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INCIDENCE OF EMBRYONIC MORTALITY IN FAYOUMI BALADI AND SOME EXOTIC BREEDS OF POULTRY

By

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SUMMARY

This study was carried out in both the animal Breeding Dept. Research Farm of the Faculty of Agriculture, Giza, and the Liberation Province. Eggs from White Leghorns, Rhode Island Reds, North Holland Blue, Fayoumi, Baladi and some crossbreds, were used.

It was found that the general pattern of the curve of embryonic mortality obtained by other investigators was also observed in all breeds studied. In eggs from the Liberation Province no definite first peak occured, and the percentage of help-outs for all breeds was lower than that obtained for the same breeds in Giza. Seasonal variation occurred. A comparison was made between the curves of embryonic mortality in eggs obtained from high hatching groups of hens as well as eggs from a low hatching one. The latter showed an exaggeration in the two peaks, with a third peak appearing in the 10th and 12th day. Cross breeding was found to reduce embryonic mortality especially at the second peak.

A relation was observed between shell thickness and the ability of the embryo to pip and emerge. Eggs that hatched were found to have thinner shells than those containing embryoes that pipped the shell but failed to emerge, and those in turn, had thinner shells than eggs containing fully formed chicks in normal position.

INTRODUCTION

Embryonic Mortalities occur at any time in the embryo's life, from the moment fertilisation takes place up to when the chick is about to emerge out of its shell. The incidence of mortality follows a definite pattern, yet it differs from flock to flock, breed to breed, and from one hatch to another.

The detection of the time of death as well as casues which lead to embryonic mortality, help in improving hatchability.

A study of the effect of crossbreeding, season and shell thickness, on the shape of the curve of embryonic mortality in the indigenous breeds and newly imported exotic breeds would be of great interest from both a scientific and economic point of view.

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MATERIALS AND METHODS

Flock, breeds and eggs used in this study were previously described by the authors (Ragab and Helmy 1962).

RESULTS AND DISCUSSION

The Giza Flock :

The incidence of mortality among chick embroyos throughout the incubation period is represented in Figure 1. The Curves of embryo mortality obtained in this work for the studied breeds of poultry *i.e.* Baladi, Fayoumi, White Leghorns and Rhode-Islands Reds, were similar to those reported by Payne (1919). In all breeds studied the first peak of mortality occured at the third day of incubation except in Fayoumi where it occured on the second day. This result agrees with those of Byerly (1930) and Byerly *et al* (1934), but differs with that of Payne (1919) who found that it takes place at the fourth day. This difference may be largely due to different methods used in estimating the age of early dying embryos.

The second peak of embryonic mortality, took place on the 20th day in all breeds except the White Leghorn where it occured on the 19th day. Byerly *et al* (1934) working with White Leghorns reported the incidence of the second peak at the 20th day. Differences in this respect may be due to the difference in the accuracy of age estimation for the mebryos which die after the 18th day of incubation. All curves showed a minor peak at about the seventh day's incubation as reported by other investigators (Byerly 1930, and Byerly *et al* 1934).

The mortality among White Leghorn embryos was heavier than among any other breed during the first four days. Although the percentage distribution of dead embryos of White Leghorns and Rhode Island Reds during the first week differed from each other, they were similar to those reported by Byerly *et al* (1934) for the same breeds. On the other hand, their results concerning mortality during the last four days differed from those reported in this study. The percentage of embryos dying on the 19th day in White Leghorns and on the 20th day in the Rhode Island Reds was higher than what they reported, while the percentage of help-outs (22nd) day was lower for White Leghorn and higher in Rhode Island Red than what they observed for the same breeds. The difference between the two breeds in distribution of embryonic mortality cancelled each other so that the total mortality was 30.3 and 29.5% for White Leghorns and Rhode Island Reds respectively.

The Fayoumi embryos showed the lowest second peak but the highest percentage of help-outs. The percentage mortality of Baladi embryos at the third day was near that of White Leghorn, while mortality distribution during the last three days was nearly similar to those of the Rhode Island Red embryos.

The Liberation Pronvice Flock :

Thre was no well defined first peak in embryonic mortality. As the testing of eggs in Liberation province was done at the 18th day of incubation, it could be inferred that the estimation of the early dead embryo's age was not accurate since such embryos were liable to putrify. The second mortality peak in all breeds took place on the 20th day of incubation. Its percentage was nearly the same for all breeds except that of R.I.R. where it was very high. Percentage of help-outs in White Leghorn was the highest of all other breeds which showed nearly the same percentage.

In White Leghorns, the second peak of mortality occurred on the 20th day (Fig. 2) in the liberation province while it occured on the 19th day in Giza flock. Moreover, the percentage of help-outs was lower than that of Giza. The percentage of those which failed to emerge in Liberation province flock was about half the percentage obtained for Rhode Island Red at Giza.

Monthly variation in distribution of embryonic mortality:

Monthly variations were observed in distribution of embryonic mortality of the breeds in Giza Farm (Fig. 3) The breeds studied showed different trends in this respect. In Baladi and Fayoumi embryos, both first and second week mortality increased with the approach of summer. At the same time there was a tendency for third week mortality to decrease. It is very clear in White Leghorn that first week mortality increased while third week mortality decreased with the advance in season. No definite trend was observed in distribution of embryonic mortality of Rhode Island Red during the different months. The patterns observed in Baladi, Fayoumi and White Leghorn may be due to the effect of climatic conditions in spring and summer. During this period the atmospheric temperature rises, thus it may affect the gastrula during the storage period in such a way that it hinders more percentage of embryoes from going in development further than the first week in White Leghorns or the second week as observed in Baladi and Fayoumi.

Fayoumi eggs from Liberation Province were incubated during January and February and the mortality distribution is nearly the same as that of the same breed in Giza at that time (Fig. 4). The same holds true for the White Leghorns since eggs of this breed in Liberation province were incubated during February and March. The high embryonic mortality occuring on the third week in the Rhode Island Reds of Liberation Province was also observed in Giza during December, January and February at which time eggs of Liberation Province were incubated. However, it can be concluded that seasonal variation plays an important part in the distribution of embryonic mortality (Figure 3).

