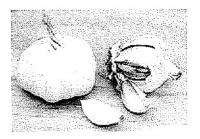
From the above results, it can be noted that *Allium sativum* and *Catharanthus roseus* had a profound antimicrobial effect on the cultures of *E.coli* and *B.subtilis*. *Azadirachta indica* (Neem), however has an effect on *B.subtilis* but not on *E.coli*. This result is similar to that stated in the article 'Anti microbial effects of some medicinal plants against some gram positive, gram negative and Fungi' written by Sanaa O. Yagoub. This might be due to presence of triterpenoids, phenolic compounds, Carotenoids, steroids, valavinoids, ketones and tetratriterpenoids azadirachtin.

As the extracts of Allium sativum and Vinca rosea appeared to be the most effective, they were selected for the main experiment.

## 1.4 Theoretical Basis:

#### GARLIC:

The Garlic extract has a profound antimicrobial effect. This property belongs to Garlic's constituent-Allicen. According to the recent results published by UCLA<sup>5</sup>, Kyloic Aged Garlic extract showed inhibition of coronary calcification in patients suffering from diseases related to the coronary artery. Garlic belongs to the family *Alliaceae*<sup>6</sup>. It is grown primarily in China (77% of world's total output) followed by India  $(4.1\%)^7$ . The composition of Garlic bulbs is water= 84.09%, organic matter=13.38%, and inorganic matter =  $1.53\%^8$ . It is more effective on gram negative bacteria than Penicillin<sup>9</sup>. It was also termed as "a biological response modifier" by Dr. Benjamin Lau of Loma Linda University school of Medicine in 1992. He found that the sulphur compounds that are present in Garlic help to boost the activity of T-lymphocytes and other immune system components.



# Figure 1-<sup>10</sup> Allium sativum

#### Catharanthus roseus:

*Catharantus roseus*, formerly called Vinca rosea is a shrubby short-lived plant with oblong leaves and with white or pink flowers. It belongs to the Apocynaceae family. Several antileukamic alkaloids, vinblatine and vincristine were obtained<sup>11</sup>. The extract of Vinca rosea has proven to cure a number of diseases including diabetes. More than seventy alkaloids have been extracted from the roots, stem, leaves and flowers of this plant most of which are monoterpene indole alkáloids.<sup>12</sup> Some of the

- <sup>5</sup> Herbal gram, volume three,p199
- <sup>6</sup> Microsoft Encarta Encyclopaedia standard 2007
- 7 Wikipedia.com
- 8 Trans. Hon. Soc. Loud., new ser., iii. p. 60
- <sup>9</sup> Herballegacy.com
- <sup>10</sup> Microsoft Encarta Encyclopaedia standard 2007
- <sup>11</sup> J. Janick, Perspectives on new crops and new uses, 1999, (Alexandria, VA: ASHS Press),p 457-458
- <sup>12</sup> International journal of green pharmacy; July September 2008; pp 176- 177

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alkaloids that were extracted from this plant have shown to exhibit hypoglycemic, tumor inhibiting properties. They have also been used to treat Hodgkin's disease <sup>13</sup>

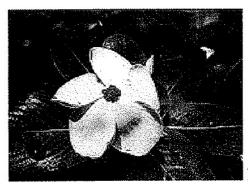


FIGURE 2 – Catharanthus roseus <sup>14</sup>

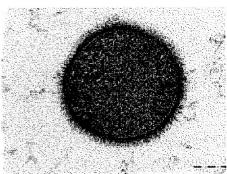
The two organisms used in the experiment are: *Bacillus subtilis* isolated from soil and *Escherichia coli (DH5 alpha)*.

#### Bacillus subtilis:

*Bacillus subtilis* belongs to the genus *Bacillus*. It is commonly found in the soil and it is a gram positive bacteria. It forms endospores thereby helping it to survive in tough environmental conditions. This type of Bacteria normally causes food contamination. *B.subtilis* is widely used as a laboratory model and can be considered as a gram positive equivalent to *Escherichia coli*,

<sup>13</sup> Alam, Muzaffar, ISOLATION AND STRUCTURAL STUDIES ON THE CHEMICAL CONSTITUENTS OF CATHARATHUS ROSEUS AND BUXES SPECIES, PhD thesis, University of Karachi, Karachi 1991.

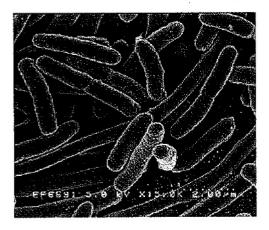
<sup>14</sup> http://en.wikipedia.org/wiki/Rosy\_Periwinkle. 4.49PM. 2/16/2009

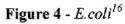




### Escherichia coli:

*E.coli* belongs to the family Enterobacteriaceae. Most *E.coli* strands are harmless but certain virulent strains can cause Gastroentritis, neo-natal meningitis, urinary tract infection in humans. They are primarily confined to the intestine even though they have the ability to survive outside it for brief periods of time. *E.coli* is a gram negative bacterium.





15 http://en.wikipedia.org/wiki/Bacillus\_subtilis.4.47pm . 2/16/2009

<sup>16</sup> http://en.wikipedia.org/wiki/Escherichia\_coli.4.44pm. 2/16/2009

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# Gentamicin<sup>17</sup>:

It is a bactericidal antibiotic that which works by disrupting protein synthesis . It is an aminoglyciside antibiotic synthesised primarily by a gram-positive bacteria.

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17 Wikipedia.com, 27/2/2009,9.30am

#### CHAPTER 2: METHODOLOGY

#### 2.1 Objectives of study:

- 1. To verify if the plant extracts reduce the growth of *Escherichia coli* and *Bacillus* subtilis.
- 2. To compare antimicrobial action of the plant extract with Gentamicin
- 3. To compare the antimicrobial activity between the extracts of *Catharanthus roseus* and *Allium sativum*

# **2.2 HYPOTHESIS**

HYPOTHESIS 1: The extracts of *Catharanthus roseus* and *Allium sativum* will reduce growth of on the cultures of *E. coli* and *Bacillus subtilis* 

HYPOTHESIS 2: The plant extracts of *Catharanthus roseus* and *Allium sativum* will show a similar antimicrobial effect as the antibiotic Gentamicin

HYPOTHESIS 3: The extracts of *Catharanthus roseus* and *Allium sativum* will show similar antimicrobial effects.

#### 2.3 Variables: CONSTANT:

- 1. Temperature (Petri dishes with the cultures were incubated at 37° C)
- 2. Bacterial cultures

#### MANIPULATIVE:

1. Concentration of Plant extract (10µl and 15 µl)

#### **RESPONDING:**

1. Growth of bacteria

#### 2.3 Materials required:

#### Micro organisms:

- Escherichia coli(DH5 alpha)
- Bacillus subtilis cultures isolated from soil

Source of the organisms: Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu, India.)

# For the Extract:

Materials	Quantity
Allium sativum	1 kg
Catharanthus roseus	1kg
Ethanol (100%)	500mL
Pestle and Mortar	2 numbers
Sterile containers (with screw caps)	2numbers
Weighing machine	Inumber

# For the Agar medium:

Materials	Quantity
Agar	80grams
Distilled water	5 litres
1000mL conical flask	4numbers
Yeast extract	12grams
Tryptone	20grams
NaCl	20grams

#### **Others:**

• Micropipettes – 100 µl (to spread the culture)

10µl (to spot the extracts on the filter paper discs)

.

- Micropipette tips (one box of compatible tips for each pipette)
- Spread rod

- Spirit lamps
- Filter paper discs
- Forceps
- Disposable Gloves

14

15

- Gentamicin sensitivity discs (readymade)
- Sterile inoculation discs
- Forceps
- Ruler
- Gloves

#### Appliances:

- Autoclave
- Incubator
- Laminar airflow chamber
- Refrigerator

No mention A sectore? Appendix A

# 2.4 Procedure<sup>18</sup>: DAY1:

- The total number of Petri dishes that were required for the experiment were 200. The media required per plate is 20 mL. Therefore the total amount of media required was 4 litres.
- The media was prepared in four sets of apparatus simultaneously. A 1000mL conical flask was rinsed with distilled water and marked 'A'. 1000mL of distilled water was added to this flask after measuring using a measuring jar. To this, 5gms of Tryptone, 3gms of Yeast extract, 5gms of NaCl were added. The substances were measured using a weighing machine.
- Sterile tissue paper was used to weigh the substances that were then transferred into the conical flasks. 20gms of Agar was added to the flask. There were three other such 1000mL flasks that were taken and they were marked B, C, D and the same quantity of substances were taken.
- When the Agar was added, it was made sure that it did not stick to the sides of the flask. If it did, it was wiped using cotton. Cotton was rolled in such a way that it acted as a stopper for the flask. This was done to enable steam to pass through while autoclaving. Steam will help to kill any microbes present inside the flasks thereby creating a sterile environment. The Pestle and Mortar and the small glass tubes were enclosed within polythene covers. All of the apparatus i.e. the conical flasks (4+ A), the tubes (which will be used to store the extract) and the Pestle and Mortar were placed in the autoclave at 15lbs pressure/(121°C). The outlet of the

<sup>&</sup>lt;sup>18</sup> M.Dilikumar, Efficacy of leaf extracts of selected medicinal plants against multi-drug resistant strains of *Staphylococcus aureus*, Scientific transactions in Environment and Technovation, 2008, pp 23-27.

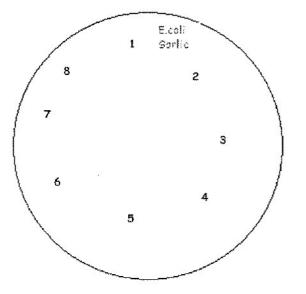
autoclave was closed after some steam escaped. After about half an hour, the apparatus was taken out of the autoclave and placed on a table. But, they were not removed from the plastic covers.

- Working in the sterile conditions of a laminar- airflow chamber, the solution from the flask A was poured into 50 sterile Petri dishes. This was done when the agar had cooled down slightly but was still in liquid form.
- These plates were left undisturbed for 15-20 minutes so as to allow it to set after which they were put in polythene covers and placed in the refrigerator at 4°C. The polythene covers help to prevent any moisture. Next, working in a laminar air-flow chamber (to keep the environment sterile), some bacteria were inoculated from the culture to a nutrient agar medium using sterile inoculation loops. The Petri dish was marked X and incubated at 37°C overnight (The temperature is ideal for the growth of Bacteria).
- The extracts were prepared using a Pestle and Mortar. The Garlic was chopped into tiny pieces (as they will be easy to grind). The *Catharanthus roseus* leaves were separated from their respective stems. 3gms of each substance was weighed and kept aside. 100% Ethanol (7mL) was added to each of the materials in the Pestle and Mortar so as to facilitate easier grinding. They were ground well and the extracts were transferred into small bottles and kept at 4°C overnight.

## **DAY 2:**

- Working in a laminar air-flow chamber, respective bacteria were taken from the Petri dish X using an inoculation loop and introduced into the conical flasks labelled *E. coli* and *Bacillus*. It was made sure that a sufficient quantity of the bacteria culture was taken. The flask was shaken well.
- 200µl of the bacteria culture from the conical flasks labelled *Bacillus* and *E. coli* were added to the respective Petri dishes (Markings are made on the Petri dishes as shown in the figure 1 below) and spread evenly throughout using a spread rod and it was left to dry. The bottles with the extract were placed in a water bath of 65°C to evaporate ethanol. The spread rods were rinsed every time in ethanol (100%) before they were used to spread the bacteria.
- Discs were cut from filter papers using a punching machine. These discs were put in a small glass bottle and autoclaved.
- Meanwhile, the Petri dishes with the nutrient medium (prepared on day 1) were taken and 8 sections were marked on it using a permanent marker. For each of the extract, ten Petri dishes were used. The makings were done as shown below.

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#### Figure 5 – Petri dish setup

The numerical represented the following: 1. Ethanol (control) / \_ \_ \_ m the devices it 'S 2. Gentamicin (antibiotic) 3. 10µl of the extract Also in tobles of alta. 4. 15µl of the extract Did Grow we are tak?

To study the antimicrobial action of every extract, 5 discs soaked in the same extract (say Garlic) were placed in every Petri dish at the marked positions. However, the amount of the extract taken was varied. The discs were soaked in the extracts with the help of a micropipette. There were 10 Petri dishes made for every extract so as to get 50 readings for the action of each extract on each bacterium. After the paper discs and the bacteria spread on the Petri dishes dried, the paper discs were placed on their respective numerals using forceps. Before doing so, the forceps were dipped in alcohol and exposed to the flame of a Bunsen burner every time so as to sterilize it. A Bunsen burner is used because the heat kills the cells of the bacteria. Alcohol is used because it is a surface sterilizing agent. After the discs were placed,

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Session. May 2009 the Petri dishes were placed in an incubator at 37°C. The results were observed the next day. The diameter of the halo around the antimicrobial extracts was measured using a ruler.

18,

Ethanol and disc were placed as control so as to ascertain that they themselves do not possess any antimicrobial properties. Gentamicin discs were placed to evaluate the efficacy of - Disces will ethonol and Disces with within (dog) or alt ...? the plant extracts.

2.5 Weakness and Improvement:

SNO	WEAKNESS	IMPROVEMENT
1	The extracts from plants are Crude extracts only.	The pure extract to be used for better results. Pure extracts can be prepared by using HPLC( High performance liquid Chromatography). HPLC is widely used in the fields of Biochemistry and analytical Chemistry to separate, identify and quantify compounds. This is a form of column chromatography. which campare to un Yeth the set of the set o
2		The experiment can be performed throughout the year during different

## 2.6 Statistical analysis:

Statistical analysis was performed using a two-tailed test

Mean<sup>19</sup>:  $\sum x$ 

<sup>&</sup>lt;sup>19</sup>Lipschutz, Seymour, Schiller, John Introduction to Probability and Statisctics, Tata McGraw-Hill Publishing company Ltd.New Delhi,2005,p5

Standard deviation<sup>20</sup>: 
$$\frac{\sqrt{\sum (x1 - \bar{x}1)^2 + \sum (x2 - \bar{x}2)^2}}{(n1 + n2 - 2)}$$

 $\bar{x}$  1 = mean of the first sample

 $\mathbf{\bar{x}2}$  = mean of the second sample

$$n_1 =$$
Size of the first sample [here  $n_1 = 50$ ]

$$n_2 = size of the second sample [here n_2 = 50]$$

t-test: To test for the significance of the difference between two sample means, we use the following formula.

