Roy's Union-Intersection Test for One –Way Multivariate Repeated Measurements Analysis of Variance Model

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Abstract

This research is devoted to the study the Roy's Union-Intersection Test in One -Way Multivariate repeated measurements analysis of variance model (MRM MANOVA), which contains one between-units factor (Group with q levels) incorporating one random effect, one within-units factor (Time with p levels) . The test statistics of various hypotheses on between-unites factor ,within-units factor and the interaction between them are given . As practical research , a study has been taken to diagnostics and isolation for kinds of bacteria which complain with tissue cultivation for the dates and the study of frustrate affection for three kinds of extractor plant , which are called *Rhus coriaria* and *Cinnamomum zeylanicum* , the excretes of adhesive for the *Bswellia* sp. plant and by using four kinds of solvent and three different condense. An experimental has been made for getting measurement for the best reacting extractor plant with the solvent by using different affection on frustrate core .

Key words :One-Way Multivariate Repeated Measures Model,Roy's Union-Intersection test , Wishart distribution, MANOVA.

1. Introduction

Repeated measurements analysis is widely used in many fields , for example, in the health and life sciences, epidemiology, biomedical, agricultural, industrial, psychological, educational research and so on. Repeated measurements is a term used to describe data in which the response variable for each experimental unite is observed on multiple occasions and possibly under different experimental conditions [6]. Repeated measures designs involving two or more independent groups are among the most common experimental designs in a variety of research settings. Various statistical procedures have been suggested for analyzing data from split-plot designs when parametric model assumptions are violated[4]. Repeated measurements analysis of variance, often referred to as randomized block and split-plot designs [3] and [6].

The focus of this paper is to study the one-way multivariate repeated measurements analysis of variance model (MRM ANOVA) . The test statistics of various hypotheses on between-units factors which are called the multivariate Roy's Union-Intersection tests are given. The practical side of this paper is about tissue agriculture of Date palm trees . The date palm *Phonenix dactylifera* is regarded as the most important fruit tree in Arab and Islamic Worlds. Palm Trees were known in Mesopotamia since 4000 B.C . Their Inscriptions were found in Assyrian Ruins. The cultivation of the Palm trees are spread in many places in Iraq. The greater part of them is focused in Basrah, where there are two millions of Palm trees (Statistics of Ministry of Agriculture, 2004). The most important reasons that make us select the subject of Palm trees are:

1- The date fruit is considered as the most important commercial crops in the countries of the Middle East.
2- The dates are fruits which belong to palmaceae family; they contain a high percentage of sugars%(44-88), fat %(0.2 – 0.5), protein %(2.3- 5.6), and there

are 15 kinds of salts, minerals and vitamins.

3- The dates contain high percentage of Antioxidants, which are important and necessary for the body. Among the wide horizon of Phenolic compounds , the dates contain PSina Pic acid, Coumaric Ferulic, as essential compounds . Antioxidants are paid a great attention by the specialists of nutrition science, and the researchers in the field of Medicine, because of its direct effect on the shorthand of the danger of chronic diseases, like cancer, heart diseases , aging and shocks .

4- They reduce the Oxidation and destruction of the DNA in the body of human beings.

The production of the Palm trees in the Arab zone, including Iraq is low, because of the negligence of the basic services, like fertilization. In addition, wars have clear effect on the production of the Palm Trees. The most recent methods of Palm trees cultivation are the tissue agriculture. Despite the fact that it is the best in some of its parts that we will clarify later. This does not prevent Palm infection by diseases and insects, as well as some kinds of bacteria, whether in the lab, or within cultivation in the field. The purpose of our study , having specified and separated three kinds of bacteria, is to examine the effect of the transactions of distance inhibitory of bacteria, and to know the best interaction of transactions through the application of the statistical test Roy's Union-Intersection. The results of application are obtained by MATLAB (R 2012) program .

