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EFFECT OF CROSSING AMONG SOME LOCAL AND FOREIGN STRAINS OF CHICKENS ON CARCASS TRAITS

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ABSTRACT

The present study was conducted at Maryout Experimental Station at El-Amria Region, Desert Research center, Ministry of Agriculture, throughout the period from 2004 to 2006. The objectives of this research were : to determine the heterotic effects of the reciprocal crosses among three strains including Gimmizah (GG) as a local strain, Rhode Island Red (RR) as a standard foreign strain and Kosmos (KK) as a commercial meat type strain on body weights at 4, 8, 12, 16 and 20 weeks of age and some carcass traits at 24 weeks of age, as well as to calculate each of strait –line difference, maternal additive effects and direct additive effect and calculate potency ratio values.

The results indicated that the cross of Gimmizah with Rhode Island Red had the highest positive average degree of heterosis for body weight of 28.01% at 4 weeks, 41.52% at 8 weeks and 19.77% at 12 weeks of age which could be due to over dominance of the Gimmizah and Rhode Island Red strains according to their potency ratio (RR) values which were 3.56, 9.65 and 4.24 at 4, 8 and 12 weeks of age, respectively. The values of average degree of heterosis (ADH%) were positive for live body weight (5.22%), drawing weight (0.46%) and eviscerated carcass weight (11.67%) at 24 weeks of age for the Rhode Island Red x Kosmos cross which could be due to dominance effects towards the high parent (Kosmos) where potency ratio value was 1.24. Using Kosmos strain as a dam strain in GK and RK crosses improved body weight trait at 4,8,12 and 16 weeks of age. Using Gimmizah strain as a sire strain in GR cross resulted in superiority of body weight at 4, 8, 12, 16 and 20 weeks of age, live body weight, eviscerated carcass weight % and edible giblets weight% at 24 weeks of age.

keywords: Heterosis, maternal and direct additive and potency ratio effects for some carcass traits.

INTRODUCTION

A strains cross in poultry industry is considered an effective method for production of hybrid vigor commercial stocks. Several investigators confirmed a slightly positive or negative heterotic effect of native breedcross breeding with foreign strains for improving carcass traits (*Salah-Eid, 1977 and El-Turkey 1981*). Also many investigators confirmed the superiority of crossbreds over the purebreds regarding reproductive and some economic traits (*Kosba et al, 1981, Farghaly and Saleh, 1988, Abdou, 1992 ,Nawar and Abdou1999 and Amin, 2007 and 2008*). Mating between native Egyptian breeds crossbreeding and foreign strains had performed better than pure strains (*Abd El-Gawad, 1981, Farghaly and Saleh, 1988 and Amin, 2007 and 2008)*.

The present study was conducted to evaluate the heterotic effects of the reciprocal crosses among Gimmizah, Rhode Island Red and Kosmos strains on body weights at 4 , 8 , 12 , 16 and 20 weeks of age and some carcass

traits at 24 weeks of age, to calculate each of strait-line difference , maternal additive effects and direct additive effect and to calculate potency ratio.

MATERIALS AND METHODS

The present study was carried out at Maryout Experimental Station at El-Amria Region, Desert Research Center, Ministry of Agriculture, throughout the period from 2004 to 2006.

Experiemental flock history : One local starin , Gimmizeh , one standard foreign strain , Rhode Island Red (RR) and one commercial meat type strain , Kosmos (KK) were used in this study. The first two strains were obtained from the Poultry Improvement Project (Ferhash, Behaira Government, while the commercial meat strain was obtained from the General Poultry Company, Cairo –Egypt.

Mating system : A total of 9 mature cocks and 45 hens were taken randomly from each of the above strains and mated in a full 3x3 diallel mating. Cocks and hens were assigned randomly to cages. Each cock was mated to five hens of its own strain or the other two strains. Hens were artificially inseminated after two weeks preliminary adaptation semen collection period.