 $\frac{(mean1 - mean2) \times \sqrt{n1 \cdot n2}}{s \times \sqrt{n1 + n2}}$ 

n1 = size of the first sample

n2= size of the second sample

s= standard deviation

Degree of freedom<sup>21</sup>  $Df = n_1 + n_2 - 2$ 

= 98

<sup>&</sup>lt;sup>20</sup> Lipschutz, Seymour, Schiller, John Introduction to Probability and Statiscics, Tata McGraw-Hill Publishing company Ltd.New Delhi, 2005, p9

<sup>&</sup>lt;sup>21</sup> Damon, Andy, McGonegal, Randy, Tosto, Patricia, Biology developed specifically for the IB Diploma, Pearson Education Limited. UK, 2007, pp1-10

# **CHAPTER 3 : DATA COLLECTION AND PROCESSING:**

Escherichia coli	with int			
Group Statistics	N	Mean	Std. Deviation	
Gentamicin	50	22.1	0.81	
Garlic on E. coli 10ul	50	21.24	1.15	
Garlic on E. coli 15ul	50	23.98	1.41	
Ethanol(control)	50	0.07	0.00	]

Gentamicin	50	23.78	0.97
Vinca rosea on E.coli 10ul	50	21.92	0.88
Vinca rosea on E.coli 15ul	50	23.72	0.88
Ethanol (control)	50	0	0.00

Bacillus subtilis		/	with
Group Statistics	N	Mean	Std. Deviation
Gentamicin	50	20.12	1.35
Garlic on Bacillus 10ul	50	21.64	1.14
Garlic on Bacillus 15ul	50	23.36	1.14
Ethanol(control)	50	0	0.00
Gentamicin	50	20.24	1.61
Vinca rosea on Bacillus10ul	50	21.46	1.66
Vinca rosea on Bacillus15ul	50	23.72	1.50
Ethanol (control)	50	0	0.00

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# Chapter 4: ANALYSIS AND INTERPRETATION

# 4.1 T-Value table For *E.coli*

SNO	SNO Comparison	
1a	Gentamicin and Garlic [10ul]	4.308
b	Gentamicin and Garlic [15ul]	8.178
2 a	Control and garlic [10ul]	130.281
b	Control and garlic [15ul]	120.529
3 a	Gentamicin and Vinca rosea[10ul]	10.030
b	Gentamicin and Vinca rosea [15ul]	0.323
4 a	control and Vinca rosea [10ul]	176.754
b	control and Vinca rosea [15ul]	190.261
5 a	Garlic and Vinca rosea [10ul]	3.320
b	Garlic and Vinca rosea [15ul]	1.107

### For Bacillus:

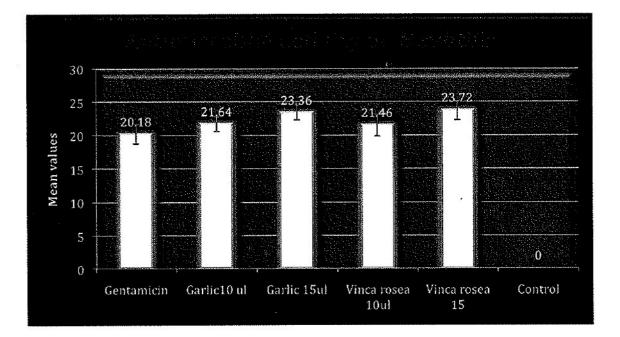
Sl.No.	Comparison	t-value	
1. a.	Gentamicin and Garlic [10ul]	6.086	
b.	Gentamicin and Garlic [15ul]	12.974	
2. a.	Control and Garlic [10ul]	134.396	
b.	Control and Garlic [15ul]	145.078	
3. a.	Gentamicin and Vinca rosea [10ul]	3.734	
b	Gentamicin and Vinca rosea [15ul]	11.184	

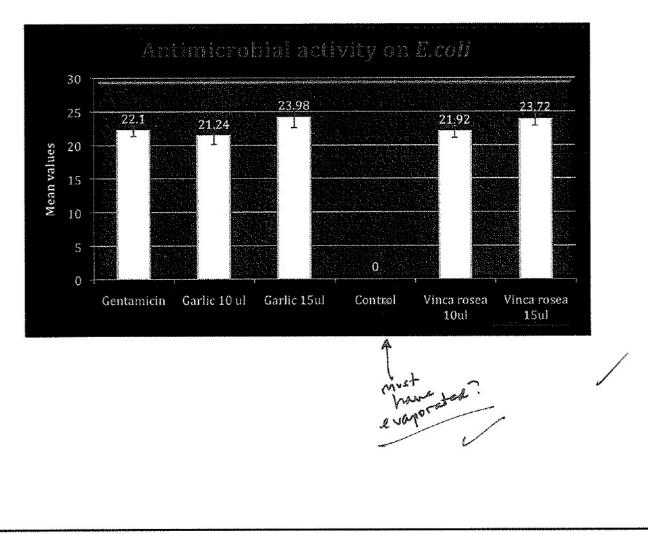
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		Session. May 2009	
4.a.	Control and Vinca rosea [10ul]	91.618	
b	Control and Vinca rosea [15ul]	111.903	
5. a.	Garlic and Vinca rosea [10ul]	0.633	
b	Garlic and Vinca rosea [15ul]	1.352	

<u>22</u>

# 4.2 GRAPHS:





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# 4.3 Interpretation:

# **TESTING HYPOTHESIS 1:**

# **Comparison of Control and Garlic:**

Null hypothesis: The plant extracts will not have an effect on the growth of *Escherichia coli* and *Bacillus subtilis* 

Positive hypothesis: The plant extracts will reduce the growth of *Escherichia coli* and *Bacillus subtilis* 

### On E.coli:

# <u>15µl:</u>

In the comparison between Garlic and the control, the t-value obtained was 130.281 at the 98 degree of freedom [p<0.05] which is more than the table value. Therefore the positive hypothesis 1 can be accepted. The results indicate that Garlic reduces the growth of *E.coli* 

## <u>10µl:</u>

In the comparison between Garlic and the control, the t-value obtained was 120.529 at the 98 degree of freedom [p<0.05] which is more than the table value. Therefore the positive hypothesis1 can be accepted. The results indicate that Garlic reduces the growth of *E.coli*.

### On Bacillus:

# <u>15µl:</u>

In the comparison between the effect of Garlic and control, the t-values obtained were 134.396 at 98 degree of freedom[p<0.05] which is more than the table value. The positive hypothesis 1 can thus be accepted. The results indicate that Garlic reduces the growth of *B.subtilis* 

### <u>10µl:</u>

In the comparison between the effect of Garlic and control, the t-values obtained were 145.078 at 98 degree of freedom[p<0.05] which is more than the table value. The positive hypothesis1 can thus be accepted. The results indicate that Garlic reduces the growth of *B.subtilis* 

Comparison between Control and Vinca rosea:

On *E.coli*: <u>15µl:</u>

In the comparison between Vinca rosea and the control, the t values obtained was 176.754 at 98 degree of freedom[p<0.05] which is more than the table t-value. The positive hypothesis1 can therefore be accepted. The results indicate that Vinca rosea reduces the growth of *E.coli* 

#### 10µ1:

In the comparison between Vinca rosea and the control, the t values obtained was and 190.261 at 98 degree of freedom [p<0.05] which are more than the table t-value. The positive hypothesis1 can therefore be accepted. The results indicate that Vinca rosea reduces the growth of *E.coli* 

# On *Bacillus*: 15µl:

In the comparison between the Control and Vinca rosea on *Bacillus*, the t-values obtained was 91.618 at 98 degrees of freedom [p<0.05] which is more than the table value and therefore the positive hypothesis1 can be accepted. The results indicate that Vinca rosea reduces the growth of B.subtilis

#### 10µl:

In the comparison between the Control and Vinca rosea on *Bacillus*, the t-values obtained was 111.903 at 98 degrees of freedom [p<0.05] which is more than the table value and therefore the positive hypothesis1 can be accepted. The results indicate that Vinca rosea reduces the growth of B.subtilis

#### **TESTING HYPOTHESIS 2:**

Null hypothesis: There will be no difference in the antimicrobial activity of Gentamicin and the plant extract

Positive hypothesis: There will be a difference in the antimicrobial activity of Gentamicin and the plant extract

#### **Comparison of Gentamicin and Garlic:**

On *E.coli*: 15µl :

In the comparison between Gentamicin and Garlic the t-value obtained is 8.178 at the 98 degrees of freedom [p<0.05] which is less than the table value. Therefore, null hypothesis 2, which indicates that the effect of Garlic on *E.coli* is similar to the antibiotic, can be accepted.

#### 10µl :

In the comparison between Gentamicin and Garlic the t-value obtained is 4.308 at the 98 degrees of freedom [p<0.05] which is less than the table value. Therefore, the null hypothesis 2, which indicates that the effect of Garlic on *E.coli* is similar to the antibiotic, can be accepted.

# **TESTING HYPOTHESIS 3:**

Null Hypothesis: There is no difference in the antimicrobial effect of the two extracts.

Positive Hypothesis: There is a difference in the antimicrobial effect of the two extracts.

#### **Comparison of Garlic and Vinca rosea:**

On *E.coli* <u>15µl :</u>

In the comparison of Garlic and Vinca rosea the t-value obtained is 3.320 at 98 degrees of freedom [p<0.05] which is less than the table value. Therefore the null hypothesis 3 can be accepted.

#### <u>10µl:</u>

In the comparison of Garlic and Vinca rosea the t-value obtained is 1.107 at 98 degrees of freedom [p<0.05] which is less than the table value. Therefore the null hypothesis 3 can be accepted.

#### On *Bacillus* 15ul:

In the comparison of Garlic and Vinca rosea the t-value obtained is 0.633 at 98 degree of freedom [p<0.05] which is less than the table value. Therefore the null hypothesis 3 can be accepted.

#### <u>10µl:</u>

In the comparison of Garlic and Vinca rosea the t-value obtained is 1.352 at 98 degree of freedom [p<0.05] which is less than the table value. Therefore the null hypothesis 3 can be accepted.

#### 4.4 Discussion:

The results indicated that the plant extracts reduce the growth of *E. coli* and *Bacillus subtilis*. The effect was seen to increase with an increase in concentration of the two extracts. From the calculated t-values, it can be observed that the antimicrobial effect of the Garlic and Vinca rosea extracts are quite similar to that of Gentamicin (antibiotic). Plant extracts can thus be a natural alternative to antibiotics. The antimicrobial effect of Garlic is due to the presence of Allicin, which disrupts the cell membrane biosynthesis by interfering with the DNA and RNA synthesis<sup>22</sup>. From the bar graph, it can be noted that Garlic and Vinca rosea have a greater antimicrobial effect on *E. coli* (gram negative) than on *Bacillus subtilis* (gram positive). This result was similar to the *r*esult observed by Mr. Pankaj

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Goyal<sup>23</sup>. It can therefore be concluded that *Bacillus* has a mild inhibitory effect<sup>24</sup>. This could be due to a difference in the cell wall composition between the two organisms<sup>25</sup>. The composition of the growth medium could potentially affect antimicrobial activity. As published in the Journal of ethnopharmacology, the antimicrobial effect of Garlic was found to be greater in media lacking tryptone or cysteine indicating that the effects might involve sulfhydryl reactivity<sup>26</sup>. Also, the efficacy of herbal compounds extracted from plants depends largely on the type of solvent used for extraction<sup>27</sup>. Here, the solvent used was 100% ethanol. Extracts prepared in methanol are known to have better antimicrobial-activity. Inspite of me using a media that contained tryptone and preparing the extracts in 100% ethanol rather than in methanol, the antimicrobial effect observed was profound. The effect, however, could have been of a greater magnitude.

Chapter 5 - CONCLUSION: Serve effect. and the best of the first the first of the content of the sativum reduce the growth of Escherichia coli and Bacillus subtilis and that the effect is more with increase in concentration of the extracts. The plant extract show similar antimicrobial activity to the antibiotic Gentamicin. Also, both the plant extracts had a similar antimicrobial effect on both cultures. They both had a higher effect on Escherichia coli than Bacillus subtilis

#### 5.1 Extensions:

- The efficacy of the plant extracts can be compared with antibiotics other than Gentamicin. The plant extract of Neem showed a very mild effect on the cultures of E. coli and Bacillus as observed in the pilot survey. However, the antimicrobial effect of this extract was not explored. Further studies on this could be done.
- The experiment's result can be observed by using 100% pure extracts. Ways to extract a 100% pure extract can be explored.

<sup>23</sup> Pankaj Goyal.Invitro evaluation of crude extracts of Catharanthus roseus for potential antibacterial activity, International journal of green pharmacy July-September 2008, pp 176-181

<sup>27</sup> P. Kaushik, In vitro evaluation of Datura innoxia for potential antibacterial activity, Indian J. Microbial. September 2008; pp 353-357.

<sup>&</sup>lt;sup>24</sup> Pankaj Goyal, Invitro evaluation of crude extracts of *Catharanthus roseus* for potential antibacterial activity. International journal of green pharmacy July-September 2008, pp 176-181

<sup>&</sup>lt;sup>25</sup>P. Kaushik, Indian J. Microbial, September 2008, pp 353 – 357.

<sup>&</sup>lt;sup>26</sup>J.L. R'ios, Journal of ethnopharmacology 100;(Spain.Departament de Farmacolog'ia, Facultat de Farm'acia, Universitat de Val'encia. 2005), pp 80-84,

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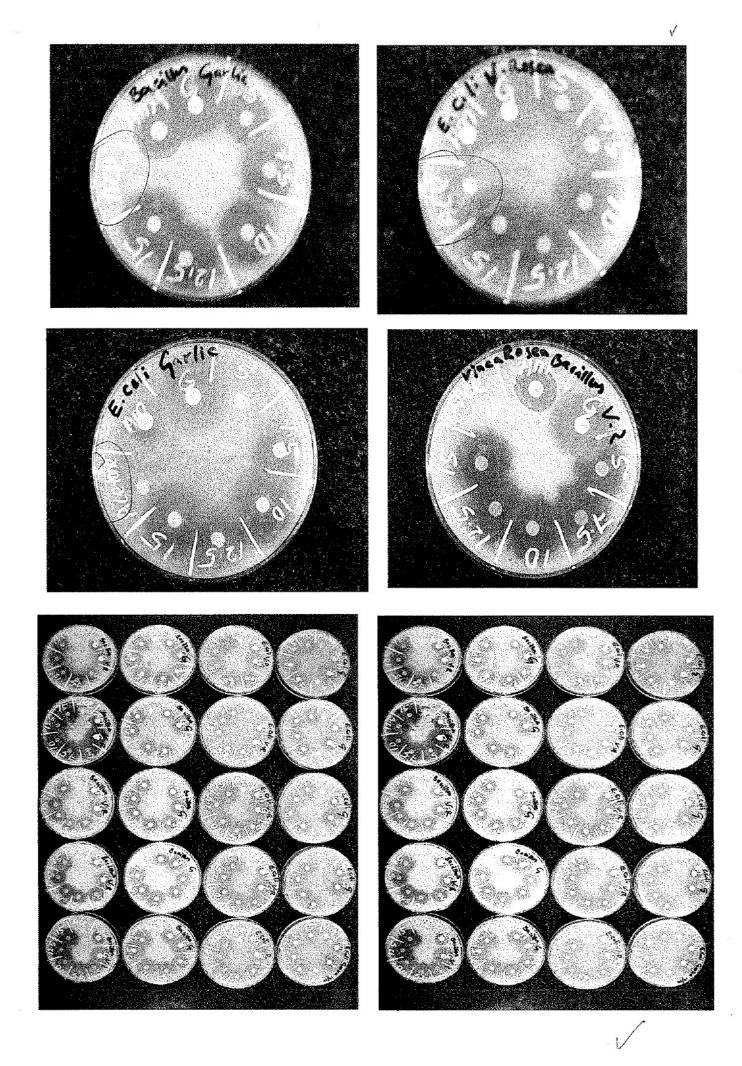
P. Kaushik. In vitro evaluation of *Datura innoxia* for potential antibacterial activity. Indian J. Microbial. September 2008.