Comparison between high and low hatching groups of hens :

A comparison of the mortality distribution was made between the eggs of high (Over 80%) and low hatching groups (below 55%) of the different breeds studied in Giza. The high hatching group comprised 3284 fertile eggs from

Baladi, Fayoumi, White Leghorn and Rhode Island Red hens with an average mortality of 16.38%. Only 646 fertile eggs from the same breeds with an embryo mortality of 60.43% were used in the case of the low hatching group. It can be seen from figure 4 that the first peak of mortality occured at similar periods in both groups, but it was much exaggerated in the low-hatching group with a middle peak appearing on the 10th and 12th days. In the high hatching group the second mortality peak took place on the twentieth day while it occured on the nineteenth day and was much higher in the low hatshing group. These curves are similar to those reported by Bronkhorst (1933) for White Leghorn hens.

Fig. 5 shows the mortality distribution in the high hatching group of each breed separately. The Rhode Islad Red embryos showed the lowest first peak mortality followed by Fayoumi, Baladi and White Leghorn. Fayoumi embyos has the least 2nd week mortality followed by Baladi and Rhode Island Reds, While White Leghron had also the highest second peak mortality (Figure 5).

In the low-hatching groups (Fig. 6) the curves of embryonic mortality for the differnt breeds showe the same distribution except for the Leghorn. The second peak in this breed appeared one day later and was much higher than for all other breeds.

Effect of crossbreeding :

The mortality curve (Figure 7) for the crosses was lower than that of the pure breeds over the entire period of incubation with the most striking difference occuring on the first and last 4 days of the incubation period. The reduction in the second peak of the crossbred embryos was so great that early and late peaks were very nearly the same. These findings are similar to those of Byerly et al (1934), although they found that the first peak for cross-breds was slightly higher than that of the last peak.

The mortality distribution of the crosses between Fayoumi males and Rhode Island Red Females or their reciprocal crosses in Liberation Provirce was slightly lower than that of the pure breeds (Fayoumi and Rhode Island Red), and the difference was the same over the whole period of incubation (Fig. 8).

Embryonic mortality resulting from each cross was plotted separately (Fig. 9 and 10). It is clear that the Baladi x White Leghorn cross showed the lowest mortality crosses during the first and last peaks.

Effect of shell thickness :

(Table 1) contains the means and standard errors of shell thickness for eggs containing fully-formed chicks dead in normal position; eggs containing embryos which pipped the shell but failed to emerge ; and eggs which hatched from all breeds studied in Giza. It is clear from this table that in all breeds,

TABLE 1.– Shell Thick ness in Dead - in - shell, Pipped and Hatched Eggs

Groups	Breeds											
	Baladi			Fayoumi			White Leghorn			Rhode Island Red		
	No	Mean	mm.	No	Mean	mm.	No	Mean	mm.	No	Mean	mm.
Dean in shell .	30	0 94	0.008	22	0.286±	0.0160	15	0.256	0.0027	27	0.257×	0.0059
Pipped	27	0.274±	0.0004**	99	0.259±	0.0040**	149	0.249	0.0027	91	0.246	0.0047
Hatched . . .	1228	0.262±	0.0011**	1507	0.254±	0.0009**	1578	0.232	0.0010**	1477	0.245×	0.0023

* Significant

** Highly Significant

hatched eggs had slightly thinner shells than those that only pipped the shell, and these in turn had thinner shells than those with dead embryoes in the shells. Similar results were obtained by Ghany (1955) who found an adverse relationship between shell thickness and hatchability. He gave two explanations for this, first that the thinner shells at hatching constitute a less difficult barrier for the young chicks to break, and the other is that a healthy hatchable chick extracts more from the eggs shell and thus leaves a comparatively thinner layer of shell after hatching.

Monthly variation in dead in shells and help-outs:

The results obtained showed that the percentage of deads in shell and fail to emerge decreased with the advance in breeding season (Fig. 11 & 12) The re-sults reported by Miller and Bearse (1934) indicated that shell percentage of eggs decreased as the season advanced towards warmer weather. Warren et al (1939) found that there was a decline in shell thickness during spring and summer. These results as well as those previously mentioned in this investigation lead to the conclusion that the decrease in percentage of dead-in-shell and help-outs is due to the thinning of shell eggs in spring and summer. However, the decline in percentage of these groups of embryos may give reason to the decrease in third week mortality in the late season.

REFERENCES

Bronkhorst, J.J. (1933). A physical, chemical and physiological study of high and low hatching lines of Single Comb White Leghorns. Ph. D. Thesis Cornell University. (Cited by Landauer, W. 1951, pp. 61).

Byerlyx, T.C. (1930). Time of occurrance and probable causes of mortality in chick embryos. (Cited by Byerly T.C., Knox C.W. and Jull. M.A. 1934).

Byerlyx, T.C. et al, C.W. Knox and M.A. Jull (1934). Effects of diet on egg composition. II. Mortality of embryos on eggs from hens on diets containing protein supplements of different origin. J. Nut., 6 : 225-242. Some genetic aspects of hatchability Poult. Sci., 13 : 230-238.

Ghany, M.A. (1955). A study of egg characteristics in the domestic fowl. Ph. D. Thesis, Lond. Univ.

Miller, M. W. and Bearse G.F. (1934). Phosphorus requirements of laying hens Washington Agr. Exp. Sta. Bull. 306.

Payne, L.F. (1919-1920). Distribution of mortality during the period of incubation. (Cited by Landauer, W. 1951, pp. 161).

Ragab, M.T. and Helmy, S.A. (1962). Fertility of Baladi, Fayoumi and some exotic breeds of fowl as affected by some genetical, environmental and physical factors. U.A.R. J. Anim. Prod. II : 37-59.

Townsley, T.S. (1929). Humidity in incubation. (Cited by Landauer, W. 1951, pp. 53).

Warren, D.C. and R.L. Schnepel (1939). The effect of air temperatures on egg shell thickness in the fowl. (Cited by Wilhelm, L.A., 1939).