Flock management : The birds were provided with 16 hr light and feeds and water were provided *ad libitum*. Pedigreed eggs as to cock and hen parental strain were collected and stored at 15° c and 85% RH and set weekly in a forced air inculator after being fumigated. Hatched chicks were wing banded as to each genotype and brooded in a conventional floor brooder until eight weeks of age, after which they were kept on floor pens. In designating a certain cross , the first and second litters denote to the strains used as a male and female parents, respectively. During the brooding period chicks were fed on a starter ration containing 22.7% crude protein and 2875 Kcal ME/kg. Then at 8 weeks of age they were fed *ad libitum* on a grower ration contained 18.6% crude protein and 2720 Kcal ME/kg. Feed and water were provided *ad libitum.* Vaccination and medication were done according to the program practiced at the farm.

Studied traits: Body weights were recorded for each individual at 4, 8, 12, 16 and 20 weeks of age. At 24 weeks of age, 8 cockerels were taken randomly from each genetic group for a carcass evaluation. Birds were starved of feed and water overnight (fastened for 12 hours) and weighed to the nearest gram before slaughtering. Birds were allowed to bleed freely. Feather was removed after scalding the birds. The carcass was weighed to obtain the drawn weight (New York dressed). Records, as to each within each genotypic group, were kept for edible giblets (livers, gizzard and heart) and eviscerated carcass weights. The percentages of the previously mentioned organs relative to the live body weight were calculated.

Statistical analysis:-

All percentage data were transformed to their corresponding arcsine angles prior to statistical analysis (SAS, 2000).Body weight and carcass traits data were analyzed by two-way analysis of variance and Duncan's multiple range test using General Linear Model (GLM) of statistical analysis system

(SAS user's Guide ,2000) in which data were initially corrected for hatch effect. Heterosis percentage (H%) was calculated for each cross or reciprocal cross according to Lazely (1978) as a deviation of crossbred mean from mid parent mean over mid parent means times 100.

Average degree of heterosis (ADH %) and potency ratio (PR) were calculated according to Sinha and Khanna (1975) as follow :-

$$\text{ADH \%} = \frac{F_1 - ½ (P_H - P_L)}{½ ((P_H + P_L)} \times 100$$

$$\text{PR} = \frac{F_1 - ½ (P_H - P_L)}{½ ((P_H - P_L)} \times 100$$

where:-

F_1 = mean of a certain cross plus its reciprocal cross,

P_H , P_L = means of the high parent and law parent, respectively.

Strait line difference, maternal additive effect and direct additive effect were calculated according to *Dickerson (1992)* as follow:-

Strait line difference $= (G^i_{Sj} + G^n_{Sj}) – (G^i_{Sk} – G^n_{Sk})$

$= (S_j \times S_j) – (S_K \times S_K)$

Maternal additive effect (i.e reciprocal crosses differences) :-

$G^m_{Sj} – G^m_{Sk} = (S_j \times S_k) - (S_k \times S_j)$

Direct additive effect (i.e. line group of sire difference)

$G^i_{Sj} - G^i_{Sk} = [(S_j \times S_j) + (S_j \times S_k)] – [(S_k \times S_k) + (S_k \times S_j)$

where :-

G^i and G^m represent direct additive and maternal additive effects ,respectively, of the subscript genetic group,

S_j denote to the j strain and

S_k denote to the k strain.

RESULTS AND DISCUSSION

The means and their standard errors of strains and their crosses for body weight at the different studied ages are presented in Table 1. The differences among the three genetic strains for body weight at the different studied ages were significant. Kosmos chicks had the highest significant means of body weights then those of Gimmizah and Rhode Island Red at the different studied ages. While the Rhode Island Red chicks had the lowest significant means of body than those of the other two strains at the same studied ages. Similar results were reported by *Nawar (1995) Mandour et at (1996), Newar et al (1997) and Aly et al. (2005)* of their reciprocal crosses KG and KR , respectively, at the different studied ages. However chickens of GR strain cross had significantly heavier body weights then those of the reciprocal cross RG, at all studied ages expect 4 weeks body weight. Kosmos birds had significantly the highest means of live body weight, eviscerated carcass weight % and adible giblets weight % at 24 weeks of age then those of the Gimmizah and Rhode Island Red, while Rhode Island Red birds had