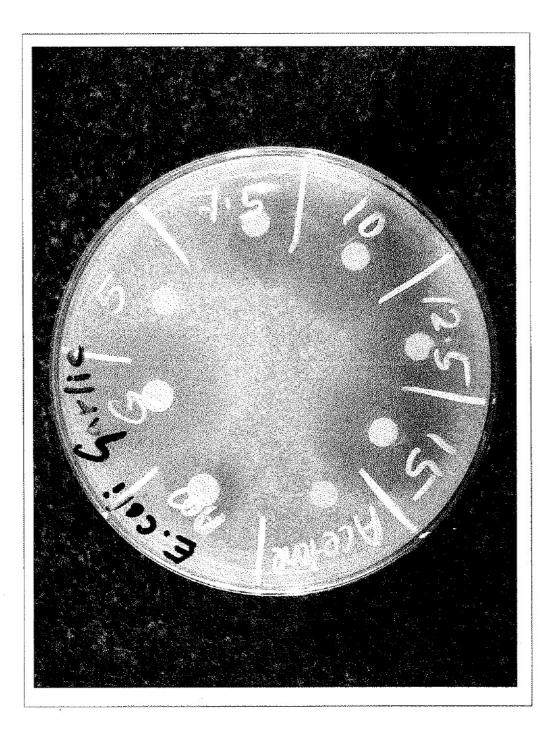
Pankaj Goyal. Invitro evaluation of crude extracts of *Catharanthus roseus* for potential artibacterial activity. International journal of green pharmacy July-September 2008,

F. Kaushik. Indian J. Microbial. September 2008, .

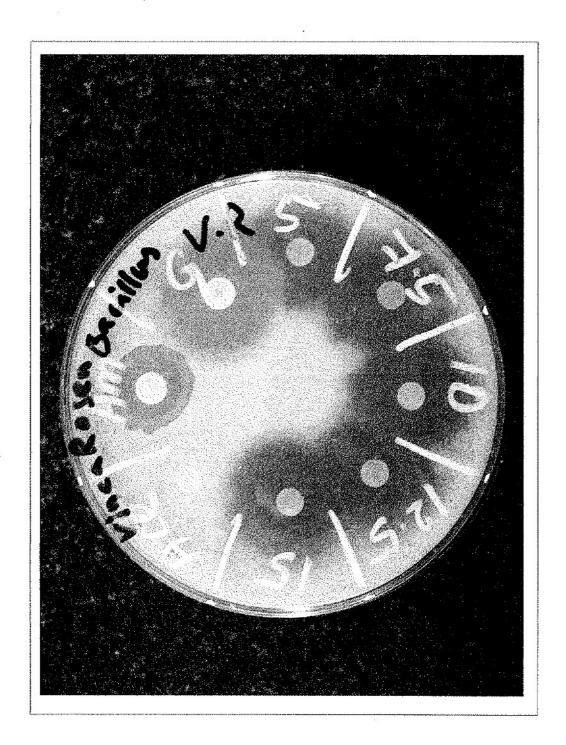
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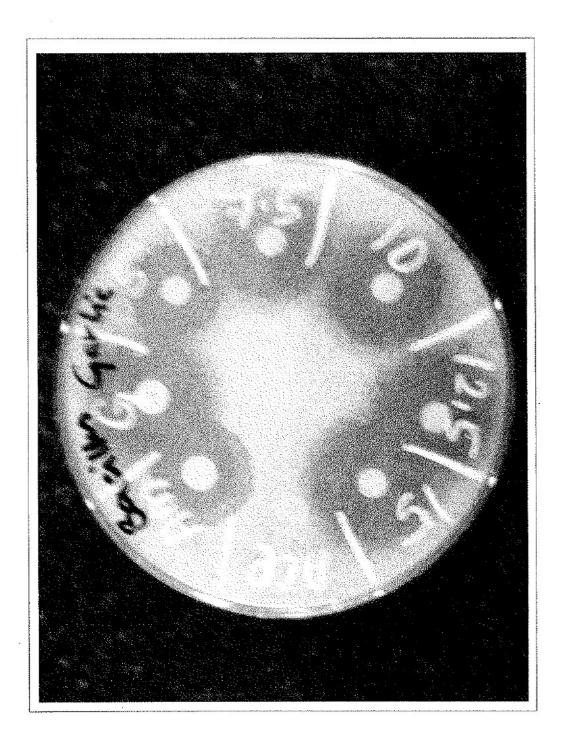
Wikipedia.com?

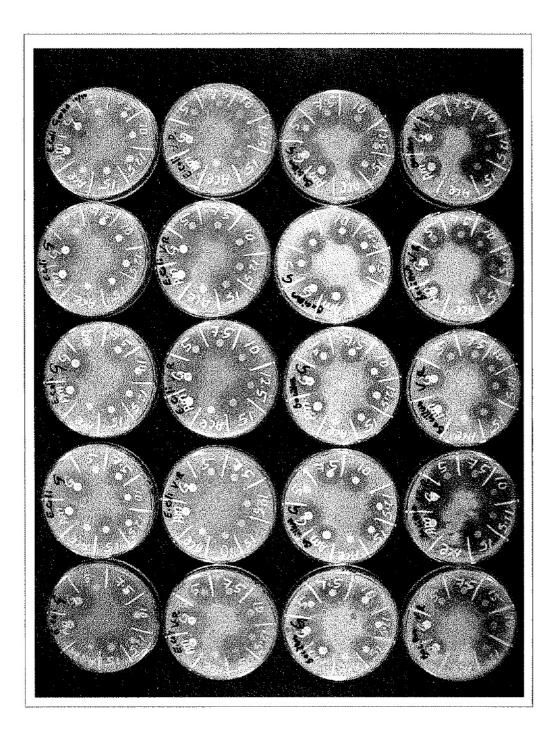




V







## APPENDIX -A

Plate No. 1 /	Acetone	Ampicillin	Cantamuni	5ul	7 5.4	10 ul	12.5 ul	15
And the second s		Paripionai	Gentamyci	Sui	7.5ul	iv ui	12.0 01	15 ul
and the second s	0	15	23	0	21	22	25	26
Plate No. 2	0	14	22	0	22	22	22	23
Plate No. 3	0	14	22	0	20	20	22	23
Plate No. 4	0	14	22	0	22	23	23	23
Plate No. 5	0	15	21	0	17	17	19	20
Plate No. 6	0	15	23	0	20	21	21	23
Plate No. 7	0	15	22	0	21	21	21	23
Plate No. 8	0 0	16	23	0	20	23	23	25
Plate No. 9	0	15	23	0	21	22	23	24
Plate No. 10	0	15	23	Ő	20	21	22	23
Plate No. 10	0	16	21	0	20	20	22	24
Plate No. 12	0	15	22	ō	21	21	22	23
Plate No. 12 Plate No. 13	0	14	21	0	21	21	23	23
a second and a second	0	15	23	0	20	21	21	24
Plate No. 14			23	0	19	22	23	26
Plate No. 15	0	15	23	0	20	21	23	20
Plate No. 16	0	15	23	0	20	21	23	24
Plate No. 17	. 0	15	23	0	18	20	23	25
Plate No. 18	0	16		0		20	23	23
Plate No. 19	0	14	21		19		23	24
Plate No. 20	0	15	22	0	18	21		
Plate No. 21	0	15	22	0	20	21	23	24
Plate No. 22	0	16	22	0	21	21	22	23
Plate No. 23	0	14	21	0	20	21	21	24
Plate No. 24	0	15	21	0	18	22	22	25
Plate No. 25	0	14	23	0	19	20	20	23
Plate No. 26	0	15	23	0	18	23	23	24
Plate No. 27	0	15	21	0	18	23	23	25
Plate No. 28	0	15	22	0	21	22	23	26
Plate No. 29	0	16	22	0	22	23	23	24
Plate No. 30	0	15	23	0	20	21	21	22
Plate No. 31	· 0	15	23	0	18	20	20	22
Plate No. 32	0	14	21	0	20	21	21	21
Plate No. 33	0	14	22	0	19	20	24	25
Plate No. 34	0	15	23	0	18	21	23	26
Plate No. 35	0	14	22	0	18	21	24	26
Plate No. 36	0	15	23	0	21	23	23	25
Plate No. 37	0	16	22	0	18	22	23	26
Plate No. 38	0	15	22	0	21	22	22	23
Plate No. 39	0	14	22	0	21	23	23	24
Plate No. 40	0	14	23	0	22	22	23	23
Plate No. 41	Ō	15	21	0	22	22	23	26
Plate No. 42	1 0	15	21	0	21	21	22	24
Plate No. 43	0	16	23	0	19	21	22	26
Plate No. 44	0	14	23	0	21	21	21	23
Plate No. 45	0	14	23	0	20	20	21	23
Plate No. 46	0	14	21	0	20	20	24	26
Plate No. 40		14	21	0	20	20	22	23
		14	21	0	21	21	22	23
Plate No. 48	And the second s			0			22	23
Plate No. 49	0	14	21	0	20	20 21	22	23
Plate No. 50	0	16			20	And the last of the last state		
Avg				0	20	21	22	
SD	1	0.69	0.81	0.00	1.31	1.15	1.15	1.

\* All values are in mm

3	Acetone		Bacillus [n= Gentamyci]	5ul I	7.5ul	10 ul	12.5 ul	15 ul
late No. 1	0	18	20	18	19	21	21	21
late No. 2	0	17	19	0	20	20	18	20
Plate No. 3	0	20	22	20	22	23	23	25
late No. 3	0	19	18	18	20	22	20	21
Plate No. 5	0	18	20	18	20	20	21	21
Plate No. 6	0	18	20	21	21	22	22	23
	0	19	19	18	20	20	20	22
Plate No. 7	0	19	18	18	20	23	23	24
Plate No. 8	0	20	22	20	20	21	21	23
Plate No. 9		2	22	19	20	22	22	23
Plate No. 10	0	18	18	19	20	22	23	23
Plate No. 11	0	18					20	24
Plate No. 12	0	18	19	18	19	20		
Plate No. 13	0	18	22	20	20	20	21	22
Plate No. 14	0	18	22	18	18	21	22	23
Plate No. 15	0	18	20	18	19	20	20	23
Plate No. 16	0	19	20	19	19	23	23	24
Plate No. 17	0	20	21	19	21	23	23	23
Plate No. 18	0	18	19	20	20	20	21	22
Plate No. 19	0	20	21	20	21	22	22	22
Plate No. 20	0	18	21	18	20	21	21	23
Plate No. 21	0	18	22	17	20	22	23	24
Plate No. 22	0	17	18	21	22	23	23	25
Plate No. 23	0	19	19	19	20	20	21	24
Plate No. 24	0.	19	20	19	21	21	21	23
Plate No. 25	0	17	20	18	20	22	22	23
Plate No. 26	0	18	20	20	20	21	22	23
Plate No. 27	0	17	21	20	20	23	22	24
Plate No. 28	0	19	22	18	20	21	22	25
Plate No. 29	0	17	21	19	20	22	23	24
Plate No. 30	0	20	21	18	21	23	23	25
Plate No. 31	0	17	22	18	19	22	22	23
Plate No. 32	0	17	20	21	21	22	23	25
Plate No. 33	0	20	19	20	20	23	23	24
Plate No. 34	0	17	19	20	20	21	21	23
Plate No. 35	0	19	19	19	19	22	23	24
Plate No. 36	0	17	18	20	20	21	21	24
Plate No. 37	. 0	18	18	18	20	22	22	24
Plate No. 38	0	17	20	19	19	23	23	25
Plate No. 39	0	20	20	20	22	23	23	24
Plate No. 40	0	17	19	21	22	23	24	25
Plate No. 41	0	18	20	18	21	22	22	23
Plate No. 42	Ō	20	22	19	20	20	21	24
Plate No. 43	0	19	21	18	19	20	20	23
Plate No. 44	0	20	21	21	21	21	21	23
Plate No. 45	ŏ	18	23	18	18	20	20	24
Plate No. 46	0	18	18	20	20	21	21	23
Plate No. 47	0	20	20	21	22	23	22	24
Plate No. 48	1 0	18	20	22	22	23	23	24
Plate No. 49	<del>o</del>	18	20	20	20	20	22	23
Plate No. 50	ŏ	20	20	19	20	23	23	23
Avg				19	22 20	23	23	24
sD				2.95	1.02	1.14	1.20	1.1
All values an	L	<u>1.07</u>	1.30	2.30	1.02	1.14	1.20	1. 1

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Antimicrobial	and the second se					40	40.5	A #* !
<b>)</b>	Acetone		Gentamyci	5ul	7.5ul	10 ul	12.5 ul	<u>15 ul</u>
Plate No. 1	0	15	26	20	22	22	23	25
Plate No. 2	0	14	24	19	20	20	21	21
Plate No. 3	0	14	24	20	20	22	25	25
Plate No. 4	0	15	23	20	20	22	24	24
Plate No. 5	0	15	24	20	20	23	23	24
Plate No. 6	0	15	24	19	20	21	22	23
Plate No. 7	0	14	25	20	20	20	22	24
Plate No. 8	0	15	24	20	20	21	21	23
Plate No. 9	0	15	26	20	20	22	22	24
Plate No. 10	0	14	24	20	20	22	23	25
Plate No. 11	0	15	24	19	20	21	22	23
Plate No. 12	0	15	26	18	19	20	23	24
Plate No. 13	0	14	24	20	20	22	22	24
Plate No. 14	ō	14	23	19	21	22	22	23
Plate No. 15	ō	15	23	20	21	23	23	23
Plate No. 16	0	14	23	20	21	23	23	23
Plate No. 17	0	14	23	19	20	23	23	22
Plate No. 17	0	15	24	20	20	23	23	23
Plate No. 18	0	15	23	20	20	23	23	23
CALL AND AND AND A REAL PROPERTY OF A REAL PROPERTY								24
Plate No. 20	0	15	24	19	21	22	23	
Plate No. 21	0	14	25	20	20	22	23	24
Plate No. 22	0	14	23	20	21	23	24	25
Plate No. 23	0	15	23	20	20	22	22	23
Plate No. 24	0	14	25	19	21	23	23	24
Plate No. 25	0	15	23	20-	20	22	24	24
Plate No. 26	0	15	23	19	20	21	22	23
Plate No. 27	0	15	24	20	20	22	22	23
Plate No. 28	0	14	23	19	20	22	23	24
Plate No. 29	0	14	23	20	21	23	23	24
Plate No. 30	0	15	25	20	21	23	24	25
Plate No. 31	0	14	23	19	20	22	24	26
Plate No. 32	0	14	23	19	20	23	24	24
Plate No. 33	0	15	23	21	20	22	24	23
Plate No. 34	0	15	24	20	21	23	24	24
Plate No. 35	0	15	23	19	21	23	23	23
Plate No. 36	0	15	23	20	20	21	22	24
Plate No. 37	0	14	24	19	22	22	23	24
Plate No. 38	0	14	25	20	21	21	23	23
Plate No. 39	0	15	23	20	22	22	23	23
Plate No. 40	0	15	26	19	21	22	23	23
Plate No. 41	Ő	15	23	20	22	23	23	24
Plate No. 42	0	10	23	20	21	21	22	23
Plate No. 43	0	14	24	20	20	20	23	23
Plate No. 44	0	15	25	20	20	20	23	24
Plate No. 45	0	14	23	20	20	22	24	<u>24</u> 25
Plate No. 46	0	15	23	19	20		and a second s	
Plate No. 47	0	15	23			21	23	23
				20	20	22	24	24
Plate No. 48	0	14	24	20	20	21	23	23
Plate No. 49	0	15	23	19	21	22	23	24
Plate No. 50	0	15	22	18	20	23	24	25
Avg	0		24	20	20	22	23	2
SD	0	0.50	0.97	0.60	0.68	0.88	0.87	0.8