2– Roy's Union-Intersection Test

Any characteristic root of HE^{-1} can be used as a test criterion . Roy (1953) proposed λ_1 , the maximum characteristic root of HE^{-1}, on basis of his "union-intersection principle "[5] The test procedure is to reject the null hypothesis if $\theta = \frac{\lambda_1}{1+\lambda_1}$ is greater than $\theta_{\alpha,s,m,N}(\alpha)$, which satisfies $P_r\ \{\ \theta \geq \theta_{\alpha,s,m,N}(\alpha)\} = \alpha$.

Where :

s= min $(v_H\ , P)$, m = $\frac{1}{2}$ $(|v_H - P|$-1) ,

$N = \frac{1}{2}(v_E - P - 1)$,

E= sum squares matrix of the error, H= sum squares matrix of the hypothesis ,

$\boldsymbol{v_E}$ = degrees of freedom for error, $\boldsymbol{v_H}$= degrees of freedom for hypothesis ,

P = number of variables(dimension) .

3 - One –Way MRM Model

There are a variety of possibilities for the between- units factors in a one-way design. In a randomized one-way MRM experiment,

the experimental units are randomized to one between-units factor (Groups with q levels), one within-units factor (Time with p levels) and random effect to experimental unit i within treatment group j , we define

the following linear model and parameterization for the one-way

multivariate repeated measurements design with one between- units factor [2]:

$$\mathbf{y_{ijk}} = \boldsymbol{\mu} + \boldsymbol{\tau_j} + \boldsymbol{\delta_{i(j)}} + \boldsymbol{\gamma_k} + (\boldsymbol{\tau\gamma})_{\mathbf{jk}} + \mathbf{e_{ijk}} \qquad (3\text{-}1)$$

Where

$i = 1, \cdots, n_j$ is an index for experimental unit within group j ,

$j = 1, \cdots, q$ is an index for levels of the between-units factor (Group),

$k = 1, \cdots, p$ is an index for levels of the within-units factor (Time),

$Y_{ijk} = [Y_{ijk1}, \cdots, Y_{ijkr}]'$ is the response measurement at time k for unit i within group j,

$\mu = [\mu_1, \cdots, \mu_r]'$ is the overall mean,

$\tau_j = [\tau_{j1}, \cdots, \tau_{jr}]'$ is the added effect for treatment group j ,

$\delta_{i(j)} = [\delta_{i(j)1}, \cdots, \delta_{i(j)r}]'$ is the random effect due to experimental unit i within treatment group j,

$\gamma_k = [\gamma_{k1}, \cdots, \gamma_{kr}]'$ is the added effect for time k ,

$(\tau\gamma)_{jk} = [(\tau\gamma)_{jk1}, \cdots, (\tau\gamma)_{jkr}]'$ is the added effect for the group j × time k interaction,

and $e_{ijk} = [e_{ijk1}, \cdots, e_{ijkr}]'$ is the random error on time k for unit i within group j.

For the parameterization to be of full rank, we imposed the following set of conditions

$$\sum_{j=1}^{q} \tau_j = 0 , \qquad \sum_{k=1}^{p} \gamma_k = 0 ,$$

$\sum_{j=1}^{q} (\tau\gamma)_{jk} = 0$ for each $k = 1, \cdots, p$;

$\sum_{k=1}^{p} (\tau\gamma)_{jk} = 0$ for each $j = 1, \cdots, q$; (3.2)

And we assumed that the e_{ijk}'s ,$\delta_{i(j)}$'s are independent with

$e_{ijk} = [e_{ijk1}, \cdots, e_{ijkr}]' \sim \text{i.i.d.} N_r(0, \Sigma_e)$, and

$\delta_{i(j)} = [\delta_{i(j)1}, \cdots, \delta_{i(j)r}]' \sim \text{i.i.d.} N_r(0, \Sigma_\delta)$ (3.3)

where Σ_e, Σ_δ are $r \times r$ positive definite matrices.