the lowest significant means of live body weight and eviscerated carcass weight % at 24 weeks of age (Table 2). Birds of the strain crosses GR, Gk and RK had significantly heavier live body weight than those of the reciprocal crosses RG, KG and KR at 24 weeks of age. The strain cross GR had lower mean of eviscerated carcass weight % (47.69%) then the reciprocal cross RG (50.32%) at 24 weeks of age but the difference between them was not significant. However the strain crosses GK and RK had significantly lower means of eviscerated carcass weight% then those of the reciprocal crosses KR. The strain crosses GR and GK had higher significantly means of edible giblets weight % (1.69 and 1.71, respectively) then those of the reciprocal crosses RG (1.54%) and KG (1.39%) as shown in Table 2. The overall means of strain crosses were higher for live body weight and edible giblets weight % by 16.10 % and 7.03 % ,respectively, and lower for drawing weight % and eviscerated carcass weight % than those of the reciprocal crosses by 0.82 % and 11.72%, respectively.

The values of heterosis percentage indicated that crossing between Gimmizah and Rhode Island Red was associated with positive heterotic effects on body weight at 4, 8 , 12 and 16 weeks (28.05 , 53.42 , 23.27 and 2.04% respectively) for the GR cross and at 4 , 8 , 12 weeks of age (27.93 , 29.61 and 16.16% , respectively) for the RG cross as shown in Table 3 . Similar results were obtained by Nawar *et al ,* 1997, Aly *et al,* 2005 and Mandour *et al*, 1996.

The cross of Gimmizah with Rhode Island Red had the highest positive average degree of heterosis for body weight at 4 (28.01%), 8 (44.52%) and 12 (19.77%) weeks of age respectively. On the contrary, crossing Kosmos strain with Gimmizah and Rhode Island Red strains gave negative heterosis percentages for body weight at 4, 8, 12, 16 and 20 weeks of age as shown in Table 3. The presence of heterotic effects on body weight at 4,8 and 12 weeks of age could be due to over dominance of the Gimmizah and Rhode Island Red strains according to their potency ratio (PR) values (3.56 , 9.65 and 4.24, respectively,). The GK cross affected by complete dominance genes toward the Gimmizah parent for body weight at 16 weeks of age, where potency ratio value was -0.85 , while partial dominance effect towards the Rhode Island Red parent was found for body weight at 16 weeks of age depends on the value of potency ratio (-0.69).

The values of average degree of heterosis (ADH%) were positive for live body weight at 24 weeks of age (5.22%), drawing weight (0.46%) and eviscerated carcass weight (11.67%) for the Rhode Island Red x Kosmos cross as shown in Table 4. The corresponding potency ratio values were 0.41, 0.37 and 1.27, respectively, which indicated that there were partial dominance towards the same parent for the eviscerated carcass weight traits. On the other hand, the average degree of heterosis value (ADH%) for the eviscerated carcass weight percentage was -6.36% for the GR cross which could be due to over dominance effects towards the small parent (Rhode Island Red) where potency ratio value was -1.49 and 11.67% for the RK cross which could be due to dominance effects towards the high parent (Kosmos) where potency ratio value was 1.24.

1

Amin, E. M.

2

1868

Table 3: Heterosis percentage, average degree of heterosis (ADH%) and poteny ratio (PR) for body weights from to 20 weeks of age

Cross Item	Trait				
	Body weight (g) at 4 weeks	Body weight (g) at 8 weeks	Body weight (g) at 12 weeks	Body weight (g) at 16 week	Body weight (g) at 20 week
Strain cross Heterosis%					
GR	28.05	53.42	23.27	02.04	-25.54
GK	-05.55	-18.49	09.10	-19.88	-26.35
RK	05.88	-16.23	-08.25	-17.38	-15.30
Mean	9.46	06.23	01.97	-11.74	-22.40
Reciprocal cross					
RG	27.93	29.61	16.16	-02.32	-43.21
KG	-10.94	-28.65	-22.88	-28.55	-39.50
KR	-11.64	-29.06	-19.13	-26.26	-23.36
Mean	01.78	-09.37	-08.62	19.06	-35.36
F_1 cross ADH (%)					
GR	28.01	41.52	19.77	-00.17	-34.37
GK	-08.19	-23.98	-15.99	-24.22	-32.92
RK	-02.88	-22.64	-13.68	-21.82	-19.33
F_1 cross PR					
GR	03.56	09.56	04.24	-00.05	-04.89
GK	-00.33	-00.48	-00.46	-00.85	-03.89
RK	-00.09	-00.43	-00.35	-00.69	-01.26