D	Acetone	Ampicillin	Gentamyci	5ul	7.5ul	10 ul	12.5 ul	15 ul
Plate No. 1	0	17	18	17	17	18	20	21
Plate No. 2	0	17	17	17	17	20	17	20
Plate No. 3	0	17	18	17	17	18	18	18
Plate No. 4	0	17	24	23	24	25	27	28
Plate No. 5	0	17	24	20	24	25	25	25
Plate No. 6	0	17	17	18	19	20	20	23
Plate No. 7	0	17	18	19	19	19	20	22
Plate No. 8	0	16	18	18	19	19	20	23
Plate No. 9	0	16	19	19	20	20	20	22
Plate No. 10	0	17	21	20	20	20	21	23
Plate No. 11	Ō	16	23	21	21	23	23	24
Plate No. 12	Ō	17	22	21	21	23	24	24
Plate No. 13	Ō	16	21	22	23	24	25 ·	25
Plate No. 14	Ō	17	20	21	22	23	23	24
Plate No. 15	0	16	21	20	21	23	23	24
Plate No. 16	0	10	20	21	21	22	23	23
Plate No. 17	0	16	22	21	21	22	23	23
Plate No. 18	0	16	23	18	20	21	23	24
Plate No. 19	0	16	21	17	19	20	22	23
Plate No. 20	0 0	16	21	18	19	20	22	23
Plate No. 21	0 0	16	22	18	19	20	23	23
Plate No. 21	ō	17	21	18	20	20	23	24
Plate No. 22 Plate No. 23	0 0	17	21	17	19	20	23	23
Plate No. 24	0	16	21	17	20	20	22	23
Plate No. 25	0	16	23	18	20	23	23	23
Plate No. 26	0	16	23	17	19	23	23	
**************************************	0	And and an an an and an						24
Plate No. 27		16	20	18	18	23	24	24
Plate No. 28	0	16	20	17	19	22	24	24
Plate No. 29	0	16	20	18	20	20	22	23
Plate No. 30	0	16	20	17	20	22	24	25
Plate No. 31	0	17	18	18	20	21	23	25
Plate No. 32	0	16	19	. 18	20	23	24	25
Plate No. 33	0	16	18	18	20	22	23	25
Plate No. 34	0	17	20	17	19	21	23	25
Plate No. 35	0	17	18	17	17	20	24	25
Plate No. 36	0	17	20	18	20	21	23	25
Plate No. 37	0	16	20	18	20	22	25	25
Plate No. 38	0	17	20	19	19	21	24	25
Plate No. 39	0	17	20	21	21	23	23	24
Plate No. 40	0	16	21	17	20	21	24	25
Plate No. 41	0	16	20	20	20	20	22	23
Plate No. 42	0	17	20	23	23	23	23	24
Plate No. 43	0	16	20	23	23	23	23	24
Plate No. 44	0	16	20	22	24	24	25	25
Plate No. 45	0	16	20	22	23	23	23	24
Plate No. 46	0	17	20	23	23	23	25	25
Plate No. 47	0	17	20	17	20	20	21	23
Plate No. 48	0	17	20	19	20	20	23	23
Plate No. 49	0	17	21	20	20	21	21	24
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c on E.coli 1           x2           22           20           23           17           21           23           21           23           21           23           21           23           21           23           21           22           21           22           21           22           21           22           21           22           21           22           21           22           21           22      <	d1=x1-X1 1 0 0 0 -1 1 1 0 -1 1 -1 -1 -1 1 0 -1 1 0 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1	1 1 -1 2 -4 0 0 0 2 1 0 -1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	d1xd1 0.81 0.01 0.01 1.21 0.81 0.81 0.81 1.21 0.01 1.21 0.81 0.81 0.81 0.81 0.81 0.81 0.81 0.81	d2xd2 0.5 0.5 1.5 3.1 17.9 0.0 0.0 0.0 3.1 0.5 0.0 1.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
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	0	17	0	-4	0	17.98
	0	21	0	0	0	0.06
[	0	21	0	0	0	0.06
	0	23	0	2	0	3.10
	0	22	0	1	0	0.58
	0	21	0	0	0	0.06
	0	20	0	-1	0	1.54
	0	21	0	0	0	0.06
	0	21	0	0	0	0.06
	0	21	0	0	0	0.06
	0	22		1	0	0.58
	0	21	0	0	0	0.06
	0	23	0	2	0	3.10
	0	20	0	-1	0	1.54
	0	20	0	-1	0	1.54
	0	21	0	0	0	0.06
	0	21	0	0	0	0.06
	0	21	0	0	0	0.06
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н.	0	23	0	2	0	3.10
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c c	0 0 0 0 0 0.0 0.00	21 21 20 21	0 0 0 0 0	0 0 -1	0 0 0 0	0.06 1.54 0.06
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D   2	0 0 0 0 0.0 0.0 0.00 50 50	21 21 20 21 21.24	0 0 0 0 0	0 0 -1	0 0 0 0	0.06 1.54 0.06
D             	0 0 0 0.0 0.0 0.00 50 50 50 Deviation	21 21 20 21 21.24 1.15	0 0 0 0	0 0 -1 total		0.06 1.54 0.06
D 2 tandard I =sq.rt of(	0 0 0 0.0 0.0 50 50 50 Deviation	21 20 21 21.24 1.15 square)+(s	0 0 0 0 0	0 0 -1 total quare))/n1-	0 0 0 0 0	0.06 1.54 0.06
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) 2 Landard I =sq.rt of(	0 0 0 0.0 0.0 50 50 50 Deviation	21 20 21 21.24 1.15 square)+(s	0 0 0 0 0	0 0 -1 total quare))/n1- 65.12 98	0 0 0 0 0	0.06 1.54 0.06
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<b>=sq.rt of(</b> um of d1:	0 0 0 0.0 50 50 2eviation ((sum of d1 square)+(su	21 21 20 21.24 1.15 square)+(s im of d2squ n1+n2-2 =	0 0 0 0 5um of d2s aare) = S=	0 0 -1 0 total quare))/n1- 65.12 98 0.66449 0.815162	0 0 0 0 0	0.06 1.54 0.06
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D I <b>andard I</b> =sq.rt of( um of d1s = (Miean ) ean X1 -	0 0 0 0.00 50 50 Deviation ((sum of d1 square)+(su	21 21 20 21.24 1.15 square)+(s im of d2squ n1+n2-2 = (2/S)(sqrt c	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	quare))/n1- 65.12 98 0.66449 0.815162 +n2) 0.86	0 0 0 0	0.00 1.54 0.00
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SD 0.00 1.41 n1 50	D) Non co	atrol ve Ga	die op E co	li 15ul			
0         26         0         2         0         4.08           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         20         0         -4         0         0.96           0         23         0         -1         0         0.96           0         24         0         0         0         0.06           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0	D) Neg col				d2=x2-X2	d1xd1	d2xd2
0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         24         0         0         0         0.00           0         24         0         0         0         0.96           0         23         0         -1         0         0.96           0         24         0         0         0         0.00           0         25         0         1         0         1.04           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         23         0         -1         0         .96           0         24         0         0         0         0.							
0         23         0         -1         0         0.96           0         20         0         -4         0         1.84           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         23         0         -1         0         0.96           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0 <td< td=""><td></td><td></td><td></td><td></td><td>**************************************</td><td></td><td></td></td<>					**************************************		
0         23         0         -1         0         9.6           0         23         0         -1         0         9.6           0         23         0         -1         0         9.6           0         23         0         -1         0         9.6           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         24         0         0         0         0.00           0         23         0         -1         0         0.6           0         24         0         0         0         0.00           0         25         0         1         0         1.04							
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$ \begin{array}{ c c c c c c c c } \hline 0 & 23 & 0 & -1 & 0 & 0.96 \\ \hline 0 & 26 & 0 & 2 & 0 & 4.08 \\ \hline 0 & 24 & 0 & 0 & 0 & 0.00 \\ \hline 0 & 26 & 0 & 2 & 0 & 4.08 \\ \hline 0 & 23 & 0 & -1 & 0 & 0.96 \\ \hline 0 & 20 & 0 & -1 & 0 & 0.96 \\ \hline 0 & 20 &$							
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0         26         0         2         0         4.08           Mean         0.0         23.98         0 total         0         96.98           SD         0.00         1.41         0         96.98           n1         50         50         50           Standard Deviation         S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2         (sum of d1square)+(sum of d2square) =         96.98           n1+n2-2 =         98         0.989592         S=         0.989592           S=         0.994782         S=         0.994782           t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)         0.86         5           Mean X1 - Mean X2/S =         -24.10578         0.86           sqrt of n1n2/n1+n2 =         25         5					and the second se		
Mean         0.0         23.98         0 total         0         96.98           SD         0.00         1.41         0         96.98           n1         50         50         50         0           Standard Deviation         S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2         98         0.989592           (sum of d1square)+(sum of d2square) =         96.98         0.989592         98           0.989592         S=         0.994782         1           t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)         0.86         0.86           sqrt of n1n2/n1+n2         25         5		0					THE REAL PROPERTY AND ADDRESS OF THE PARTY
SD $0.00$ $1.41$ n1 $50$ standard Deviation         S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2         (sum of d1square)+(sum of d2square) = $96.98$ $n1+n2-2 =$ $98$ $0.989592$ $S=$ S= $0.994782$ t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)         Mean X1 - Mean X2/S = $-24.10578$ $sqrt of n1n2/n1+n2 =$ $25$ $5$	Mean	0.0			£		
n1       50         n2       50         Standard Deviation         S=sq.rt of((sum of d1square)+(sum of d2square) =       96.98         n1+n2-2 =       98         0.989592       S=       0.994782         t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)       0.86         Mean X1 - Mean X2/S =       -24.10578       0.86         sqrt of n1n2/n1+n2 =       25       5	SD	0.00					
Standard Deviation         S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2         (sum of d1square)+(sum of d2square) =       96.98         n1+n2-2 =       98         0.989592       S=       0.994782         t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)       0.86         sqrt of n1n2/n1+n2 =       25         5       5	n1	50					
S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2 (sum of d1square)+(sum of d2square) = 96.98 n1+n2-2 = 98 0.989592 S= 0.994782 t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2) Mean X1 - Mean X2/S = -24.10578 0.86 sqrt of n1n2/n1+n2 = 25 5	n2						
(sum of d1square)+(sum of d2square) = 96.98 n1+n2-2 = 98 0.989592 S= 0.994782 t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2) Mean X1 - Mean X2/S = -24.10578 0.86 sqrt of n1n2/n1+n2 = 25 5							
n1+n2-2 = 98 0.989592 S= 0.994782 t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2) Mean X1 - Mean X2/S = -24.10578 0.86 sqrt of n1n2/n1+n2 = 25 5					quare))/n1-	+n2-2	
$\begin{array}{rcl} 0.989592 \\ S = & 0.994782 \\ t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2) \\ Mean X1 - Mean X2/S = & -24.10578 & 0.86 \\ sqrt of n1n2/n1+n2 = & 25 \\ & 5 \end{array}$	(sum of d1	square)+(sı		are) =			
S=         0.994782           t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)           Mean X1 - Mean X2/S =         -24.10578         0.86           sqrt of n1n2/n1+n2 =         25         5			n1+n2-2 =		98		
t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2) Mean X1 - Mean X2/S = -24.10578 0.86 sqrt of n1n2/n1+n2 = 25 5					0.989592		
Mean X1 - Mean X2/S = -24.10578 0.86 sqrt of n1n2/n1+n2 = 25 5							
sqrt of n1n2/n1+n2 = 25 5							
5			=				
	sart of n1n	2/n1+n2 =					
1=120:5289 t value be consider as positive					1		
			1=	-120.5289	t value be	consider as	positive

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E) Pos.cor	troi veVin	a rosos or	E.coli 10	1		1
-/ 103.001	x1	x2	d1=x1-X1	d2=x2-X2	d1xd1	d2xd2
	26	22	2	0	4.9284	0.01
	24	20	0	-2	0.0484	3.69
	24	22	0	0	0.0484	0.01
	23	22	-1	0	0.6084	0.01
	24	23	0	1	0.0484	1.17
	24	21	0	-1	0.0484	0.85
	25	20	1	-2	1.4884	3.69
	24	21	0	-1	0.0484	0.85
	26	22	2	0	4.9284	0.01
	24 24	22 21	0	0	0.0484	0.01
	24	20	2	-2	4.9284	3.69
	24	22	0	-2	0.0484	0.03
	23	22	-1	0	0.6084	0.01
	23	23	-1	1	0.6084	1.17
	23	23	-1	1	0.6084	1.17
	24	22	0	0	0.0484	0.01
	23	23	-1	1	0.6084	1.17
	23	22	-1	0	0.6084	0.01
	24	22	0	0	0.0484	0.01
	25	22	1	0	1.4884	0.01
	23	23	-1	1	0.6084	1.17
	23	22	-1	0	0.6084	0.01
	25	23	1	1	1.4884	1.17
	23	22	-1	0	0.6084	0.01
	23 24	21 22	-1	-1	0.6084	0.85
	24	22	-1	0	0.0484	0.01
	23	23	-1	1	0.6084	1.17
	25	23	1	1	1.4884	1.17
	23	22	-1	0	0.6084	0.01
	23	23	-1	1	0.6084	1.17
	23	22	-1	0	0.6084	0.01
	24	23	0	1	0.0484	1.17
	23	23	-1	1	0.6084	1.17
	23	21	-1	-1	0.6084	0.85
	24	22	0	0	0.0484	0.01
	25	21	1	-1	1.4884	0.85
	23	22	-1	0	0.6084	0.01
	26	22	2	0		
	23 23	23 21	-1	1	0.6084	1.17
	23.	21	-1	-1	0.6084	0.85
	25	20	1	-2	1.4884	0.01
	23	22	-1	0	0.6084	0.01
	24	21	0	-1	0.0484	0.85
	23	22	-1	0	0.6084	0.01
	24	21	. 0	-1	0.0484	0.85
	23	22	-1	0	0.6084	0.01
	22	23	-2	1	3.1684	1.17
Mean	23.8	21.92	0	total	46.58	37.68
SD	0.97	0.88				
n1 ~2	50					
n2 Standard I	50					
		square)+(s	tim of do-	anna litera		
		square)+(s im of d2squ		quare)/n11 84.26	112-2	
	-quuie/*(80	n1+n2-2 =	aic) =	04.20 98		
				0.859796		
			S=	0.927252		
t = (Mean )	(1 - Mean )	(2/S)(sart o	-			
Mean X1 -	Mean X2/S		2.005928	0.86		
sart of n1n	2/n1+n2 =		25			
			5			
		t=	10.02964			

'os.cor	strol vsVinc	a rosea or	ı E.coli 15u	I		
			d1=x1-X1	d2=x2- <b>X2</b>	d1xd1	d2xd2
	26	25	2	1	4.9284	1.64
	24	21	0	-3	0.0484	7.40
	24	25	0	1		1.64
	23	24	-1	0		0.08
	24	24	0	Ő		0.08
	24	24	0	-1		
					0.0484	0.52
	25	24	1	0		0.08
	24	23	0	-1	0.0484	0.52
	26	24	2	0	4.9284	0.08
	24	25	0	1	0.0484	1.64
	24	23	0	-1	0.0484	0.52
	26	24	2	0	4.9284	0.08
	24	24	0	0		······
5	23	23	-1	-1	0.6084	0.52
	23	23		-1	0.6084	
			<b>.</b>			
	23	24	-1	0		
	24	22	0	-2		
	23	23	-1	-1		0.52
	23	24	-1	0	0.6084	0.08
	24	23	0	-1	0.0484	0.52
	25	24	1	Ó		
	23	25	-1	1	0.6084	
	23	23	-1	1	0.6084	
						A REAL PROPERTY AND A REAL
	25	24	1	0		
	23	24	-1	0		
	23	23	-1	-1		
	24	23	0	-1	0.0484	0.52
	23	24	-1	0	0.6084	0.08
	23	24	-1	0		
	25	25	1	1		
				2		
	23	26	-1			
	23	24	-1	0		
	23	23	-1	-1		
	24	24	0	0	0.0484	0.08
	23	23	-1	-1	0.6084	0.52
	23	24	-1	0	0.6084	0.08
	24	24	0	0	0.0484	
	25	23	1	-1		
	23	23	-1			
	26	23	2			
	23	24	-1	0		
	23	23	-1	-1	0.6084	0.52
	24	24	0	0	0.0484	0.08
	25	24	1	C		
	23	25	-1	1		
	24	23	0			
			-1	Contractory of the second s		
	23	24		-	1	
	24	23	0			
	23	24	-1			
	22	25	-2	1	3.1684	1.64
an	23.8	23.72	0	total	46.58	
	0.97	0.88				
	50					
	50					
ndavet	Deviation	L				
	((sum of d1					
n of d1	square)+(sı		lare) =	84.66		
		n1+n2-2 =		98		
				0.863878	ł	
			S=	0.92945	÷	
(Mean	X1 - Mean )	(2/S)(sort 4	-			
	Mean X2/S		0.064554			
an X1 -	INDOLL NE/U		0.004004	0.00		
			05			
	2/n1+n2 =		25 5			