Let $Y_{ij} = [Y_{ij1}, Y_{ij2}, \cdots, Y_{ijp}]'$,

$$\text{That is } Y_{ij} = \begin{bmatrix} Y_{ij11} & Y_{ij21} \cdots & Y_{ijp1} \\ Y_{ij12} & Y_{ij22} \cdots & Y_{ijp2} \\ \vdots & \vdots \ddots & \vdots \\ Y_{ij1r} & Y_{ij2r} \cdots & Y_{ijpr} \end{bmatrix} \qquad (3.4)$$

The variance- covariance matrix of $\vec{Y}_{ij}$ is denoted as $\sum$, where $\vec{Y}_{ij} = \mathrm{Vec}(Y_{ij})$.

The $\mathrm{Vec}(\cdot)$ operator creates a column vector from a matrix Y_{ij} by simply stacking the column vectors of Y_{ij} below one another .

The variance- covariance matrix $\sum$ of the model (3.1) satisfies the assumption of compound symmetry, i.e.

$$\Sigma_\delta = \begin{bmatrix} \Sigma_e + \Sigma_\delta & \Sigma_\delta & \cdots & \Sigma_\delta \\ \Sigma_\delta & \Sigma_e + \Sigma_\delta & \cdots & \Sigma_\delta \\ \vdots & \vdots & \ddots & \vdots \\ \Sigma_\delta & \Sigma_\delta & \cdots & \Sigma_e + \Sigma_\delta \end{bmatrix}, \quad (3.5)$$

Where I_p denotes the $p \times p$ identity matrix, J_p denotes $p \times p$ matrix of one's and $\otimes$ is the Kronecker product operation of two matrices. obviously , we have that

$$e_{ij} = [e_{ij1}, \cdots, e_{ijp}]' \sim \mathrm{i.i.d.}\, N_{p\times r}(0, I_p \otimes \Sigma_e) \,.$$

4 -Analysis of variance (ANOVA) for the One-Way Multivariate Repeated Measurements Model

Let U^* be $p \times p$ orthogonal matrix. It is partitioned as follows:

$$U^* = \left(p^{\frac{-1}{2}} j_p U\right) \qquad (3.7)$$

Where j_p denotes the $p \times 1$ vector of one's , U is $p \times (p-1)$ matrix . Because U^* is chosen to be orthogonal, we have that $U' j_p = 0$ and $U'U = I_{p-1}$ .Let $Y_{ij}^* = Y_{ij} U^*$

$$\text{where} Y_{ij} = \begin{bmatrix} Y_{ij11}^* & Y_{ij21}^* \cdots & Y_{ijp1}^* \\ Y_{ij12}^* & Y_{ij22}^* \cdots & Y_{ijp2}^* \\ \vdots & \vdots \ddots & \vdots \\ Y_{ij1r}^* & Y_{ij2r}^* \cdots & Y_{ijpr}^* \end{bmatrix} \quad (3.8)$$

So $\mathrm{Cov}(\vec{Y}_{ij}^*) = Cov\,(\overrightarrow{Y_{ij}U^*}) = Cov\left(\left(U^{*'} \otimes I_r\right) \vec{Y}_{ij}\right)$

$$= (U^{*'} \otimes I_r)\Sigma(U^* \otimes I_r) (3.9)$$

For (3.5) we get $\mathrm{Cov}(\vec{Y}_{ij}^{*}) = ({U^{*}}'\otimes I_r)(\mathrm{I_P} \otimes \Sigma_e + \mathrm{J_P} \otimes \Sigma_\delta)(U^{*} \otimes I_r)$.

$$= \mathrm{I_P} \otimes \Sigma_e + {U^{*}}'\mathrm{J_P}U^{*}\otimes\Sigma_\delta = \begin{bmatrix} \Sigma_e + \mathrm{P}\Sigma_\delta & 0 & \cdots & 0 \\ 0 & \Sigma_e & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \Sigma_e \end{bmatrix} \qquad (3.10)$$

That means $\mathrm{Y}_{\mathrm{ij1}}^{*}$, … , $\mathrm{Y}_{\mathrm{ijP}}^{*}$ are independent of each other