(Printed in 1967)

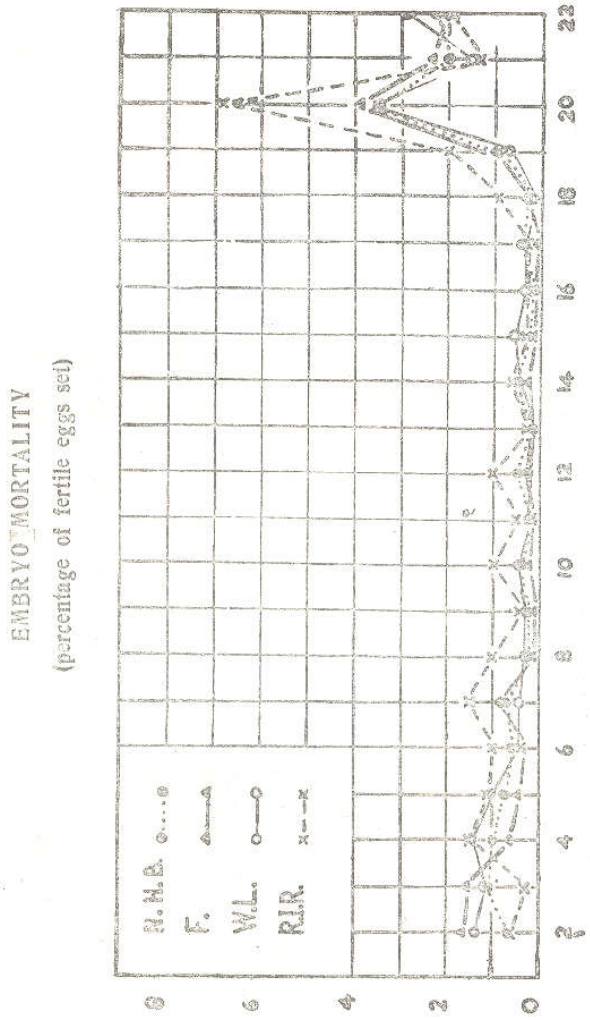


Figure 1.—Distribution of Embryonic Mortality of the Breeds in Giza Farm

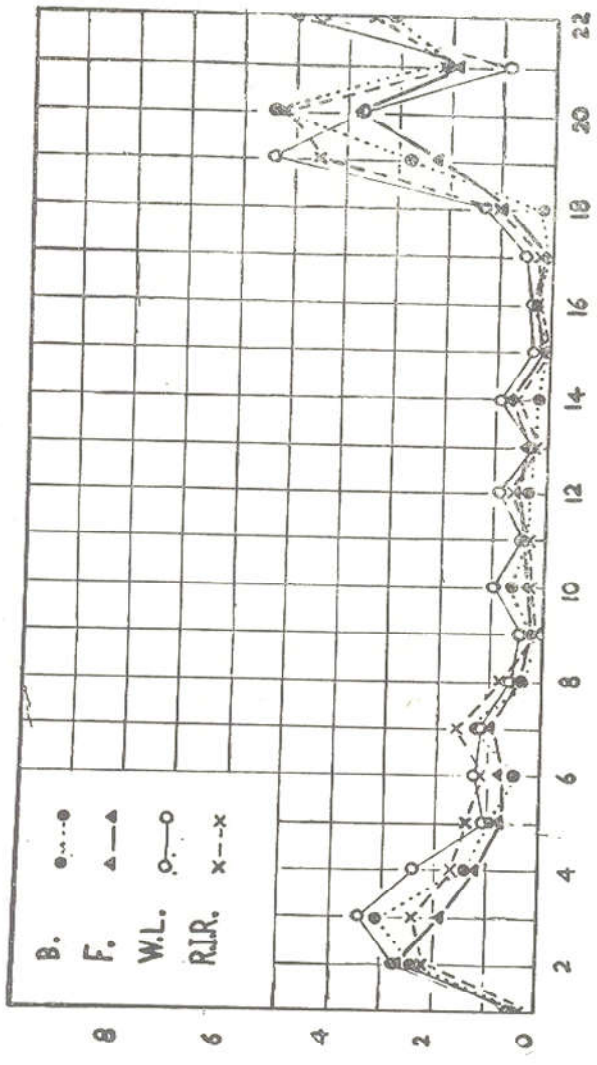


Figure 2.—Distribution of embryonic mortality of the breeds in Liberation province Farm