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a) Neg.co	ntrol vsVinc		d1=x1-X1	d2=x2-X2	d1xd1	d2xd2
	x1 0	2 22	01=x1-X1 0	az=xz- <b>xz</b>	01001	0.01
	0	20	0	-2	0	3.69
	0	20	0	0	0	0.00
	0	22	0	0	0	0.01
	Ő	23	0	1	Ö	1.17
	õ	21	Ő	-1	Ő	0.85
	Õ	20	0	-2	0	3.69
	Ō	21	0	-1	0	0.85
	ō	22	0	0	0	0.01
	0	22	0	0	0	0.01
	0	21	0	-1	0	0.85
	0	20	0	-2	0	3.69
	0	22	0	0	0	0.01
	0	22	0	0	0	0.01
	0	23	0	1	0	1.17
	0	23	0	1	0	1.17
	0	22	0	0	0	0.01
	0	23	0	1	0	1.17
	0	22	0	0	0	
	0	22	0	0	0	0.01
	0	22	0	0	0	
	0	23	0	1	0	1.17
	0	22	0			
	0	23	0	1	0	1.17
	0	22	0	0	0	0.01
	0	21	0			
	0	22	0			*** **** **** **** * * * * * * * * * *
	0	22	0	and the second se		
	0	23	0			
	0	23	0	the second se		
	0	22	0			
	0	23	0			S
	0	22	0			
	0	23	0			
	0	23	0			
	0	21	0			
	0	22	0			
	0	21	0			
	0	22	0			
	0	22	0			
	0	23	0	and the second se		
	0	21	0			Contraction of the second s
	0	20	0			
	0	22	0			
	0	22	0			
	0	21 22				
	0	22				
	0	21 22				
	0	23				
Mean	0.0	23		total		
SD	0.00	0.88		loidi	U	51.00
50 n1	50	0.00	1			
12	50			•		
	Deviation					
S=sq.rt of	((sum of d1 square)+(su			quare))/n1 37.68		
		n1+n2-2 =		98		
				0.38449		
			S=	0.620072		
t = (Mean	X1 - Mean )	2/SVent	-			
Mean X1	Mean X2/S	asonadus ≕	-35.35071		1	
model A1 *					,	
sart of p1n	//n14n2 ⇒					
sqrt of n1n	2/n1+n2 ≐		25 5			

) Neg.com	ntrol vsVin	ca rosea or	n E.coli 15u	l		
£	x1			d2=x2- <b>X2</b>	d1xd1	d2xd2
	0	25	0	1	0	1.64
	0	21	0	-3	0	7.40
	0	25	0	1	0	1.64
	0	24	0	0	0	0.08
	0	24	0	0	0	0.08
	0	23	0	-1	0	0.52
	0	24	0	0	0	0.08
	0	23	0	-1		0.52
	0	24	0	0		0.08
	0	25	0	1	0	1.64
	0	23	0	-1	0	0.52
	0	24	0	0	0	0.08
	0	24	0	0		
	0	23	0	-1	0	1
	0	23	0	-1	0	0.52
	0	24	0	0		0.08
	0	22	0	-2	0	2.96
	0	23	0	-1	0	0.52
	0	24	0	0	0	
	0	23	0	-1	0	0.52
	0	24	0	0	0	
	0	25	0	1	Ó	1.64
	0	23	0	-1	0	
	0	24	0	0	0	0.08
	0	24	0	0	0	0.08
	0	23	0	-1	0	0.52
	0	23	0	-1	0	
	0	24	0	0	1 0	
	0	24	0	C	0	0.08
	0	25	Õ	1	0	
	0	26	0	2		
	0	24	Ō	C		
	0	23	0	-1		
	Ō	24	Ō	C		
	0	23	Ö	-1		
	0	24	0	C		
	0	24	D	C	0	
	ō	23	Ō	-1		
	0	23	Ō	-1		
	0	23	0			
	0	24	0	C		
	Ō	23	Ō	-1		
	ō	24	Ő	Ċ		
	0	24	0	Ċ		
	0	25	0	1		
	0	23	ŏ	-1		
	0	24	0	C		
	0	23	0	-1		
	Ö	24	0			
	0	25	0	1		
ean	0.0			total	<u>v</u>	
5	0.00		4		U U	00.00
	50	<u> </u>	l			
	50					
andard	Deviation	<u></u>				
		isquare)+(s	sum of d2s	quare)Vo4	+n2-2	
		um of d2squ		38.08		
		n1+n2-2 =	,	98		
				0.388571		
			S=	0.623355		
					r	
	X1 . Mean	X2/SVent				
= (Mean		X2/S)(sqrt o	of n1n2/n1+	•n2)		
(Mean ean X1 -	Mean X2/S		of n1n2/n1+ -38.05215	<b>n2)</b> 0.86	<b>i</b> .	
• (Mean ean X1 -			of n1n2/n1+	<b>n2)</b> 0.86	<b>.</b>	

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n1 50							
n2 50 Stored Deviction		interest in the second s	L				
Standard Deviation							
S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2	o-sq.rt of	((Sum Of C))	square)*(s	SUMI OT Q2S			
(sum of d1square)+(sum of d2square) = 102.80	(Sum of d'E	square)+(St		are) =			
n1+n2-2 = 98			$n_1 + n_2 - 2 =$				
1.04898				-			
S= 1.024197							
t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)							
Mean X1 - Mean X2/S = -0.663935 0.86			=				
sqrt of n1n2/n1+n2 = 25	sqrt of n1n	2/n1 + n2 =					
5			No. ( Contractor Contractor Contractor				
t= -3.319674				-3 319674	1		

	k vinca ros x1	x2	d1=x1-X1	d2=x2-X2	d1xd1	d2xd2
	26	25	2	1	4.0804	
	20	25	-1	-3		
	23	25	-1	-3		
	23	25	-1	0		
	23	24	-1			······
	20	23	-1	-1	0.9604	
1	23	24	-1	0		
l	25	23	1	-1	1.0404	
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	23	25	-1	1		
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	23	24	-1	0		
	24	23	0	-1	0.0004	0.52
	26	23	2	-1	4.0804	0.52
	24	24	0	0		
	25	22	1	-2		
	25	23	1	-1	4	
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	23	23	-1			
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	23	24	-1			
	26	23	2	-1		
	23	24	-1	0	£	
	23	23	-1	-1		
	23	24	-1			
	26	25	2			
Mean	24.0			total	96.98	
SD	1.41	0.88				
n1	50					
n2 Standard	50	l				
S=sq.rt of	( <b>(sum of d</b> 1 square)+(st	um of d2squ n1+n2-2 =	uare) = S=	135.06 98 1.378163 1.173952		
t = (Mean Mean X1						
Mean X1 -	Mean X2/S		0.221474	0.86		
Mean X1 -				0.86		

	x2 21 20 23 22 20 22 20 23 21 22 23 20 21 20 23 20 21 20 21 20 21 20 23 20 21 22 23 20 21 22 23 20 21 22 23 20 20 23 20 20 23 20 20 23 20 20 20 20 23 20 20 20 20 20 20 20 20 20 20	bacillus 10 d1=x1-X1 0 -1 2 -2 -2 0 0 0 -1 -2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		d1xd1 0.0144 1.2544 3.5344 4.4944 0.0144 1.2544 3.5344 3.5344 3.5344 1.2544 3.5344 3.5344 0.0144 0.0144 0.0144 0.7744 1.2544 0.7744	d2xd2 0.41 2.69 1.85 0.13 2.69 0.13 2.69 1.85 0.41 0.13 1.85 2.69 2.69 2.69 0.41 2.69 1.85 1.85 1.85 1.85 0.43
20           19           22           18           20           20           19           18           22           18           19           18           22           20           22           20           20           21           19           21           21           21           21           21           21           22           20           21           22           23           24           25           26           20           20           20           20           20           20           20           20           20           20           20           20	21 20 23 22 20 22 20 23 21 22 23 20 20 21 20 23 23 20 22 21 22 23 20 22 21 22 23 20 22 21 22 23 20 22 21 20 23 20 23 20 20 21 22 23 20 20 23 21 22 20 23 20 22 20 22 20 23 22 20 23 20 22 20 20 22 20 20 23 20 22 20 23 20 20 23 20 20 23 20 20 20 20 20 20 20 20 20 20 20 20 20	-1 2 -2 0 0 -1 -2 2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -	-2 1 0 -2 0 -2 1 -2 -2 -2 -2 -2 -1 -1 -2 -2 -1 1 -2 -2 -1 1 -2 0 0	1.2544 3.5344 0.0144 0.0144 1.2544 3.5344 3.5344 3.5344 1.2544 3.5344 3.5344 3.5344 0.0144 0.0144 0.7744 1.2544 0.7744	2.69 1.85 0.13 2.69 0.13 2.69 1.85 0.41 0.13 1.85 2.69 2.69 0.41 2.69 0.41 2.69 1.85 1.85 2.69
19         22         18         20         20         19         18         22         23         18         19         22         20         20         20         21         19         21         21         21         21         21         21         21         21         21         21         21         21         22         23         24         25         26         20         20         20         20         20         20         20         20         20         20         20         20         20         20         20         20          20	20 23 22 20 22 20 23 21 22 23 20 20 21 20 23 23 20 22 21 22 23 20 22 21 22 23 20 22 21 22 23 20 22 21 20 23 20 23 20 20 21 22 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 23 20 20 23 20 20 23 20 20 23 20 20 20 20 20 20 20 20 20 20 20 20 20	2 -2 0 -1 -2 2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -	1 0 -2 0 -2 1 -1 -1 -1 -1 -2 -2 -2 -1 -1 -2 -1 -1 -2 -2 -1 -1 -2 -2 -1 -1 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2	3.5344 4.4944 0.0144 1.2544 3.5344 3.5344 3.5344 1.2544 3.5344 3.5344 3.5344 0.0144 0.0144 0.7744 1.2544 0.7744	1.85 0.13 2.69 0.13 2.69 1.85 0.41 0.13 1.85 2.69 2.69 0.41 2.69 1.85 1.85 1.85 2.69
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20 20 21 19 21 21 21 22 18 19 20 20 20	20 23 23 20 22 21 22 23 20 21	0 0 1 -1 1 1 2	-2 1 1 -2 0	0.0144 0.0144 0.7744 1.2544 0.7744	2.69 1.85 1.85 2.69
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21 19 21 21 22 18 19 20 20 20	23 20 22 21 22 23 20 21	1 1 _1 _1 1 _2	1 -2 0	0.7744 1.2544 0.7744	1.85 2.69
19 21 21 22 18 19 20 20 20 20	20 22 21 22 23 20 21	-1 1 1 2	-2 0	1.2544 0.7744	2.69
21 21 22 18 19 20 20 20	22 21 22 23 20 21	1 1 2	0	0.7744	
21 22 18 19 20 20 20 20	21 22 23 20 21	1			0.13
22 .18 19 20 20 20 20	22 23 20 21	2	_1		
18 19 20 20 20 20	23 20 21		in the second se	0.7744	0.41
19 20 20 20	20 21	-2	0	3.5344	0.13
20 20 20	21		1	4.4944	1.85
20 20		-1	-2	1.2544	2.69
20	00	0	1	0.0144	0.41
	22	0	0	0.0144	0.13
21	21	0	-1	0.0144	0.41
	23	1	1	0.7744	1.85
22	21	2	-1	3.5344	0.41
21	22	1	0		0.13
21	23	1	1	0.7744	1.85
22	22	2	0	******	0.13
20	22	0	0		
19	23	-1	1	1.2544	1.85
19	21	-1	-1	1.2544	0.41
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		<u> </u>			1.85
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				*****	and the second se
		-	total	89.28	63.52
	1.14	{			
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um of d1	im of d2squ		152.80		
	n1+n2-2 =	S=	1.559184		
- Mean 3	(2/\$)/sart	-			
ean X2/S		-1.217293	0.86		
11+n2 =		5			
	uare)+(su - Mean ) ean X2/S 1+n2 =	19       22         18       21         18       22         20       23         20       23         19       23         20       22         22       20         21       21         23       20         21       21         23       20         21       21         23       20         20       23         20       23         20       23         20       23         20       23         20       23         20       23         20       23         20       23         20       23         20       23         20       23         20       23         20       23         50	19       22       -1         18       21       -2         18       22       -2         20       23       0         20       23       0         19       23       -1         20       23       0         20       23       0         20       22       20         21       20       1         23       20       1         21       21       1         23       20       3         18       21       -2         20       23       0         20       23       0         20       23       0         20       23       0         20       23       0         20       23       0         20       23       0         20       23       0         20       23       0         20       23       0         135       1.14       0         50       0       0         135       1.14       0         1470       1.14       0	19       22       -1       0         18       21       -2       -1         18       21       -2       0         20       23       0       1         20       23       0       1         19       23       -1       1         20       22       0       0         22       20       2       -2         21       20       2       -2         21       21       1       -1         23       20       3       -2         21       21       1       -1         23       20       3       -2         18       21       -2       -1         20       23       0       1         20       23       0       1         20       23       0       1         20       23       0       1         20       23       0       1         20       23       0       1         20       23       0       1         135       1.14       1       1.14         50       1       15	19       22       -1       0       1.2544         18       21       -2       -1       4.4944         18       22       -2       0       4.4944         20       23       0       1       0.0144         20       23       0       1       0.0144         20       23       0       1       0.0144         20       23       -1       1       1.2544         20       23       0       1       0.0144         20       22       0       0       0.0144         20       22       0       0       0.0144         21       20       1       -2       0.7744         21       21       1       -1       0.7744         23       20       3       -2       8.2944         18       21       -2       -1       4.4944         20       23       0       1       0.0144         20       23       0       1       0.0144         20       23       0       1       0.0144         20       23       0       1       0.0144         20

x1         x2         d1=x1-x1         d2=x2-x2         d1xd1         d2xd2           20         21         0         -2         0.0144         5.57           20         21         0         -2         2.3.5344         2.69           18         21         -2         2.4.4944         5.57           20         23         0         0         0.0144         5.57           20         23         0         0         0.0144         5.57           20         23         0         0         0.0144         0.13           19         22         -2         1         4.4944         0.41           22         23         2         0         3.5344         0.13           21         23         2         0         3.5344         0.13           20         23         0         0         0.0144         0.43           22         23         2         0         3.5344         0.43           20         23         0         0         0.0144         0.43           21         23         1         0         0.7744         0.85           21         <	L) Positive	control vs	Garlic on	bacillus 15	iul		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$						d1xd1	d2xd2
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$				0	-2	0.0144	5.57
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		22	25	2	2	3.5344	2.69
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		18	21	-2	-2	4.4944	5.57
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		20	21	0	-2	0.0144	5.57
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		20	23	0	0	0.0144	0.13
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		19	22	-1	-1	1.2544	1.85
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		18	24		1	4.4944	0.41
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		18	24			4.4944	0.41
$\frac{19}{20}  \frac{25}{23}  \frac{-1}{2}  \frac{2}{1,2544}  \frac{2,69}{20} \\ 20  23  0  0  0.0144  0.13 \\ 22  24  2  1  3.5344  0.41 \\ 21  23  1  0  0.7744  0.13 \\ 21  23  24  3  1  8.2944  0.41 \\ 23  24  3  1  8.2944  0.41 \\ 18  23  -2  0  4.4944  0.13 \\ 20  24  0  1  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0.0144  0.41 \\ 20  23  0  0  0  0  0.0144  0.41 \\ 20  20  24  0  1  0.0144  0.41 \\ 20  20  24  0  0  0  0  0  0  0  0  0  $	2	20	25			0.0144	2.69
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		20	24	0	1	0.0144	0.41
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				0	0		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		22	24	2	1	3.5344	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				1	0	0.7744	
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$\begin{array}{c c c c c c c c c c c c c c c c c c c $							
ean       20.1       23.36       0 total       89.28       63.52         D       1.35       1.14       50       50       50         candard Deviation       =       50       50       50         candard Deviation       =       50       50       50         candard Deviation       =       152.80       1.14       50         um of d1square)+(sum of d2square) =       152.80       1.559184       50         S=       1.248673       5       5       1.248673         ean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)       0.86       1.12       1.12         ean X1 - Mean X2/S =       -2.594755       0.86       1.12         int of n1n2/n1+n2       25       5       5							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Aean		and the second		total	89.28	63.52
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	SD		1.14	<u> </u>			
andard Deviation         =sq.rt of{(sum of d1square)+(sum of d2square) =         um of d1square)+(sum of d2square) =         152.80         n1+n2-2 =         98         1.559184         S=       1.248673         = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)         ean X1 - Mean X2/S =       -2.594755         1rt of n1n2/n1+n2 =       25         5	1						
=sq.rt of{(sum of d1square)+(sum of d2square) =       152.80         n1+n2-2 =       98         1.559184       S=         S=       1.248673         = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)       0.86         pt of n1n2/n1+n2       25         5       5	2		L				
um of d1square)+(sum of d2square) =       152.80 $n1+n2-2 =$ 98         1.559184       S=         S=       1.248673         = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)       ean X1 - Mean X2/S =         ean X1 - Mean X2/S =       -2.594755       0.86         pt of n1n2/n1+n2       25       5							
n1+n2-2 = 98 $1.559184$ S = 1.248673 = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2) ean X1 - Mean X2/S = -2.594755 0.86 pt of n1n2/n1+n2 = 25 5							
$\begin{array}{rcl} & 1.559184 \\ S = & 1.248673 \\ \hline & (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2) \\ ean X1 - Mean X2/S = & -2.594755 & 0.86 \\ pt of n1n2/n1+n2 = & 25 \\ & 5 \end{array}$	sum of d1	square)+(si		uare) =			
S=         1.248673           = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)           ean X1 - Mean X2/S =         -2.594755         0.86           prt of n1n2/n1+n2 =         25         5			n1+n2-2 =				
= (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2) ean X1 - Mean X2/S = -2.594755 0.86 prt of n1n2/n1+n2 = 25 5				0			
ean X1 - Mean X2/S = -2.594755 0.86 pt of n1n2/n1+n2 = 25 5		va					
rt of n1n2/n1+n2 = 25 5						. 1	
5			-				
	synt of n1n	z/n1+n2 =					
H-12/3/3/0 I VAIUE DE CONSIDER AS POSITIVE			4m			oonelder	maniti.
	······.		4	~12.9/3/8	I value be	consider as	positive