$\mathrm{Cov}\ (\mathrm{Y}_{\mathrm{ijk}}^{*}) = \Sigma_\mathrm{e} + \mathrm{P}\Sigma_\delta$ and $\mathrm{Cov}\ (\mathrm{Y}_{\mathrm{ijk}}^{*}) = \Sigma_\mathrm{e}$, for each k=2,…,p

Now $Y_{\mathrm{ij1}}^{*}= Y_{\mathrm{ij}}P^{-1/2}J_P$,[$\mathrm{Y}_{\mathrm{ij2}}^{*}$ …$\mathrm{Y}_{\mathrm{ijP}}^{*}$]= $Y_{\mathrm{ij}}U$

$$\mathrm{Cov}(\vec{Y}_{ij}^{*}) = \begin{bmatrix} \Sigma_e + \mathrm{P}\Sigma_\delta & 0 & \cdots & 0 \\ 0 & \Sigma_e & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \Sigma_e \end{bmatrix} \qquad (3.11)$$

So $Y_{ij1}^{*} = \begin{bmatrix} Y_{ij11}^{*} \\ Y_{ij12}^{*} \\ \vdots \\ Y_{ij1r}^{*} \end{bmatrix} = \begin{bmatrix} \frac{1}{\sqrt{p}}\sum_{k=1}^{p} Y_{ijk1} \\ \frac{1}{\sqrt{p}}\sum_{k=1}^{p} Y_{ijk2} \\ \vdots \\ \frac{1}{\sqrt{p}}\sum_{k=1}^{p} Y_{ijkr} \end{bmatrix}$,

From (3.1), we obtain $Y_{ij1}^{*} = p^{\frac{-1}{2}}\sum_{k=1}^{p} Y_{ijk}$

$=p^{\frac{-1}{2}}\left(\sum_{k=1}^{p}(\mu + \tau_j + \delta_{i(j)} + \gamma_k + (\tau\gamma)_{jk} + e_{ijk})\right) = p^{\frac{1}{2}}\mu + p^{\frac{1}{2}}\tau_j + p^{\frac{1}{2}}\delta_{i(j)} + p^{\frac{-1}{2}}\sum_{k=1}^{p} e_{ijk}$

$Y_{ij1}^{*} = \mu^{*} + \tau_j^{*} + \delta_{i(j)}^{*} + e_{ij1}^{*}$ Then the set of

vectors$\left(\boldsymbol{Y}_{\boldsymbol{111}}^{*},\cdots,\boldsymbol{Y}_{\boldsymbol{n_1 11}}^{*}\right)',\left(\boldsymbol{Y}_{\boldsymbol{121}}^{*},\cdots,\boldsymbol{Y}_{\boldsymbol{n_2 21}}^{*}\right)',\cdots,\left(\boldsymbol{Y}_{\boldsymbol{1q1}}^{*},\cdots \boldsymbol{Y}_{\boldsymbol{n_q q1}}^{*}\right)'$

Has mean vectors

$ß_1 = \sqrt{p}\mu + \sqrt{p}\tau_1$, $ß_2 = \sqrt{p}\mu + \sqrt{p}\tau_2$, …, $ß_q = \sqrt{p}\mu + \sqrt{p}\tau_q$

respectively, and each of them has covariance matrix $\Sigma_e + p\Sigma_\delta$.

So, the null hypothesis of the same treatment effects is: $H_{01}: \tau_1 = \tau_2 = \cdots = \tau_q = 0$

equivalent to the null hypothesis for the same mean vector $H_{01} = ß_1 = ß_2 = \cdots = ß_q = 0$.