[1] **The first parent of each cross denote to the sire parent.**

Table 4:Heterosis% percentage, average degree of heterosis (ADH%) and potency ratio (PR) for body weights for Carcass traits at 24 weeks of age

Cross Item	Trait			
	Live body weight (g)	Drawing weight (%)	Eviscerated carcass weight (%)	Edible giblets weight (%)
Strain cross Heterosis %				
GR	- 00.69	- 2.06	-08.87	00.59
GK	- 02.11	0.28	-09.49	-003.39
RK	16.37	0.27	02.49	- 15.17
Mean	04.52	0.50	- 05.29	05.99
Reciprocal cross				
GR	-04.32	1.39	03.84	-08.33
GK	-18.60	-00.85	00.97	-21.47
RK	05.94	0 0.57	20.84	-10.11
Mean	-09.62	00.37	05.99	-13.30
F_1 cross ADH (%)				
GR	-02.50	-0.45	-06.36	-03.57
GK	-10.35	-0.28	-04.25	-12.43
RK	05.22	0.46	11.67	-12.36
F_1 cross PR				
GR	-00.43	-0.47	-01.49	-06.00
GK	-00.74	-0.96	-00.76	-02.20
RK	00.41	0.37	01.24	-02.44

[1] **The first parent of each cross denote to the sire parent.**

Meternal additive effects:-

Using Kosmos strain as a dam strain in GK and RK crosses improved body weight trait at 4 , 8 , 12 and 16 weeks of age (Table 5). Also, using Kosmos strains as a dam strain with Gimmizah starin as a sire strain improved edible giblets weight percentage at 24 weeks of age (Table 6). Aly *et al* (2005) reported that body weight at 4, 8, 12, and 16 weeks of age of chickens mothered by Gimmizah starin were higher than those produced by Bandara dams. Also, Khalil *et al.*, (1999) found significant maternal effects on body weight in chickens.

Table 5: Strait line difference , maternal additive effect and direct additive effect for body weights at studied ages

Parameters	Trait				
	Body weight (g) at 4 weeks	Body weight (g) at 8 weeks	Body weight (g) at 12 weeks	Body weight (g) at 16 week	Body weight (g) at 20 week
Strait line difference					
GG-RR	040.9	0043.6	0080.1	0095.0	301.9
GG - KK	-179.9	-1026.1	-0949.9	-1120.1	-425.0
RR-KK	-219.8	-1069.7	-1030.0	-1215.1	-726.9
Maternal additive effect					
(GxR) – (RxG)	000.3	0119.6	0060.3	0059.2	379.7
(GxK) –(KxG)	019.8	0100.0	0249.9	0169.9	330.3
(RxK) – (KxR)	059.6	0130.2	0145.3	0.169.9	190.3
Direct additive effect					
[(GxG)+(GxR)]-[(RxR)+(RxG)]	040.2	0163.2	0140.2	0154.8	682.0
[(GxG)+(GxK)]-[(KxK)+(KxG)]	-160.1	0925.6	0860.3	0950.2	094.7
[(RxR)+(RxK)]-[(KxK)+(KxR)]	-160.2	-0939.5	-0894.7	-1045.2	-338.4

[1] The first parent of each cross denote to the sire parent.

Table 6 : Strait line difference , maternal additive effect and direct additive effect for crosses traits at 24weeks of ages

parameters	Trait			
	Live body weight (g)	Drawing weight %	Eviscerated carcasses weight (%)	Edible giblets weight %
Strait line difference				
GG-RR	0287.9	-1.69	04.45	-0.02
GG - KK	-0842.3	0.51	-06.20	-0.20
RR-KK	-1130.2	2.20	-10.65	-0.18
Maternal additive effect				
(GxR) – (RxG)	0891.0	-2.90	-02.63	0.15
(GxK) –(KxG)	0498.1	1.00	-06.03	0.32
(RxK) – (KxR)	0583.1	-0.27	-10.17	-0.09
Direct additive effect				
[(GxG)+(GxR)]-[(RxR)+(RxG)]	0377.0	-4.59	01.82	0.13
[(GxG)+(GxK)]-[(KxK)+(KxG)]	-1443.1	1.51	-12.23	0.12
[(RxR)+(RxK)]-[(KxK)+(KxR)]	-0647.1	1.93	-20.82	0.27

Direct additive effects:-

Using Gimmizah strain as a sire strain in GR cross resulted in superiority of body weight at 4,8,12, 16 and 20 weeks of age (Table 5), live body weight eviscerated carcass weight % and edible giblets weight% at 24 weeks of age (Table 6). Aly et al (2005) found that Gimmizah sire chicken of the Gimmizah with Bandara cross had heavier body weights at 4, 8, 12, and 16 weeks of age than those produced from Bandara sire.