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MI Nea Cor	itrol vs Gai	lic on baci	itus 10ul			
	x1		d1=x1-X1	d2=x2-X2	d1xd1	d2xd2
	0	21	0	-1	0	0.41
ľ	0	20	0	-2	0	2.69
1	0	23	0	1	0	1.85
t t	0	22	0	0	0	0.13
ł	- ŏ t	20	0	-2	0	2.69
ł	ŏ	22	Ő	0	0	0.13
ŀ	ŏ	20	<u>0</u>	-2	Ő	2.69
ŀ	0	23	0	1	- o	1.85
ŀ		23	0	-1	ŏ	0.41
-	0	21	0	0	0	0.41
	0	22	0	1	ŏ	1.85
-	0		0	-2	0	2.69
		20		-2	0	2.69
ļ	0	20	0		0	
1	0	21	0	-1		S
	0	20	0	-2	0	
1	0	23	0	1	0	
1	0	23	0	1	0	
	0	20	0	and the second se	0	
	0	22	0	0	0	
	0	21	0		0	
	0	22	0	0	0	
	0	23	0		0	1.85
	0	20	0	-2	0	2.69
	0	21	0	-1	0	0.41
	0	22	0	0	Ö	0.13
	0	21	0	and the second se		
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	Ő	21	Õ			
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	0	23	0			
	0	22	0			
	0	20	0			2.69
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	0	20	0			
	Ō	21	Č		And and the subscription of the local division of the local divisi	
	Ŭ.	23	Ċ			
	0	23				
	0	23				
	0	23				
Mean	0.0	23		total		
SD	0.00	1.14		- IORDI	L L	, 03.3Z
		1.14	1			
n1 ~?	50 50					
n2 Chandrad	50	l	I			
Standard I						
	((sum of d1					
(sum of d1	square)+(sı		iare) =	63.52		
		n1+n2-2 =		98		
				0.648163		
			S=	0.805086	i	
	X1 - Mean )					
Mean X1 -	Mean X2/S	=	-26.87912		;	
	AL 4. A		25			
sart of n1n	$2/n^{1}+n^{2} =$		20			1
sqrt of n1n		t=	ŧ	i		

N) Neg cor	ntrol vs Ga	rlic on baci	llus 15ul			1
			d1=x1- <b>X1</b>	d2=x2- <b>X2</b>	d1xd1 (	d2xd2
	0	21	0	-2	0	5.57
	0	20	0	-3	0	11.29
	0	25	0	2	0	2.69
	0	21	0	-2	0	5.57
	0	21	0	-2 0	0	5.57 0.13
	0	23 22	0	-1	0	1.85
	0	24	0	1	0	0.41
	0	23	0	i o	0	0.13
	0	23	0	Ő	0	0.13
	0	24	0	1	0	0.41
	0	23	0	0	0	0.13
	0	22	0	-1	0	1.85
	0	23	0	0	0	0.13
	0	23	0	0	0	0.13
	0	24	0		0	0.41
	0	23	0		0	0.13
	0	22	0	-1	0	1.85
	0	22	0		0	1.85
	0	23				0.13
	0	24 25	0			2.69
	0	25	0		- O	0.41
	0	23	0			0.13
	- ŏ	23	0	L		0.13
	0	23	Č			0.13
	0	24	C			0.41
	0	25	C	2	0	2.69
	0	24	C	1	0	0.41
	0	25	C	2		2.69
	0	23	0			0.13
	0	25	<u> </u>			2.69
	0	24	0			0.41
	0	23				0.13
	0	24	<u> </u>			0.41
	0	24				0.41
	0	25				2.69
	0	20				0.41
	0	25				2.69
	- 0	23				0.13
	1 0	24				0.41
	0	23	(	) (	0 0	0.13
	0	23	(			0.13
	0	24	(	and the second s		0.41
	0	23	(			0.13
	0	24		)		0.41
	0	24		2		0.41
	0	23				0.13
Macro	0	24		) total		63.62
Mean SD	0.0			1008	U	63.52
ธบ n1	0.00	1 1.14	[]			
n2	50					
	Deviation					
	f((sum of d	1square)+(	sum of d2	square))/n1	+n2-2	
	1square)+(s			63.5	2	
10.000000000000000000000000000000000000		n1+n2-2 =		98	3	
				0.64816		
			S=	0.80508	6	
	X1 - Mean				_	
	- Mean X2/S		-29.0155		5	
sqrt of n1	n2/n1+n2 =		2			
				5 71 tuoluo bo	consider as	nonitive
		17	-143.077	R value be	consider as	μυριίνε

17         20         -3         -1         10.4976         2           18         18         2         -3         5.0176         11           24         25         4         4         14.1376         12           17         20         -3         -1         10.4976         2           18         19         -2         -2         5.0176         6           18         19         -2         -2         5.0176         2           23         23         3         2         7.6176         2           24         1         3         0.5776         2         2           21         24         1         3         0.5776         2           21         24         1         3         0.5776         2           21         23         1         2         0.5776         2           21         23         1         2         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1		trol veVin	10 69201 61	Bacillus 1	10:11		
18         18         -2         -3         5.0176         11           17         20         -3         -1         10.4976         2           18         18         -2         -3         5.0176         11           24         25         4         4         14.1376         12           17         20         -3         1.04976         2           18         19         -2         2.5.0176         6           19         20         -1         1.5376         2           21         20         1         -1         0.5776         2           21         23         2         2.0976         2         2           21         23         1         2.05776         2           20         23         0         2.05776         2           21         23         1         2.05776         2           21         23         1         2.05776         2           21         20         1         -1.05776         2           21         20         1         -1.05776         2           21         20         1         -1.05776<						d1xd1	d2xd2
17       20       -3       -1       10.4976       2         18       18       -2       -3       5.0176       11         24       25       4       44       14.1376       12         17       20       -3       -1       10.4976       2         18       19       -2       5.0176       6         18       19       -2       2.5.0176       6         19       20       -1       -1       1.5376       2         23       23       3       2       7.6176       2         21       20       23       0       2       0.5776       2         21       23       1       2       0.5776       2         21       23       1       2       0.5776       2         21       23       1       -1       0.5776       2         21       20       1       -1       0.5776       2         21       20       1       -1       0.5776       2         21       20       1       -1       0.5776       2         21       20       1       -1       0.5776							11.97
24         25         4         4         14.1376         12           17         20         -3         -1         10.4976         12           18         19         -2         -2         5.0176         6           18         19         -2         -2         5.0176         6           19         20         -1         -1         1.5376         2           23         23         3         2         7.6176         2           21         20         1         -1         0.5776         2           21         23         1         2         0.5776         2           21         23         1         2         0.5776         2           21         23         1         1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>2.13</td>							2.13
24         25         4         4         14.1376         12           17         20         -3         -1         10.4976         2           18         19         -2         -2         5.0176         2           18         19         -2         -2         5.0176         2           21         20         -1         -1         1.5376         2           23         23         3         2         7.6176         2           21         24         1         3         0.5776         2           20         23         0         2         0.5776         2           20         22         0         1         0.0576         2           21         23         1         2         0.5776         2           20         22         2         1         3.0976         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         22         1		18	18		-3	5.0176	11.97
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		24	25	4	4	14.1376	12.53
18       19       -2       -2       5.0176       6         19       20       -1       -1       1.5376       2         21       20       1       -1       0.5776       2         23       23       2       2.3.0976       2         21       24       1       3       0.5776       2         20       23       0       2       0.0576       2         21       23       1       2       0.5776       2         20       22       2       1       3.0976       2         21       23       21       3       0       7.6176       2         22       22       2       1       0.5776       2         21       20       1       -1       0.5776       2         21       20       1       -1       0.5776       2         21       20       1       -1       0.5776       2         21       20       1       -1       0.5776       2         21       20       1       1       0.5776       2         20       23       0       2       0.5776				4	4	14.1376	12.53
18         19         -2         -2         5.0176         2           19         20         -1         -1         1.5376         2           21         20         1         -1         1.5376         2           23         23         3         2         7.6176         2           21         24         1         3         0.5776         2           20         23         0         2         0.0576         2           20         22         2         1         3.0976         2           21         23         1         2         0.5776         2           20         22         22         1         3.0976         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         0.5776         2         2           21         20         1         0.5776         2           20         23         3         2		17	20	-3	-1	10.4976	2.13
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		18	19	-2	-2	5.0176	6.05
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	1	18	19	-2	-2	5.0176	6.05
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		19	20	-1	-1	1.5376	2.13
22         23         2         2         3.0976         2           21         24         1         3         0.5776         6           20         23         0         2         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         0           21         20         21         3.0976         0           23         21         3         0         7.6176         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         21         1         0         0.5776         0           21         22         1         1         0.5776         0           21         22         1         1         0.5776         0           20         20         1         -1         0.5776         0           20         20         0         1         0.0576         0           20         20         0         1		21	20	1	-1	0.5776	2.13
22         23         2         2         3.0976         2           21         24         1         3         0.5776         6           20         23         0         2         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         0           21         20         21         3.0976         0           23         21         3         0         7.6176         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         21         1         0         0.5776         0           21         22         1         1         0.5776         0           21         22         1         1         0.5776         0           20         20         1         -1         0.5776         0           20         20         0         1         0.0576         0           20         20         0         1		23	23	3	2	7.6176	2.37
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$			23		2	3.0976	2.37
21         23         1         2         0.5776         2           20         22         0         1         0.0576         0           22         22         2         1         3.0976         0           23         21         3         0         7.6176         0           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         21         1         0         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           20         23         0         2         0.0576         2           20         20         0         1         0.0576         2           20         20         0         1         0.0576         2           20         21         0         0		21			3	0.5776	6.45
20         22         0         1         0.0576         0           22         22         2         1         3.0976         0           23         21         3         0         7.6176         0           21         20         1         -1         0.5776         2           21         20         2         -1         3.0976         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         1         0.5776         2           21         20         1         1         0.5776         2           20         23         0         2         0.0576         2           20         20         0         1         0.0576         2           20         21         -2         1         5.0176         2           20         21         0         <		20	23	0	2	0.0576	2.37
20         22         0         1         0.0576         0           22         22         2         1         3.0976         0           23         21         3         0         7.6176         0           21         20         1         -1         0.5776         2           21         20         2         -1         3.0976         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         -1         0.5776         2           21         20         1         1         0.5776         2           21         20         1         1         0.5776         2           20         23         0         2         0.0576         2           20         20         0         1         0.0576         2           20         21         -2         1         5.0176         2           20         21         0         <		21		1	2	0.5776	2.37
23         21         3         0         7.6176         0           21         20         1         -1         0.5776         2           21         20         2         -1         3.0976         2           21         21         1         0         0.5776         2           21         21         1         0         0.5776         2           21         20         1         -1         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           20         23         0         2         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         21         0         0         0.0576         2           20         21         0         0         0.0576         2           20         21         0         0		20	22	0			
23         21         3         0         7.6176         0           21         20         1         -1         0.5776         2           22         20         2         -1         3.0976         2           21         21         1         1         0         0.5776         2           21         21         21         1         0         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           20         23         0         2         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         21         0         0         0.0576         2           20         21         0         0         0.0576         2           20         21		22	22	2	1	3.0976	0.29
21         20         1         -1         0.5776         2           21         20         2         -1         3.0976         2           21         21         1         1         0         0.5776         2           21         21         1         1         0         0.5776         2           21         20         1         -1         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           21         22         1         1         0.5776         2           20         23         0         2         0.0576         2           20         22         0         1         0.0576         2           20         21         0         1         0.0576         2           20         21         0         0         0.0576         2           20         21         0         0         0.0576         2           20         21         0         0         0.0576         2           20         23			21			7.6176	
21         20         1         -1         0.5776         2           22         20         2         -1         3.0976         2           21         21         21         1         0         0.5776         0           21         22         1         1         0.5776         0           21         22         1         1         0.5776         0           21         22         1         1         0.5776         0           20         23         3         2         7.6176         0           20         23         0         2         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           18         22         -2         1         5.0176         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         23 <td< td=""><td></td><td></td><td></td><td></td><td></td><td>and the second sec</td><td></td></td<>						and the second sec	
22         20         2         -1         3.0976         2           21         21         1         0         0.5776         0           21         22         1         1         0.5776         0           21         22         1         1         0.5776         0           23         23         3         2         7.6176         0           20         23         0         2         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           18         21         -2         1         5.0176         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         23         0         2<					-1		
21         21         1         0         0.5776         0           21         20         1         -1         0.5776         2           21         22         1         1         0.5776         2           23         23         3         2         7.6176         2           20         23         0         2         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         21         -2         1         5.0176         2           18         20         -2         -1         5.0176         2           20         21         0         0         0.0576         2           20         21         0         0         0.0576         2           20         23         0		the second se					
21         20         1         -1         0.5776         2           21         22         1         1         0.5776         0           23         23         3         2         7.6176         0           20         22         1         1         0.5776         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           18         21         -2         1         5.0176         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2<			L				
21         22         1         1         0.5776         0           23         23         3         2         7.6176         2           21         22         1         1         0.5776         0           20         23         0         2         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         22         0         1         0.0576         2           20         21         0         0         0.0576         2           18         22         -2         1         5.0176         2           20         21         0         0         0.0576         2           20         21         0         0         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>and the second se</td>							and the second se
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20         20         0         -1         0.0576         2           20         22         0         1         0.0576         0           18         21         -2         0         5.0176         0           19         23         -1         2         1.5376         2           18         22         -2         1         5.0176         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         0         -1         0.0576         0           20         20         0 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>							
20         22         0         1         0.0576         0           18         21         -2         0         5.0176         0           19         23         -1         2         1.5376         2           18         22         -2         1         5.0176         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         0         -							
18         21         -2         0         5.0176         0           19         23         -1         2         1.5376         2           18         22         -2         1         5.0176         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         22         0         1         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         0         0			and the second se				
19         23         -1         2         1.5376           18         22         -2         1         5.0176         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         22         0         1         0.0576         0           20         22         0         1         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         0         0         1.							
18         22         -2         1         5.0176         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           20         22         0         1         0.0576         0           20         21         0         0         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         20         0         -1         0.0576         1           20         20         0         0<					and the second s		
20         21         0         0         0.0576         0           18         20         -2         -1         5.0176         1           20         21         0         0         0.0576         1           20         22         0         1         0.0576         1           20         21         0         0         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         20         0         -1         0.0576         1           20         20         0         -1         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         24         0         3         0.0576         1           20         20         0         -1         0.0576         1           20         20         0         -1         0.0576         1           20         20         0 <t< td=""><td></td><td><u>.</u></td><td></td><td></td><td></td><td></td><td></td></t<>		<u>.</u>					
18         20        2         -1         5.0176         20           20         21         0         0         0.0576         0           20         22         0         1         0.0576         0           20         21         0         0         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         0         -1         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         20         0         -1         0.0576         0           20         20         0         0         -1         0.0576         0         0         0 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>							
20         21         0         0         0.0576         0           20         22         0         1         0.0576         0           20         21         0         0         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         0         -1         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         0         0         -1         0.0576         0           20         20         20         0         -1         0.0576         0           20         2							
20         22         0         1         0.0576         0           20         21         0         0         0.0576         0           20         23         0         2         0.0576         0           21         21         1         0         0.5776         0           20         20         0         -1         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         23         0         2         0.0576         0           20         20         0         -1         0.0576         0           20         20         0         -1         0.0576         0           20         20         0         -1         0.0576         0           20         21         1				And the second second second second			
20         21         0         0.0576         0           20         23         0         2         0.0576         1           21         21         1         0         0.5776         1           20         20         0         -1         0.0576         1           20         20         0         -1         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         20         0         -1         0.0576         1           20         20         0         0         -1         0.0576         1           20         21         1         0         0         0.0576         1           20         21.46         <							
20         23         0         2         0.0576         2           21         21         1         0         0.5776         1           20         20         0         -1         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         20         0         -1         0.0576         1           20         21         1         1         0         0.5776         1           20         21.46         0         total         127.12         13           SD         1.61							
21         21         1         0         0.5776         0           20         20         0         -1         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         20         0         -1         0.0576         2           20         20         0         0         -1         0.0576         2           20         21         1         0         0         0.0576         2           SD         1.61         1.66         1         127.12         13           Standard Deviati			L. n. n				
20         20         0         -1         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         20         0         -1         0.0576           20         20         0         -1         0.0576           20         20         0         -1         0.0576           20         20         0         -1         0.0576           20         21         1         0         0         0.5776           20         21.46         0         total         127.12         13           SD         1.61         1.66         127.12         13           n2         50         50         50         50           Standard Deviation </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
20         23         0         2         0.0576           20         23         0         2         0.0576           20         24         0         3         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         23         0         2         0.0576           20         20         0         -1         0.0576           20         20         0         -1         0.0576           20         20         0         -1         0.0576           20         21         1         0         0.5776           20         21         0         0         0.0576           20         21.46         0         total         127.12         13           SD         1.61         1.66         127.12         13           n2         50         50         50         50           Standard Deviation         Ssay of d1square)+(sum of d2square))/n1+n2-2         50			and the second se				
20         23         0         2         0.0576           20         24         0         3         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         23         0         2         0.0576         1           20         20         0         -1         0.0576         1           20         20         0         -1         0.0576         1           20         20         0         -1         0.0576         1           20         20         0         -1         0.0576         1           20         21         1         0         0.5776         1           20         21.46         0         total         127.12         13           SD         1.61         1.66         1         127.12         13           SD         1.61         1.66         1         127.12         13           Standard Deviation         S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2         1         1         1         1							
20         24         0         3         0.0576         0           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         20         0         -1         0.0576         2           20         20         0         -1         0.0576         2           20         20         0         -1         0.0576         2           20         21         1         0         0.5776         2           20         21         0         0         0.0576         2           20         21.46         0         total         127.12         13           SD         1.61         1.66         127.12         13           n2         50         5         5         5         5           Standard Deviation         S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2         5         5							
20         23         0         2         0.0576         2           20         23         0         2         0.0576         2           20         20         0         -1         0.0576         2           20         20         0         -1         0.0576         2           20         20         0         -1         0.0576         2           20         21         1         0         0.5776         2           20         21         0         0         0.0576         3           20         21         0         0         0.0576         3           SD         1.61         1.66         1         127.12         13           SD         1.61         1.66         1         127.12         13           Standard Deviation         50         50         5							
20         23         0         2         0.0576           20         20         0         -1         0.0576           20         20         0         -1         0.0576           20         20         0         -1         0.0576           21         21         1         0         0.5776           20         21         0         0         0.0576           20         21         0         0         0.0576           20         21.46         0         total         127.12         13           SD         1.61         1.66         127.12         13           SD         1.61         1.66         127.12         13           Standard Deviation         50         50         127.12         13           Standard Deviation         5         5         14         127.12         13					) 3	0.0576	
20         20         0         -1         0.0576           20         20         0         -1         0.0576           21         21         1         0         0.5776           20         21         0         0         0.0576           20         21         0         0         0.0576           20         21         0         0         0.0576           20         21.46         0         total         127.12         13           SD         1.61         1.66         1         127.12         13           SD         1.61         1.66         1         127.12         13           Standard Deviation         50         1         1         1         1           S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2         1         1         1         1         1		Sector and the sector of the s					
20         20         0         -1         0.0576           21         21         1         0         0.5776         0           20         21         0         0         0.0576         0           20         21         0         0         0.0576         0           Mean         20.2         21.46         0         total         127.12         13           SD         1.61         1.66         1         127.12         13           n1         50         1<		And the second s					
21         21         1         0         0.5776         0           20         21         0         0         0.0576         0           Mean         20.2         21.46         0         total         127.12         13           SD         1.61         1.66         1         127.12         13           n1         50         1         1         127.12         13           Standard Deviation         50         1         127.12         13           Standard Deviation         5         1						and the second s	
20         21         0         0         0.0576         4           Mean         20.2         21.46         0 total         127.12         13           SD         1.61         1.66         1         127.12         13           SD         1.61         1.66         1         127.12         13           n1         50         1         1         13           standard Deviation         50         1         1         1           S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2         1         1         1         1							
Mean         20.2         21.46         0 total         127.12         13           SD         1.61         1.66         1         13         13           n1         50         1         1         16         13           n2         50         1         13         13           Standard Deviation         5         14							
SD         1.61         1.66           n1         50							
n1 50 n2 50 Standard Deviation S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2				-6	) total	127.12	2 134.42
n2 50 Standard Deviation S≖sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2			1.66				
Standard Deviation S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2		1					
S=sq.rt of((sum of d1square)+(sum of d2square))/n1+n2-2				<u> </u>		······	
(sum of d1square)+(sum of d2square) = 261.54	-						
	(sum of d1	square)+(s		uare) =			
n1+n2-2 = 98			n1+n2-2 =				
2.668776					2.668776	3	
S= 1.633639				_		)	
t = (Mean X1 - Mean X2/S)(sqrt of n1n2/n1+n2)				of n1n2/n1	+n2)		
Mean X1 - Mean X2/S = -0.746799 0.86						6	
sqrt of n1n2/n1+n2 = 25	sqrt of n1n	12/n1+n2 =		25	5		
5							
t= ~3.733996	L		t=	-3.733996	<u>š</u>		