The ANOVA based on the set of transformed observations above, the $Y^*_{ij1}{}'s$ provides the ANOVA for the between-units effects. This leads to the following form for the sum square terms: SS_G and $SS_{u(G)}$,where

$$SS_G = \sum_{j=1}^{q} n_j (\bar{Y}^*_{j1} - \bar{Y}^*_1)(\bar{Y}^*_{j1} - \bar{Y}^*_1)'$$

$$SS_{u(G)} = \sum_{j=1}^{q} \sum_{i=1}^{n_j} (Y^*_{ij1} - \bar{Y}^*_{j1})(Y^*_{ij1} - \bar{Y}^*_{j1})'$$

where

$$\bar{Y}^*_{j1} = \frac{\sum_{i=1}^{n_j} Y^*_{ij1}}{n_j} \qquad , \bar{Y}^*_1 = \frac{\sum_{j=1}^{q} \sum_{i=1}^{n_j} Y^*_{ij1}}{n}$$

Obviously , $SS_{u(G)} \sim W_r(n-q\ , p\Sigma_\delta + \Sigma_e)$

When $H_{01}: \tau_1 = \tau_2 = \cdots = \tau_q = 0$ is true

$SS_G \sim W_r(q-1, p\Sigma_\delta + \Sigma_e)$ where W_r denotes the multivariate-Wishart distribution. Then the Roy's union- Intersection test or largest root , $\lambda_1 =$ largest characterizations root of $ss_G ss^{-1}_{u(G)}$

The ANOVA based on the k^{th} set of transformed observations, the $Y^*_{ijk}{}'s$ for each $k = 2, \ldots, p$, i.e.

$$Y_{ijk}^{*} = \begin{bmatrix} Y_{112}^{*} & Y_{113}^{*} & \cdots & Y_{11P}^{*} \\ Y_{212}^{*} & Y_{213}^{*} & \cdots & Y_{21P}^{*} \\ \vdots & \vdots & & \vdots \\ Y_{n_1 12}^{*} & Y_{n_1 13}^{*} & \dots & Y_{n_1 1p}^{*} \\ Y_{122}^{*} & Y_{123}^{*} & \cdots & Y_{12p}^{*} \\ Y_{222}^{*} & Y_{223}^{*} & \dots & Y_{22p}^{*} \\ \vdots & \vdots & \cdots & \vdots \\ Y_{n_2 22}^{*} & Y_{n_2 23}^{*} & \vdots & Y_{n_2 2p}^{*} \\ \vdots & \vdots & \cdots & \vdots \\ Y_{1q2}^{*} & Y_{1q3}^{*} & \cdots & Y_{1qp}^{*} \\ \vdots & \vdots & \cdots & \vdots \\ Y_{n_q q2}^{*} & Y_{n_q q3}^{*} & & Y_{n_q qp}^{*} \end{bmatrix}$$

has the model

$$Y_{ijk}^{*} = \sum_{k'=1}^{p} u_{kk'} Y_{ijk\prime}$$

$$= \sum_{k'}^{p} u_{kk'} \left(\mu + \tau_j + \delta_{i(j)} + \gamma_{k'} + (\tau\gamma)_{jk'} + e_{ijk'}\right). \quad (4.1)$$

where k = 2, … ,p

Because the components of $\left(\boldsymbol{U_{k1}}, \cdots, \boldsymbol{U_{kp}}\right)$sum to zero for each $k = 2, \cdots, p$

the k^{th} model in (4.1) is equivalent to

$$Y_{ijk}^{*} = \gamma_k^{*} + (\tau\gamma)_{jk}^{*} + e_{ijk}^{*}\ , \quad (4.2)$$

Where $[\gamma_2^{*}, \dots, \gamma_p^{*}] = [\gamma_1, \dots, \gamma_p]U$.

Obviously , where $\gamma_1 = \dots = \gamma_p = 0$, it is sure $\gamma_2^{*} = \ \dots = \ \gamma_p^{*} = 0$. other wise because $\sum_{k=1}^{p} \gamma_k = 0$ then $[\ 0, \gamma_2^{*}, \dots, \gamma_p^{*}\ ] = [\ \gamma_1, \dots, \gamma_p\ ]\ U^{*}$

So $[\ \gamma_1, \dots, \gamma_p\ ] = [\ 0, \gamma_2^{*}, \dots, \gamma_p^{*}\ ] U'^{*}$

Which implies that when $\gamma_2^{*} = \ \dots = \ \gamma_p^{*} = 0$, it is sure that $\gamma_1 = \dots = \gamma_p = 0$ there are ,

$H_{02}: \gamma_1 = \ldots = \gamma_p = 0$ is equivalent to $H_{02}: \gamma_2^* = \ldots = \gamma_p^* = 0$.