EMBRYONG MORTALITY

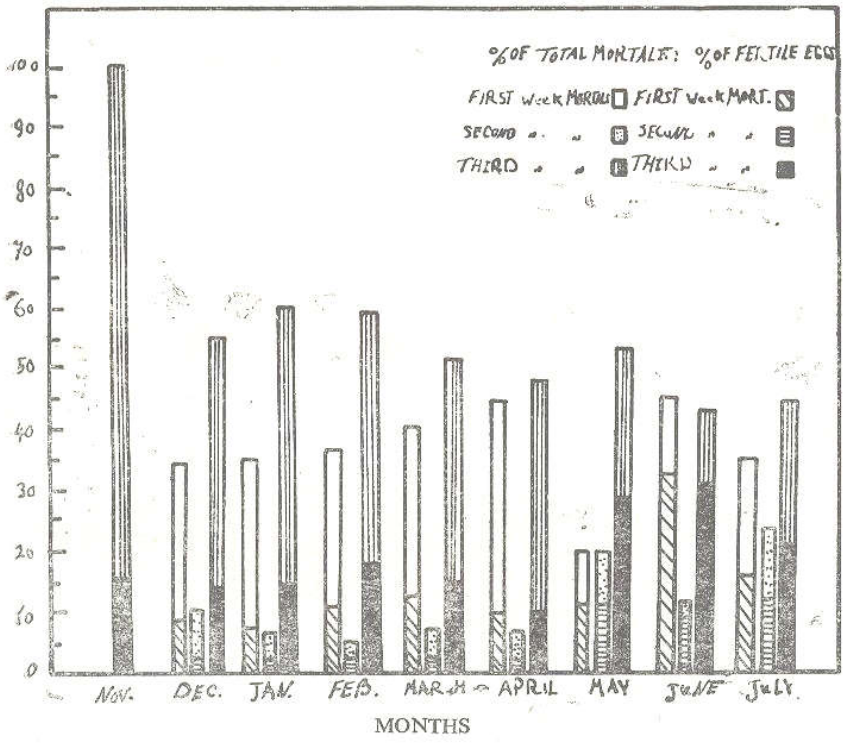


Figure 3

(*a*) Baladi

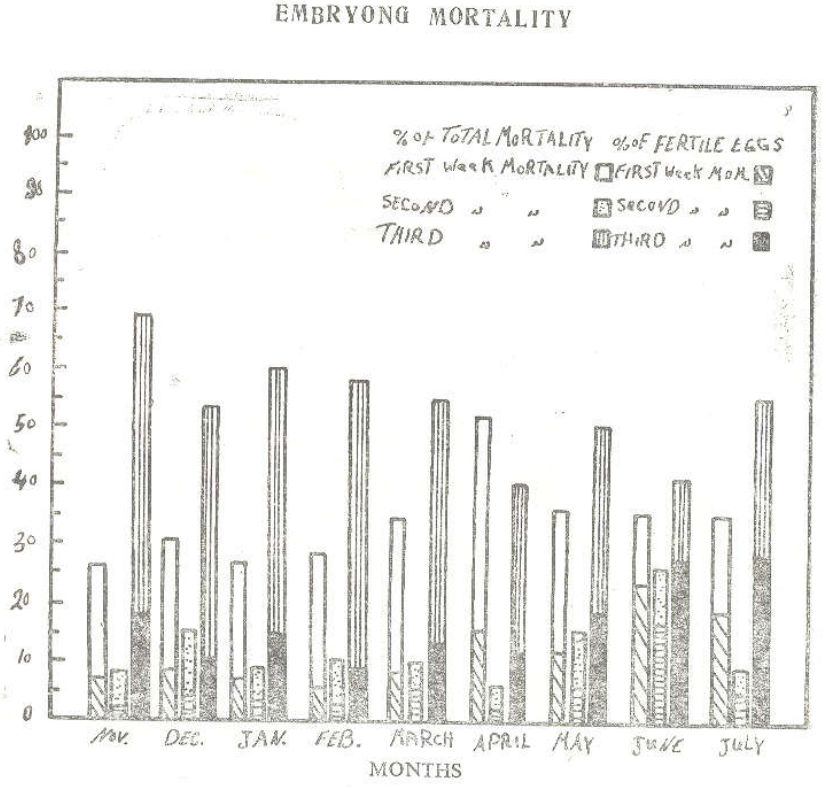


Figure 3

(*b*) Fayoumi

Fig. 3 (*a* & *b*)—Monthly variation in Distribution of Embryonic Mortality of the Breeds in Giza Farm

EMBRYONG MORTALITY

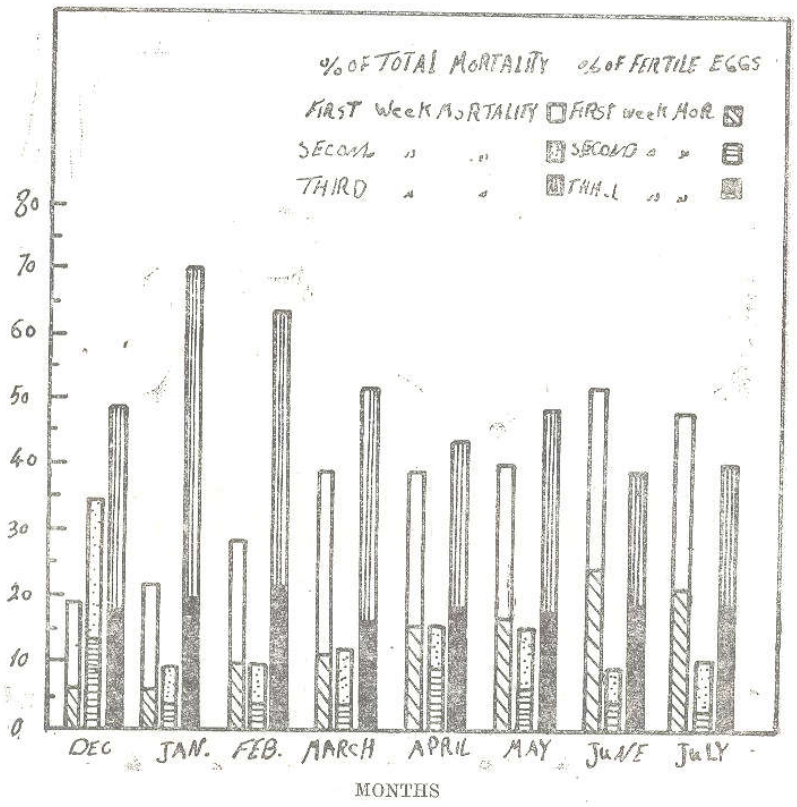


Figure 3.

(*a*) White Leghorn

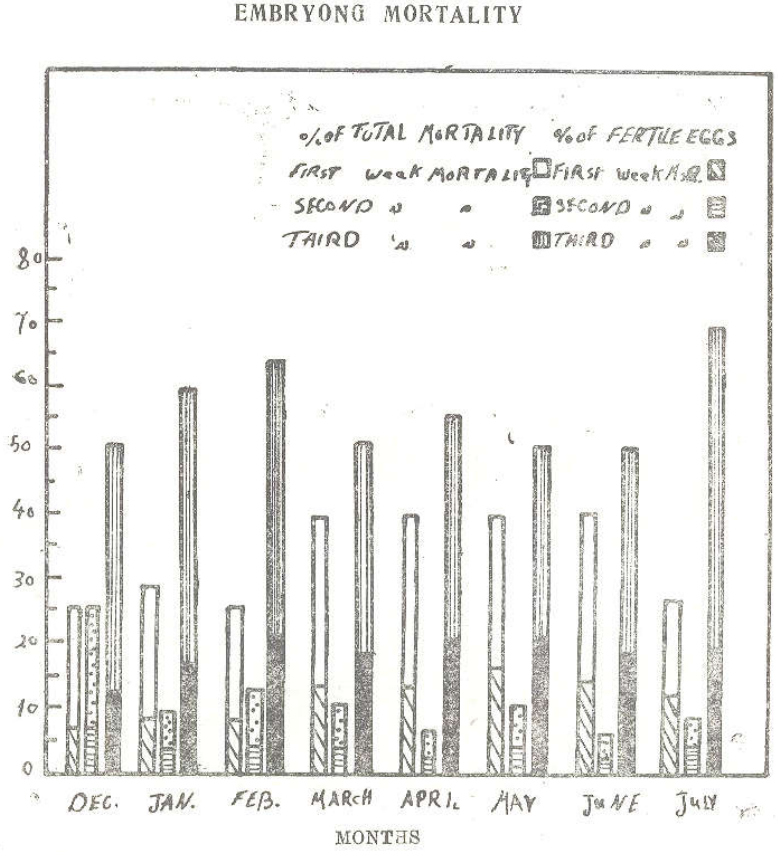


Figure 3

(*b*) Rhode Island Red

Figure 3 (*a* & *b*)—Monthly variation in Distribution of Embryonic Mortality of the Breeds in Giza Farm