P) Pos.con	trol vsVin	a rosea or	Bacillus 1	511		ŀ
	x1	x2	d1=x1-X1	d2=x2-X2	d1xd1	d2xd2
	18	21	-2	-3	5.0176	7.40
	17	20	-3	-4	10.4976	13.84
	18	18	-2	-6	5.0176	32.72
	24	28	4	4	14.1376	18.32
	24	25	4	1	14.1376	1.64
	17	23	-3	-1	10.4976	0.52
	18	22	-2	-2	5.0176	2.96
	18	23	-2	-1	5.0176	0.52
	19	22	-1	-2	1.5376	2.96
	21	23	1	-1	0.5776	0.52
	23	24	3	0	7.6176	0.08
	22	24	2	0	3.0976	0.08
	21	25	1	1	0.5776	1.64
	20	24	0	0	0.0576	0.08
	21	24	1	0	0.5776	0.08
	20	23	0	-1	0.0576	0.52
	22	23	2	-1	3.0976	0.52
	23	24	3	0	7.6176	0.08
	21	23	1	-1	0.5776	0.52
	21	23	1	1	0.5776	
	22	24	2	Ö		
	21	24	1	Ő	0.5776	
	21	23	1	-1	0.5776	A contract of the state of the second s
	21	23	1	-1	0.5776	
	23	23	3			
	21	24	1	Ó	0.5776	
	20	24	Ö			and the second s
	20	24	ŏ			
	20	23	0			
	20	25	ő	**************************************	0.0576	
	18	25	-2			
	10	25	-1	1		
	13	25	-2	\$		
	20	25	0			
	18	25	-2			
	20	25	0			
	20	25	Ö			
	20	25	Ö		and a start of the	
	20	24	Ö			
	21	25	1			and an owner of the second s
	20	23	0			
	20	24	Ö			
	20	24				
	20	25	0			
	20	23	0			
	20	24	0			
0	20	23				
	20	23				
	20	23	1			
	21	23				
Mean	20			total	127.12	
SD	1.61			(Utdt	127.12	. 10.06
		1.50	1			
n1 n2	50 50					
nz Standard		I				
		1square)+(s	eum of doo	M113PA1144	402.2	
		um of d2squ		237.20		
(sum 0) 01	adrigite)#(S	n1+n2-2 =		237.20		
		iii≠n <b>∠-</b> 2 ≖				
1			e-	2.420408		
• - /Maar	V4 84	V0/01/	S= of od o 2/o4.	1.555766		
		X2/S)(sqrt (				
	Mean X2/S	, -	-2.23684			
syntornin	2/n1+n2 =		25			
		t=	14 4940		oonnidee	nocitivo
		A TOP SHOW SHOW	-11.1042	t value be	consider as	positive

O) Non co	atrol uc Vin	ca rosea or	Bacillue 1	1Aut			
				d2=x2-X2	d1xd1	Ta	l2xd2
	0	18	0	-3		5	11.97
	0	20	0	-1		5	2.13
	0	18	0	-3	(	5	11.97
	0	25	0	4	(	D	12.53
	0	25	0	4		D	12.53
	0	20	0	-1		D	2.13
	0	1 <del>9</del>	0	-2		D	6.05
	0	19	0	-2		D	6.05
	0	20	0	-1		0	2.13
	0	20	0	-1		<u>p</u>	2.13
	0	23	0	2		D	2.37
	0	23	0	2		0	2.37
	0	24	0	3		D	6.45
	0	23	0	2		<u>o</u>	2,37
	0	23	0	2		0	2.37
	0	22	0	1			0.29
	0	22	0	1			0.29
	0	21		0		0	0.21
	0	20 20	0	-1		0	2.13
	0	20	0	-1			2.13 2.13
	0	20	0	-1		0	2.13
	0	20	0	-1		허	2.13
	0	20	0	-1		0	0.29
	0	22	0	2		허	2.37
	0	23	0			허	0.29
	0	22	0	2		6	2.37
	ō	22	Ö			ŏ	0.29
	Ö	20	Ő	-1		ŏ	2.13
	Ō	22	Ő	1		ŏ	0.29
	0	21	0	Ō		õ	0.21
	Ō	23	0	2		õt	2.37
	0	22	0	1		ōt	0.29
	0	21	0	0		ō	0.21
	0	20	0	-1		ōŤ	2.13
	0	21	0	0		ō	0.21
	0	22	0	1		ō	0.29
	0	21	Ő	0		0	0.21
	0	23	0	2		0	2.37
	0	21	0			0	0.21
	0	20	0	-1		Ō	2.13
	0	23	0	2		0	2.37
	0	23	0	2		0	2.37
	0	24	Ö			0	6.45
	0	23	0	2		힉	2.37
	0	23	0	2		<u>o</u>	2.37
	0	20	0			ol	2.13
	0	20	0				2.13
	0	21	0	and the second se		<u>o</u>	0.21
loan	The second s	21	0		1	<u>o</u>	0.21
fean D	0.0			total		0	134.42
1	0.00	1.66					
1 2	50 50	•					
	Deviation	l	L				
		lsquare)+(s	11m af -12-	nuare))/ef	un7.7		
		um of d2squ		quare)//n11 134.42			
	oquare)+(St	n1+n2-2 =	are)	134.42			
		111112-2 =		1.371633			
			S=	1.37 1633			
= (Moan )	X1 - Mean	X2/S)(sqrt o	-				
	Mean X2/S		-18.3236				
	2/n1+n2 =		-10.3230				
			25				
		t=					
				, 			

З.

() Neg.col	ntrol vsVin	ca rosea or x2	d1=x1-X1	15ul d2=x2-X2	d1xd1	d2xd2
	x1 0	21	0	-3	0	7.40
	0	21	0	-3	0	13.84
	0	18	0	-6	0	32.72
	0	28	0	-0	0	18.32
	0	20	0	4	0	1.64
	0	23	0	-1	0	0.52
	0	23	0	-2	0	2.96
	0	22	0	-1	0	0.52
	0	22	0	-2	0	2.96
	0	23	0	-1	0	0.52
	ŏ	24	0	0	Ő	0.02
	ō	24	0	Ŏ	Ő	0.08
	ŏ	25	0 0	1	0	1.64
	ō	24	Ö	0	Ő	0.08
	Ő	24	Ő	Ő	0	0.08
	0	23	0	-1	0	0.52
	Ö	23	0	-1	Ő	0.52
	0	24	0	Ó	Ő	0.08
	0	23	0	-1	0	0.52
	0	23	0 0	-1	Ő	0.52
	0	24	0	0	Ö	0.08
	Õ	24	ŏ	ŏ	ŏ	0.08
	Ö	23	Ö	-1	Ő	0.52
	0	23	0	-1	ō	0.52
	0	23	0	-1	Ő	0.52
	Ō	24	0	0	Ō	0.08
	0	24	0	0	ō	0.08
	0	24	0	0	ō	0.08
	Ō	23	Ō	-1	Ö	0.52
	0	25	0	1	ō	1.64
	0	25	0	1	0	1.64
	0	25	Ō	1	Ö	1.64
	0	25	Ō	1	Ō	1.64
	0	25	0	1	0	1.64
	0	25	0	1	0	1.64
	0	25	0	1	0	1.64
	0	25	0	1	0	1.64
	0	25	0	1	0	1.64
	0	24	0	Ō	0	0.08
	0	25	Ó	1	0	1.64
	0	23	0	-1	0	0.52
	0	24	0			0.08
	0	24	0	0	0	0.08
	0	25	0	1	0	1.64
	0	24	0	0	0	0.08
	0	25	0	1	0	1.64
	0	23	Ő			0.52
	0	23	0			0.52
	0	24	0	0	0	0.08
		~~	0	-1	0	0.52
	0	23			0	110.08
	0.0	23.72	0	total	0	
SD		23.72	0	total	v	
SD 11	0.0 0.00 50	23.72	0	total		- <u>4</u> -5.17
SD 11 12	0.0 0.00 50 50	23.72	0	total	~ 	<u></u>
	0.0 0.00 50 50 Deviation ((sum of d1	23.72 1.50 square)+(s	0 sum of d2s	quare))/n1+	+n2-2	-My-My-La - La
SD 11 12 Standard I S=sq.rt of	0.0 0.00 50 50 Deviation	23.72 1.50 square)+(s	0 sum of d2s	<b>quare))/n1</b> - 110.08	+n2-2	
SD 11 12 Standard I S=sq.rt of	0.0 0.00 50 50 Deviation ((sum of d1	23.72 1.50 square)+(s	0 sum of d2s	<b>quare})/n1</b> - 110.08 98	+n2-2	
SD 11 12 Standard I S=sq.rt of	0.0 0.00 50 50 Deviation ((sum of d1	23.72 1.50 square)+(s	0 sum of d2s lare) =	<b>quare})/n1</b> - 110.08 98 1.123265	+n2-2	
SD 1 2 Standard I S=sq.rt of sum of d1	0.0 0.00 50 50 Deviation ((sum of d1 square)+(su	23.72 1.50 square)+(s im of d2squ n1+n2-2 =	0 sum of d2s lare) = S=	<b>quare}}/n1</b> - 110.08 98 1.123265 1.059842	+n2-2	
SD 12 Standard I S=sq.rt of sum of d1 := (Mean )	0.0 0.00 50 Deviation ((sum of d1 square)+(su	23.72 1.50 square)+(s im of d2squ n1+n2-2 = (2/S)(sqrt o	0 sum of d2s lare) = S= of n1n2/n1+	quare})/n1- 110.08 98 1.123265 1.059842 +n2)	+n2-2	
SD 51 Standard I S=sq.rt of sum of d1 t = (Mean X	0.0 0.00 50 50 Deviation ((sum of d1 square)+(su X1 - Mean X Mean X2/S	23.72 1.50 square)+(s im of d2squ n1+n2-2 = (2/S)(sqrt o	0 sum of d2s lare) = S= of n1n2/n1+ -22.38069	quare})/n1- 110.08 98 1.123265 1.059842 -n2) 0.86	+n2-2	
SD 52 Standard I S=sq.rt of sum of d1 == (Mean X	0.0 0.00 50 Deviation ((sum of d1 square)+(su	23.72 1.50 square)+(s im of d2squ n1+n2-2 = (2/S)(sqrt o	0 sum of d2s lare) = S= of n1n2/n1+ -22.38069 25	quare})/n1- 110.08 98 1.123265 1.059842 -n2) 0.86	+n2-2	
SD 54andard I S=sq.rt of sum of d1 = (Mean X1 -	0.0 0.00 50 Deviation ((sum of d1 square)+(su X1 - Mean ) Mean X2/S 2/n1+n2 =	23.72 1.50 square)+(s im of d2squ n1+n2-2 = (2/S)(sqrt of =	0 sum of d2s lare) = S= of n1n2/n1+ -22.38069 25 5	quare})/n1- 110.08 98 1.123265 1.059842 -n2) 0.86	+n2-2	