Similarly for all j $\left[(\tau\gamma)_{j2}^*, \ldots, (\tau\gamma)_{jp}^*\right] = [(\tau\gamma)_{j1}, \ldots, (\tau\gamma)_{jp}]U$

$H_{03}: (\tau\gamma)_{j1} = \cdots = (\tau\gamma)_{jp} = 0$

Is equivalent to the hypothesis $H_{03}: (\tau\gamma)_{j2}^* = \cdots = (\tau\gamma)_{jp}^* = 0.$

Then

1) $SSE = \sum_{k=2}^{p} \sum_{j=1}^{q} \sum_{i=1}^{n_j} (Y_{ijk}^* - \bar{Y}_{jk}^*)(Y_{ijk}^* - \bar{Y}_{jk}^*)'$

$SSE \sim W_r((p-1)(n-q), \Sigma_e)$

where

$$\bar{Y}_{jk}^* = \frac{\sum_{i=1}^{n_j} Y_{ijk}^*}{n_j},$$

When $H_{03}: (\tau\gamma)_{jk} = 0, \forall$ j, k is true

2) $SS_{G\times T} = \sum_{k=2}^{p} \sum_{j=1}^{q} n_j (\bar{Y}_{jk}^* - \bar{Y}_k^*)(\bar{Y}_{jk}^* - \bar{Y}_k^*)'$

$SS_{G\times T} \sim W_r((p-1)(q-1), \Sigma_e)$

where $\bar{Y}_K^* = \dfrac{\sum_{j=1}^{q} n_j \bar{Y}_{jk}^*}{n}, \quad k = 2, \ldots, p$

3) $SS_{Time} = \sum_{k=2}^{p} n(\bar{Y}_k^* (\bar{Y}_k^*)')$

$SS_{Time} \sim W_r((p-1), \Sigma_e)$

when $H_{02}: \gamma_k = 0$, $\forall$ k ; is true

So when the null hypothesis of equivalent time effects is true . i.e when H_{02} : γ_k= 0,∀k ; is true then the Roy's Union – Intersection test λ_1 = largest characterizations root of $ss_T ss_E^{-1}$.

Also when the null hypothesis no group × time interaction is true . i.e when H_{03} :$(\tau\gamma)_{jk}$ = 0 , ∀ j , k; is true , then the Roy's Union – Intersection test λ_1 = largest characterizations root of $ss_{G\times T} ss_E^{-1}$.

Table 1: ANOVA table for the random effects one – way MRM design with one between- unit factor , with Roy's criterion .

	Source	D.F	SS	Roy's Union-Intersection Criterion
Between	Group Unit(Group)	q-1 n-q	SS_G $SS_{u(G)}$	Largest characteristics root of $(SS_G SS_{u(G)}^{-1})$
Within	Time Group×Time	p-1 (q-1)(p-1)	SS_T $SS_{G\times T}$	Largest characteristics root of $(SS_T SS_E^{-1})$ Largest characteristics root of $(SS_{G\times T} SS_E^{-1})$
	Error	(p-1)(n-q)	SSE	

5- The Experiment

The tissue agriculture is considered as modern technology to propagate many plants which belong to different plant families. The technology of the tissue agriculture has proved its efficiency in the propagation of the plants, which can be produced from the root of the same plant and the matching plants arising from their origins, in terms of genetic stability [1] . The tissue propagation is achieved either by the organogenesis from the growing top of the plant and the axillary buds[9], or the formation of the Somatic embryogenesis which passes through the Callus stage, from which the Vegetative embryos is created by cultivating the tissue of the plant in industrial sterile food environment. The first attempts of Palm trees propagation by this technology started at the beginning of the seventies of the twentieth century. Implementation mechanism tissue culture propagation is developed in the last two decades. The benefits of the application of the tissue agriculture in the field of the plant improvement and gaining new off springs has greatly increased.