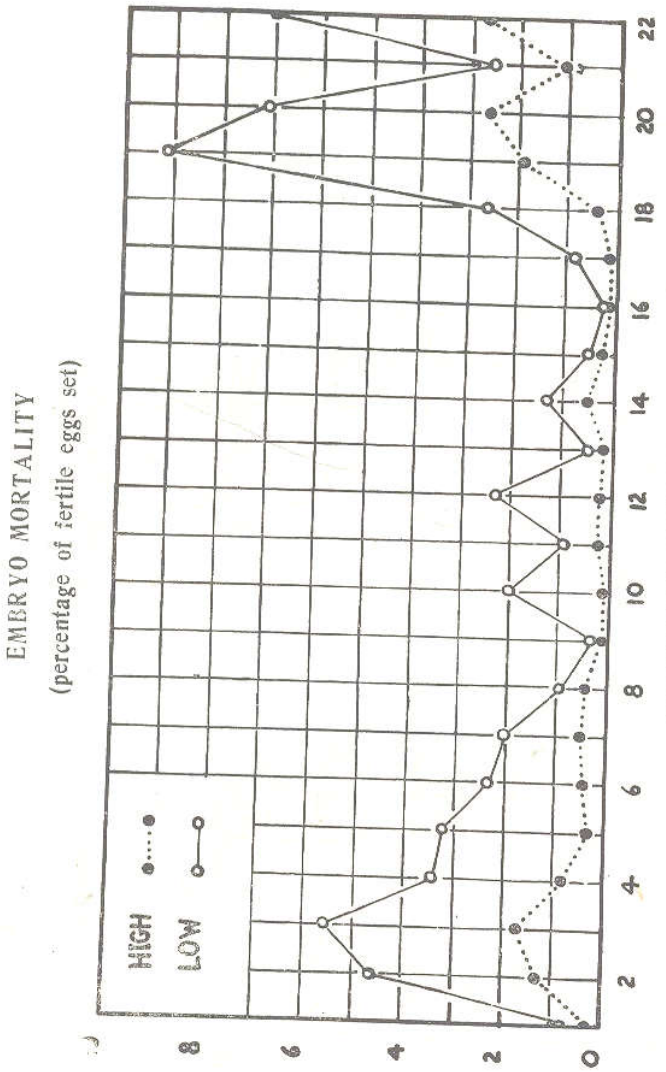


Figure 4—Distribution of embryonic mortality among a high and a low hatching group of hens from the different breed in Giza

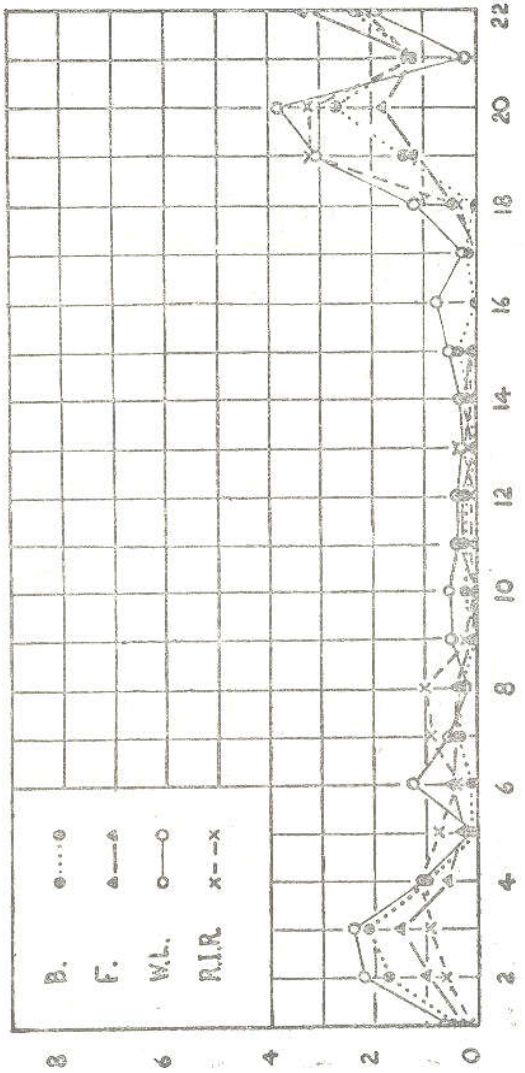


Figure 5—Distribution of embryonic mortality within a high hatching group of hens from each breed.

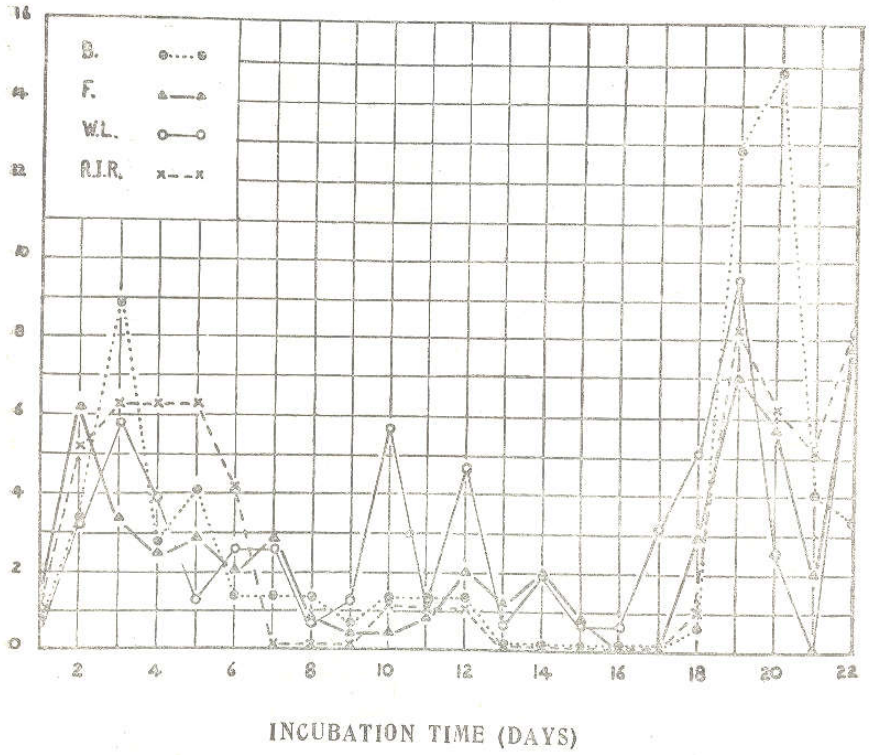


Figure 6—Distribution of embryonic mortality within a low hatching group of hens from each breed.