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تأثير الخلط بين بعض انواع الدجاج الاجنبية والمحلية على صفات الذبيحة

عماد محمد امين

مركز بحوث الصحراء- وزارة الزراعة – القاهرة

أجريت هذه الدراسة في محطة بحوث مريوط بمنطقة العامرية التابعة لمراكز بحوث الصحراء – وزارة الزراعة خلال الفترة من عام ٢٠٠٤ إلى عام ٢٠٠٦ وكانت اهداف هذه الدراسة تتلخص فى :-

تحديد تأثيرات قوة الخلط في الخلطات المتبادلة بين ثلاث سلالات تشمل الجميزة (كسلالة محلية) والرود أيلاند الاحمر (كسلالة أجنبية قياسية) والكوزموس (كسلالة تجارية لإنتاج اللحم) على صفات أوزان الجسم عند عمر٤ ، ٨ ، ١٢ ، ١٦ ، ٢٠ أسبوع وبعض صفات الذبيحة عند عمر ٢٤ أسبوع وحساب كلٍ من التأثيرات الأمويـة التجميعيـة والتأثيرات التجميعيـة المباشرة وحساب قيم درجات السيادة.

وقد أظهرت النتائج أن خليط الجميزة مع الرود أيلاند الأحمر حاز على أعلى متوسط لدرجة الخلط لوزن الجسم حيث كانت ٢٨,٠١% عند عمر ٤ أسابيع و ٤١,٥٢% عند عمر ٨ اسابيع و١٩,٧٧ % عند ١٢ اسبوع والتي ترجع إلى وجود سيادة فائقة نحو سلالة الجميزة الأثقل وزناً حيث كانت قيم درجات السيادة ٣,٥٦ ، ٩,٥٦ ، ٤,٤٢ عند عمر ١٢،٨،٤ أسبوع على التوالي.

وكانت قيم متوسط درجة الخلط موجبة لوزن الجسم الحي (٥,٢٢%) و لوزن الذبيحة بعد التربيش (٤٦%) و لوزن الذبيحة المجوفة (١١,٦٧%) بالنسبة لخليط الرود أيلاند الأحمر مع الكوزموس والتي يمكن إرجاعها إلى وجود تأثيرات سائدة نحو الاب الاثقل وزنا (الكوزموس) حيث كانت قيمة درجة السيادة ١,٢٤.

استخدام سلالة الكوزموس كسلالة اموية فى خلطات الجميزة مع الكوزموس والرود ايلاند الاحمر مع الكوزموس أدى إلى تحسين صفة وزن الجسم عند عمر ٤ و ٨ و١٢ و١٦ اسبوع .

استخدام سلالة الجميزة كسلالة أبوية في خليط الجميزة مع الرود أيلان الأحمر نتج عنه زيادة في وزن الجسم عند عمر ٢٠،١٦،١٢،٨،٤ أسبوع وكذلك في وزن الجسم الحي ونسبة وزن الذبيحة المجوفة ونسبة وزن الحلويات و وزن الحلويات عند عمر ٢٤ أسبوع.

Table 1 : Means ($\bar{x}$) and their standard errors (S.E) for body weights at studied ages for the different populations