	x1	x2	d1=x1-X1	d2=x2-X2	d1xd1	d2xd2
		18	-1	-3	0.4096	11.97
	21		-2	-1	2.6896	2.13
	20	20	-2	L	1.8496	
	23	18				
	22	25	0			A CONTRACTOR OF THE OWNER OWNE
	20	25	-2			
	22	20	0		0.1296	
	20	19	-2		2.6896	
	23	19	1			
	21	20	-1			
	22	20	0		Ā	
	23	23	1			
	20	23	-2			2.37
	20	24	-2			
	21	23	-1	E		
	20	23	-2	2	and the second se	f
	23	22	1	1	1.8496	0.29
	23	22	1			0.29
	20	21	-2	0		
	22	20	0	-1	0.1296	2.13
	21	20	-1	-1	0.4096	2.13
	22	20	0	-1	0.1296	and the second se
	23	21	1	0	****	
	20	20	-2	-1	2.6896	
	21	22	-1		0.4096	
	22	23	C	2	0.1296	2.37
	21	22	-1			
	23	23	1			
	21	22	-1			
	22	20	Ċ			
	23	22	1	-		
	23	21	Ċ			
	22	23	č			
	22	23	1			**********
	23	22	-1			
	22	20				
	22	20				
			-1			
	22	22 21				
			1			
	23	23 21	1			
	23		1			
	22	20	0			
	20	23	-2	2		
	20	23	-2			
	21	24	-1			
	20	23	-2			
	21	23	-1			
	23	20	1			
	23	20	1			the second s
	22	21	( <u> </u>		and the state of t	
	23	21	1		-	
Mean	21.6			) total	63.52	? 134.42
SD	1.14	1.66				
n1	50					
···•	50					
n2	Deviation					
n2 Standard			sum of d2s	quare))/n1	∻n2-2	
n2 Standard S=sg.rt of	((sum of d1					
n2 Standard S=sg.rt of				197.94	ł	
n2 Standard S=sg.rt of	((sum of d1			197.94 98		
n2 Standard S=sg.rt of	((sum of d1	im of d2squ			3	
n2 Standard S=sg.rt of	((sum of d1	im of d2squ		98	5	
n2 Standard S=sg.rt of (sum of d1	((sum of d1	ım of d2squ n1+n2-2 =	Jare) = S=	98 2.019796 1.421195	5	
n2 Standard S=sg.rt of (sum of d1 t = (Mean	<b>((sum of d1</b> Isquare)+(su	im of d2squ n1+n2-2 = <b>(2/S)(sqrt</b> (	Jare) = S=	98 2.019796 1.421195 <b>+n2)</b>	5	
n2 Standard S=sg.rt of (sum of d1 t = (Mean Mean X1 -	( <b>(sum of d1</b> (square)+(su X1 - Mean )	im of d2squ n1+n2-2 = <b>(2/S)(sqrt</b> (	uare) = S= of n1n2/n1	98 2.019796 1.421195 <b>+n2)</b> 4 0.86	5	
n2 Standard S=sg.rt of (sum of d1 t = (Mean Mean X1 -	<b>X1 - Mean X</b> Mean X2/S 2/n1+n2 =	im of d2squ n1+n2-2 = <b>(2/S)(sqrt</b> (	uare) = S= of n1n2/n1 0.126654 25	98 2.019796 1.421195 <b>+n2)</b> 4 0.86	5	

() Gardie P	vinca rose	a 15ul	····				
the second s			11=x1- <b>X1</b>	d2≕x2-X2	To	i1xd1	d2xd2
ľ	21	21	-2	-3	-	5.5696	7.40
ŀ	20	20	-3	-4	_	11.2896	13.84
ľ	25	18	2	-6	_	2.6896	32.72
	21	28	-2	4	-	5.5696	18.32
	21	25	-2	1	-	5.5696	1.64
	23	23	0	-1		0.1296	0.52
Ļ	22	22	-1	-2	-	1.8496	2.96
Ļ	24	23	1	-1		0.4096	0.52
	23	22	0	-2		0.1296	2.96 0.52
	23	23	0	-1	-	0.1296	0.52
ŀ	24 23	<u>24</u> 24				0.4096	0.08
-	23	25	-1			1.8496	1.64
	23	23	0			0.1296	0.08
•	23	24	Ő			0.1296	0.08
ŀ	24	23	1		_	0.4096	0.52
ŀ	23	23	0		-	0.1296	0.52
	22 .	24	-1		_	1.8496	0.08
ł	22	23	-1			1.8496	0.52
	23	23	0		1	0.1296	0.52
ľ	24	24	1		ō	0.4096	0.08
	25	24	2		D	2.6896	
	24	23	1		1	0.4096	0.52
	23	23	0		<u> </u>	0.1296	
[	23	23	0		-	0.1296	0.52
	23	24	0		0	0.1296	
	24	24	1		D	0.4096	
	25	24	2		<u>o</u>	2.6896	
	24	23	1		-	0.4096	and the second sec
	25	25	2		1	2.6896	
	23	25	0	L	1	0.1296	
	25	25	2		1	2.6896	
	24 23	25 25	1		$\frac{1}{1}$	0.4096	
	23	25	1		뉘	0.4096	
	24	25			ł	0.4096	And the second se
	24	25			1	0.4096	
	24	25	2		1	2.6896	
	23	23	4		ó	0.4096	
	25	25	2		ĭ	2.6896	
	23	23	Č		1	0.1296	
	24	24	1		ō	0.4096	
	23	24	(		ō	0.1296	0.08
	23	25	(		1	0.1296	1.64
	24	24	1		0	0.4096	
·	23	25	(		1	0.1296	
	24	23	1		1	0.4096	
	24	23	1		1	0.4096	
	23	24	(		이	0.1296	
	24	23			1	0.4096	
an	23.4			) total		63.52	110.08
)	1.14	1.50					
	50 50						
ndo-d	50 Deviation	I					
		lsquare)+(s	um of do	diare))/n	1.*	n2-2	
		um of d2squ		173.6			
	aquare/riot	n1+n2-2 =			8		
				1.77142			
			S=	1.3309			
(Mean	X1 - Mean X	X2/S)(sqrt o	_		-		
	Mean X2/S		-0.27048		6		
	2/n1+n2 =		2		2		
			ł	5			
		t=	-1.35241	t value be	e c	consider as	s positive
					-		

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## APPENDIX -C

## Table of Critical Values for T

		nin anti-contra processi anti-	and and a second se	Two Tailed Significance								
	0.2	0.1	0.05	0.01	0.005	0.001	0.0005	0.0001				
	2 1.89	2.92	4.30	9.92	14.09	31.60	44.70	100.14				
····· -····	3 1.64	2.35	3.18	5.84	7.45	12.92	16.33	28.01				
	4 1.53	2.13	2.78	4.60	5.60	8.61	10.31	15.53				
	5 1.48	2.02	2.57	4.03	4.77	6.87	7,98	11.18				
	6 1.44	1.94	2.45	3.71	4.32	5.96	6.79	9.08				
	7 1.41	1.89	2.36	3.50	4.03	5.41	6.08	7.89				
	8 1.40	1.86	2.31	3.36	3.83	5.04	5.62	7.12				
	9 1.38	1.83	2.26	3.25	3.69	4.78	5.29	6.59				
1	0 1.37	1.81	2.23	3.17	3.58	4.59	5.05	6.21				
1	1 1.36	1.80	2.20	3.11	3.50	4.44	4.86	5.92				
12	2 1.36	1.78	2.18	3.05	3.43	4.32	4.72	5.70				
13	3 1.35	1.77	2.16	3.01	3.37	4.22	4.60	5.51				
14	1 1.35	1.76	2.14	2.98	3.33	4,14	4.50	5.36				
15	5 1.34	1.75	2.13	2.95	3.29	4.07	4.42	5.24				
16		1.75	2.12	2.92	3.25	4.01	4.35	5.13				
17	1.33	1.74	2.11	2.90	3.22	3.97	4.29	5.04				
18		1.73	2.10	2.88	3.20	3.92	4.23	4.97				
19	1.33	1.73	2.09	2.86	3.17	3.88	4.19	4.90				
20	1.33	1.72	2.09	2.85	3.15	3.85	4.15	4.84				
	1.32	1.72	2.08	2.83	3.14	3.82	4.11	4.78				
22	1.32	1.72	2.07	2.82	3.12	3.79	4.08	4.74				
23		1.71	2.07	2.81	3.10	3.77	4.05	4.69				
24	1.32	1.71	2.06	2.80	3.09	3.75	4.02	4.65				
25		1.71	2.06	2.79	3.08	3.73	4.00	4.62				
26	-	1.71	2.06	2.78	3.07	3.71	3.97	4.59				
27	1.31	1.70	2.05	2.77	3.06	3.69	3.95	4.56				
28	1.31	1.70	2.05	2.76	3.05	3.67	3.93	4.53				
29	1.31	1.70	2.05	2.76	3.04	3.66	3.92	4.51				

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30	) 1.31	1,70	2.04	2.75	3.03	3.65	3.90	4.48
38	5 1.31	1.69	2.03	2.72	3.00	3.59	3.84	4.39
40	1.30	1.68	2.02	2.70	2.97	3.55	3.79	4.32
45	1.30	1.68	2.01	2.69	2.95	3.52	3.75	4.27
50	1.30	1.68	2.01	2.68	2.94	3.50	3.72	4.23
55	1.30	1.67	2.00	2.67	2.92	. 3.48	3.70	4.20
60	1.30	1.67	2.00	2.66	2.91	3.46	3.68	4.17
65	1.29	1.67	2.00	2.65	2.91	3.45	3.66	4.15
70	1.29	1.67	1.99	2,65	2.90	3.43	3.65	4.13
75	1.29	1.67	1.99	2.64	2.89	3.42	3.64	4.11
80	1.29	1.66	1.99	2.64	2.89	3.42	3.63	4.10
85	1.29	1.66	1.99	2.63	2.88	3.41	3.62	4.08
90	1.29	1.66	1.99	2.63	2.88	3.40	3.61	4.07
95	1.29	1,66	1.99	2.63	2.87	3.40	3.60	4.06
100	1.29	1.66	1.98	2.63	2.87	3.39	3.60	4.05
200	1.29	1.65	1.97	2.60	2.84	. 3.34	3.54	3.97
500	1.28	1.65	1.96	2.59	2.82	3.31	3.50	3.92
1000	1.28	1.65	1.96	2.58	2.81	3.30	3.49	3.91
Infinity	1.28	1.64	1.96	2.58	2.81	3.29	3.48	3.89

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17	P=.9	.8	.7	.6	.5	.4	.3	.2	.1	.05	.02	.01	.001
1	.158	.325	.510	.727	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.619
2	.142	.289	.445	617	.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.598
3	.137	.277	.424	.584	.765	.978	1.250	1.638	2.353	3.182	4.541	5.841	12.941
4	.134	.271	.414	.569	.741	.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	.132	.267	.408	.559	.727	.920	1.156	1.476	2.015	2.571	3.365	4.032	6.859
б	.131	.265	.404	.553	.718	.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	.130	.263	.402	.549	.711	.896	1.119	1.415	1.895	2.365	2.998	3.499	5.405
8	.130	.262	.399	.546	.706	.889	1.108	1.397	1.860	2.306	2.896	3,355	5.041
9	.129	.261	.398	.543	.703	.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	.129	.260	.397	.542	.700	.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	.129	.260	.396	.540	.697	.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	.128	.259	.395	.539	.695	.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	.128	.259	.394	.538	.694	.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	.128	.258	.393	.537	.692	.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	.128	.258	.393	.536	.691	.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	.128	.258	.392	.535	.690	.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	.128	.257	.392	.534	.689	.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	.127	.257	.392	.534	.688	.862	1.067	1.330	1.734	- 2.101	2.552	2.878	3.922
19	.127	.2.57	.391	.533	.688	.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883

TABLE 39. TABLE OF THE DISTRIBUTION OF # FOR CERTAIN PROBABILITY LEVELS\*

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	P=.9	.8	.7	.6	5	.4	.3	.2	.1	.05	.02	.01	.001
n			.391	.533	.687	.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
20	.127	.257		.532	.686	.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
. 21	.127	.257	.391		.686	.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
22	.127	.256	.390	.532	.685	.858	1.060	1.319	1.714	2.069	2.500	2.807	3.767
23	.127	.256	.390	.532	.685	.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
24	.127	.256	.390	.531	.684	.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
25	.127	.256	.390	.531	.684	.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
26	.127	.256	.390	.531	.684	.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
. 27	.127	.256	.389	.531	.683	.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
28	.127	.256	389	.530		.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
29	.127	.256	.389	.530	.683	.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
30	.127	.256	.389	.530	.683		100	1.303	1.684	2.021	2.423	2.704	3.551
40	.126	.255	.388	.529	.681	.851	1.050		1.671	2.000	2.390	2.660	3.460
60	.126	.254	.387	.527	.679	.848	1.046	1.296		1.980	2.358	2.617	3.373
120	.126	.254	.386	.526	.677	.845	1.041	1.289	1.658	1	2.326	2.576	3.291
00	.126	.253	.385	.524	.674	.842	1.036	1.282	1.645	1.960	2	2.370	3.291

\* From Fisher and Yates, Statistical Tables for Biological, Medical and Agricultural Research, Edinburgh, Oliver and Boyd, Ltd., 1938, by permission of the publishers.

## Assessment form (for examiner use only)

Assessment criteria

	<u></u>		 	****	 	 
Candidate session number	0	0				

	Achi	evement lev	evel			
	First		Second			
	examiner	maximum	examiner			
A research question	2	2	2			
B introduction	2	2	2.			
C investigation	4	4	<b>\$</b> 3			
D knowledge and understanding	ng Ly	4	4			
E reasoned argument	4	4	4			
F analysis and evaluation	3	4	e-g			
G use of subject language	4	4	4			
H conclusion	1	2	1			
I formal presentation	4	4	4			
J abstract	2	2	2			
K holistic judgment	3	4	4			
Total out of 36	33	]_/	34			
		V				

See