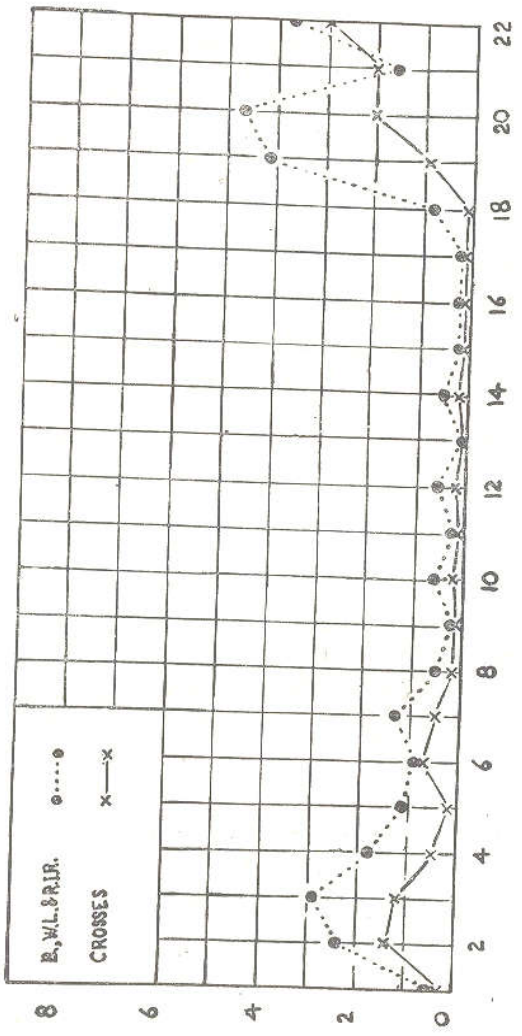


Figure 7—The unweighted average mortality percentage on each day of the Incubation period for the pure breeds and their crosses in Giza Farm.

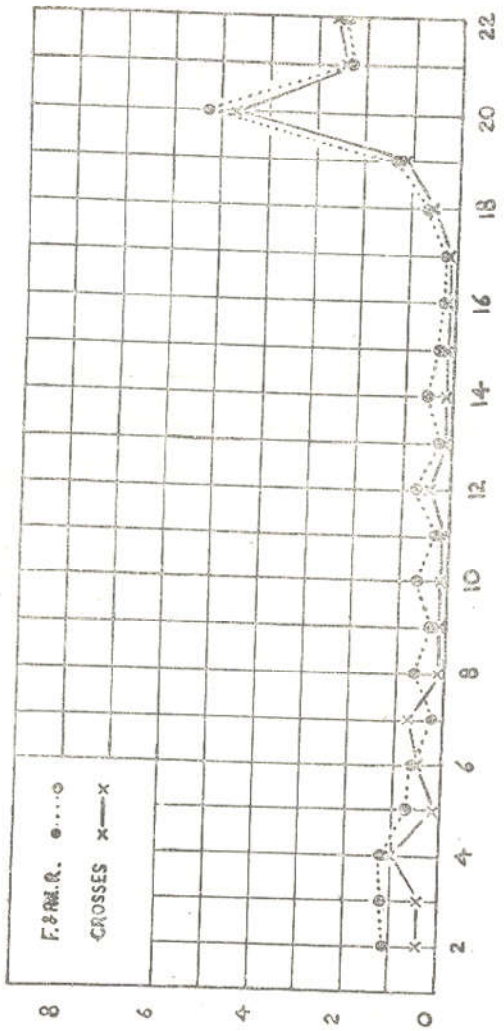


Figure 8—The unweighted average mortality percentage on each day of the incubation period for the pure breeds and their corsses in Liberation Province Farm.

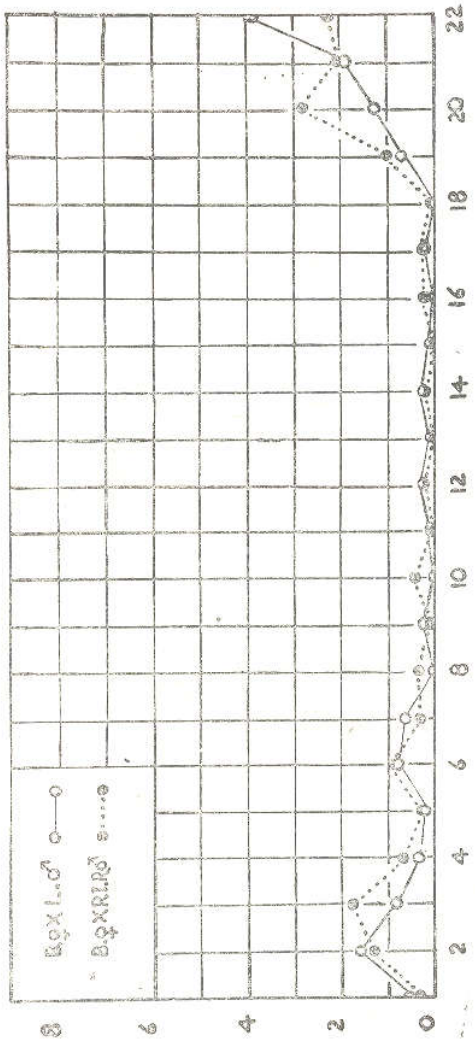


Figure 9—The distribution of embryonic mortality in the different crosses in Giza Farm.