Population	Trait				
	Body weight (g) at 4 weeks	Body weight (g) at 8 weeks	Body weight (g) at 12 weeks	Body weight (g) at 16 week	Body weight (g) at 20 week
Pure strain					
Gimmizah ,GG	270.2±09.2^{y} *	0524.0±22.7^{y}	0900.3± 22.7^{y}	1400.2±32.2^{y}	2300.2±33.2^{y}
Rhode Island Red ,RR	230.3± 11.2^{z}	0480.4±23.3^{z}	0820.2±30.2 ^{z}	1305.2±45.2 ^{z}	1998.3±32.2 ^{z}
Kosmos , KK	450.1±08.4 ^{x}	1550.1±21.5 ^{x}	1850.2±03.2 ^{x}	2520.3± 39.2 ^{x}	2725.2±35.5 ^{x}
Mean	316.9	0851.5	1190.2	1741.9	2341.2
Strain - crosses[1]					
GR	320.5±07.3 ^{b}**	0770.5±23.6 ^{b}	1060.5±36.2 ^{b}	1380.3±36.2 ^{b}	1600.3±50.6 ^{c}
GK	340.6± 09.7 ^{a}	0840.5±26.3 ^{a}	1250.2±40.2 ^{a}	1570.5±50.3 ^{a}	1850.5±52.3 ^{b}
RK	360.2±08.3 ^{a}	0850.5±25.7 ^{a}	1225.1±36.2 ^{a}	1580.4±40.6 ^{a}	2000.5±65.3 ^{a}
Mean	340.4	820.5	1178.6	1510.4	1817.1
Reciprocal- cr					
RG	320.2±05.6 ^{b}	650.9±15.2 ^{c}	1000.2±25.2 ^{c}	1320.5±39.3 ^{c}	1220.6±42.2 ^{d}
KG	320.8±05.0 ^{b}	740.0±22.3 ^{b}	1060.6±33.3 ^{b}	1400.6±52.2 ^{b}	1520.2±44.0 ^{c}
KR	300.6±08.6 ^{c}	0720.3±25.2 ^{b}	1079.8±25.3 ^{b}	1410.5±23.0 ^{b}	1810.0±36.3 ^{b}
Mean	313.9	0674.0	1046.9	1377.2	1516.9

[1] The first parent of each cross denote to the sire parent,

*** Means in each column within the pure strain group and having the same capital letter are non significantly at P≤0.05,**

**** Means in each column and having the same small letter are non significant at p≤0.05.**

Table 2 : Means ($\bar{x}$) and their standard errors (S.E) of carcass traits for the different populations at 24 weeks of age

Population	Trait			
	Live body weight (g)	Drawing weight %	Eviscerated carcass weight (%)	Edible giblets weight %
Pure strain				
Gimmizah, GG	2600.0±75.1 ^{y*}	88.80 ± 0.64 ^{y}	54.55± 0.45 ^{y}	1.67 ±0.04 ^{y}
Rhode Island Red ,RR	2312.1 ± 50.5 ^{z}	90.49 ±0.03 ^{x}	50.10 ±0.32 ^{z}	1.69 ±0.04 ^{y}
Kosmos , KK	3442.3±50.5 ^{x}	88.29 ± 0.14 ^{y}	60.75 ±1.27 ^{x}	1.87 ± 0.03 ^{x}
Mean	2784.8	89.19	55.13	1.74
Strain - crosses[1]				
GR	2439.1±20.6 ^{b**}	87.80 ±0.05 ^{b}	47.69 ± 1.94 ^{c}	1.69 ±0.08 ^{a}
GK	2957.5 ± 09.4 ^{a}	88.80±0.03 ^{b}	52.18 ±0.28 ^{c}	1.70 ±0.03 ^{a}
RK	3041.4±98.5 ^{a}	89.63±0.02 ^{a}	56.81 ± 1.22 ^{b}	1.51 ±0.04 ^{b}
Mean	2812.7	88.74	52.23	1.64
Reciprocal- cross				
RG	2350.0±88.1 ^{c}	90.70 ±0.26 ^{a}	50.32 ± 0.75 ^{c}	1.54 ± 0.01 ^{b}
KG	2459.4 ± 67.7 ^{b}	87.80 ± 0.01 ^{b}	58.21 ± 0.22 ^{b}	1.39 ± 0.00 ^{c}
KR	2458.3 ±14.9 ^{b}	89.90 ± 0.02 ^{a}	66.98 ± 9.05 ^{a}	1.60 ± 0.06 ^{b}
Mean	2422.6	89.47	58.50	1.51

[1] **The first parent of each cross denote to the sire parent,**

*** Means in each column within the pure strain group and having the same capital letter are non significantly at P≤0.05,**

**** Means in each column and having the same small letter are non significant at p≤0.05.**