Having clarified the meaning of the tissue agriculture, we can talk now about the details of the experiment .The data of the experiment was taken from Date palm research center, Basrah university – which represent for isolation and identification of bacterial types that contaminated date palm tissue culture., and studied the inhibiting activities of three types of plant extracts on fruit of *Rhus coriaria* , bark of *Cinnamomum zeylanicum* and gummy extraction of *Bswellia* sp., using four types of solvent water , methyl alcohol , normal hexane and ethyl acetate , in two concentrations (0.5 , 1) % . The results of isolation and identification of bacteria appeared contamination of callus tissue of date palm tissue culture by three genera of bacteria *Staphylloccus aureus* , *Bacillus subtilius* and *proteus* spp .

According to the mathematical formula of the model study (3.1) and by applying the model to the experiment, we get the sum squares matrices , of the effects between-units factors, within-units factors, effect to interaction between-unit factor (Group) and within-units factors (Time), of the Experiment as follows:

	Hypotheses	Calculated value of Roy's Union-Intersection	Table value of Roy's Union-Intersection	The comparison	The decision
Between	$H_{01}: \tau_1^* = \tau_2^* = \tau_3^* = 0$	0.9999	0.563	0.9999>0.563	Rejection H_{01}
Within	$H_{02}: \gamma_2^* = \gamma_3^* = 0$	0.9999	0.374	0.9999>0.374	Rejection H_{02}
interaction between and within	$H_{03}: (\tau\gamma)_{j2}^* = (\tau\gamma)_{j3}^* = 0$	0.9998	0.472	0.998>0.472	Rejection H_{03}

We reject hypothesesH_{01} ,H_{02} and H_{03} ,that by using Roy's Union-Intersection test at 0.05 level of significance, because of the calculated Roy's Union-Intersection greater then table values. In rejection our hypothesis H_{01},we mean that the group factor has active effect, and each one of *Rhus coriaria* , *Cinnamomum zeylanicum* , *Bswellia* sp. has different affection on frustrate core of bacteria . In point of hypothesis H_{02} , mean our rejection that for each one of bacteria kinds (time factor) will be touching effectually . H_{03} is rejected because we can find affection for the interaction between group factor and time factor, and we can say that , the results showed that ethyl acetate extracts 1% of each *Rhus coriaria* and *Bswellia* sp. appeared the highest inhibition zone of about (23.00 , 24.00)mm respectively against *S.aureus* while the inhibition zone of ethyl acetate acetate extract 1% of *Bswellia* sp.against *B.subtilius* was 18.33 mm , the results showed that alcohol and ethyl for acetate *Rhus coriaria* extract were the best extracts that gave the highest inhibition zone

(16.76,16.33) mm respectively against *Proteus* spp.

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اختبار Roy's Union-Intersection لنموذج القياسات المتكررة المتعدد المتغيرات ذي الاتجاه الواحد

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الخلاصة:

يتناول هذا البحث دراسة تحليل التباين المشترك لنموذج القياسات المتكررة ذات الاتجاه الواحد (One-way MRM) حيث يحتوي عامل واحد بين الوحدات يدعى (المجموعة) مضاف لها التأثير العشوائي بين الوحدات وعامل واحد داخل الوحدات يدعى الزمن. وكذلك ندرس إحصائياتَ اختبار الفرضياتِ المُخْتَلِفةِ على عوامل بين الوحدات ، وداخل الوحدات و التفاعل بينهم .و كجانب عملي للبحث أخذت دراسة لعزل وتشخيص أنواع البكتريا المرافقة للزراعة النسيجية لنخيل التمر و دراسة التأثير التثبيطي لثلاث أنواع من المستخلصات النباتية و هي ثمار نبات السماق وقلف نبات القرفة و الإفرازات الصمغية للعلك المر و باستعمال أربعه أنواع من المذيبات و بتركيزين مختلفين .و أجريت لتجربة لقياس مدى أفضلية تفاعل المستخلصات النباتية مع المذيبات بتراكيز مختلفة على القطر التثبيطي للبكتريا .