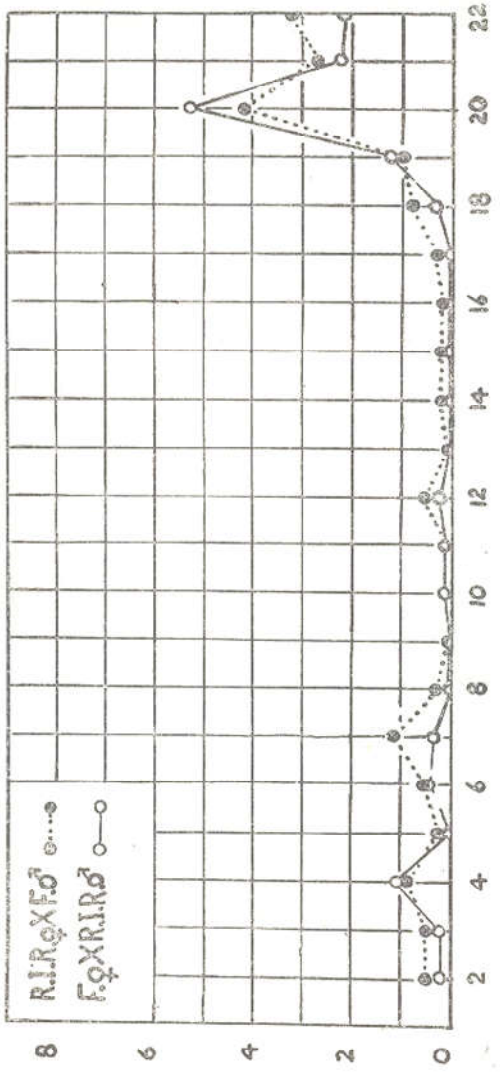


Figure 10—The distribution of embryonic mortality in the different crosses in Liberation Province Farm.

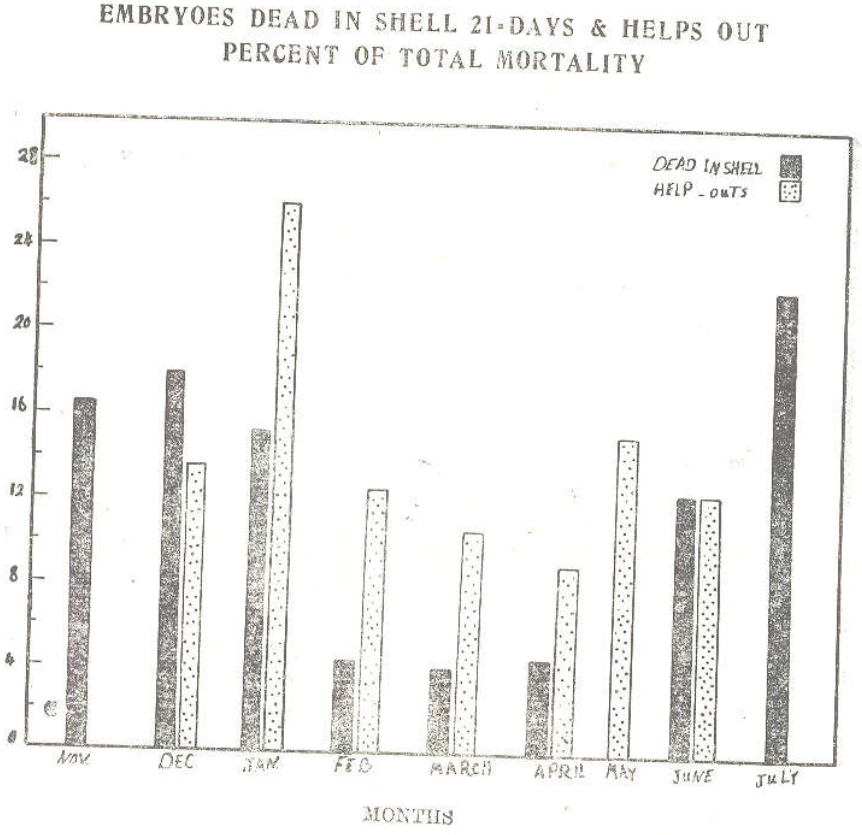


Figure 11.

(*a*) Baladi

EMBRYOES DEAD IN SHELL 21-DAYS & HELPS OUT
PERCENT OF TOTAL MORTALITY

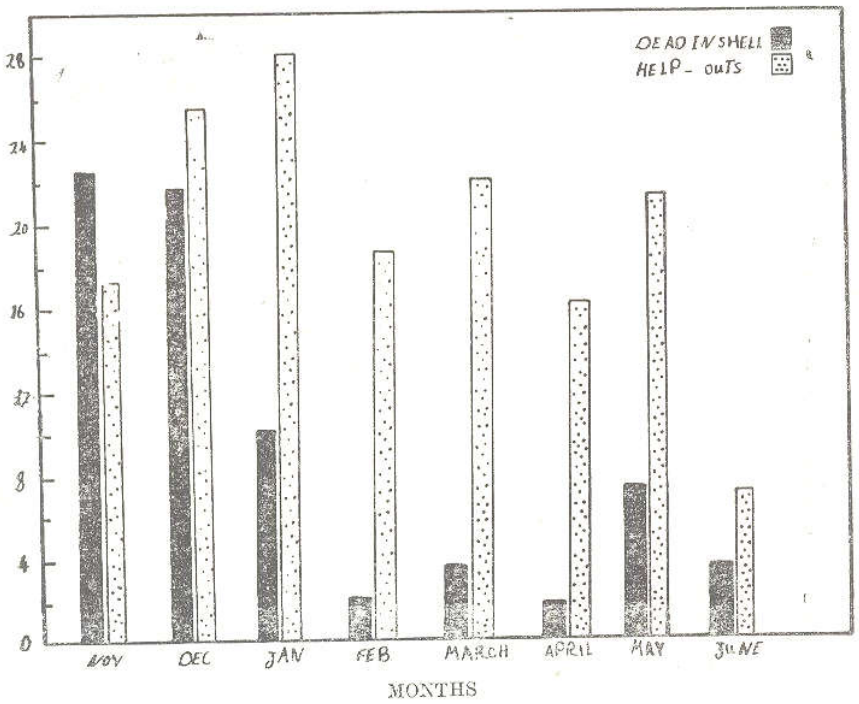


Figure 11

(*b*) Fayoumi

Fiflure 11 (*a* & *b*)—Monthly variation In percentage of dead in shells and Help-out,

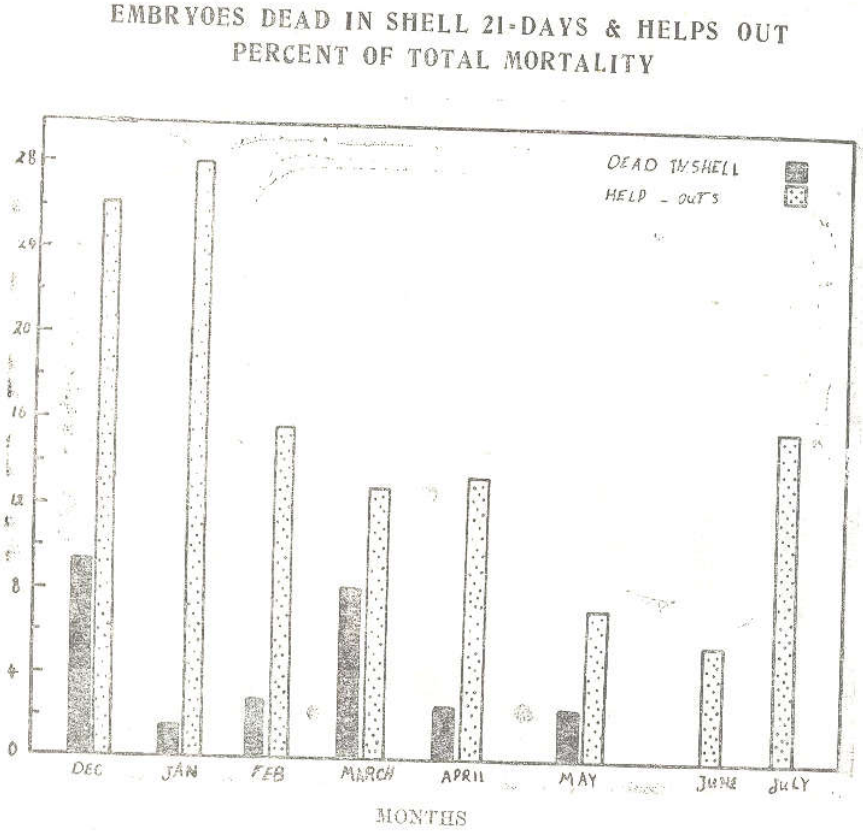
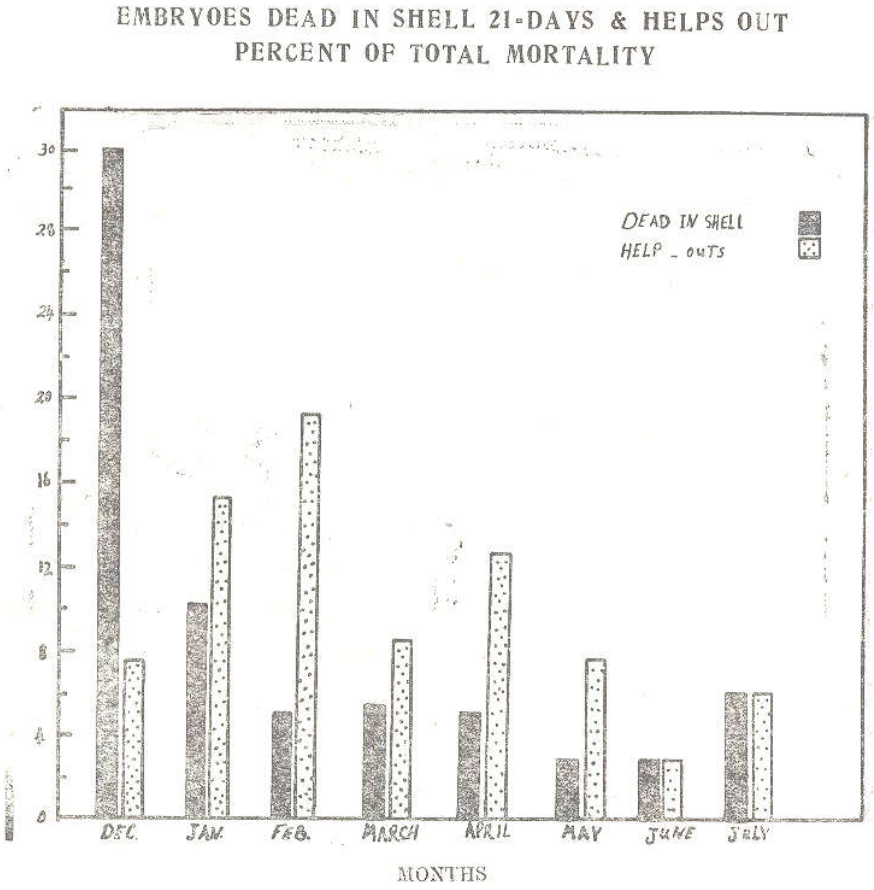


Figure 12.

(*a*) White Leghorn



(*b*) Rhode Island Red

Figure 12.

Figure 12 (*a* & *b*)—Monthly variation of dead in shells and Help-cut.

النفوق الجنينى فى الدجاج الفيومى والبلدى وبعض الأنواع الأجنبية

الملخص

شملت هذه الدراسة قطعان الدجاج فى كل من مزرعة الدواجن الخاصة بقسم تربية الحيوان بكلية الزراعة ــ جامعة القاهرة ، ومزارع دواجن مديرية التحرير •

وقد فحص هذا البحث بحثا داخليا للبيض المستبعد من المفرخ بواسطة الفحص الضوئى وكذلك البيض المتبقى بعد اليوم ٢٢ من صوانى الفقس قدر عمر الجنين تبعـا للصفات الخارجيـة •

وقد وجد من البحث أن منحنى النفوق فى الأنواع التى درست يطابق المنحنى المعروف عن هذه الظاهرة •

كما تبين أنه لم تتميز فى المنحنى الخاص بالبيض من مديرية التحرير القمة الأولى كما أن نسبة الكتاكيت الفاقسة كانت أقل من النسبة المقابلة لفقس الأنواع فى الجيزة • وقد لوحظ بصفة عامة أن هناك تباين فى هذا المنحنى فى فصول وشهور السنة المختلفة •

وعند مقارنة منحنيات النفوق فى البيض الناتج من الدجاج عالى الانتاج بمثيله من الدجاج منخفض الانتاج وجد أن هناك ارتفـاع مبـالغ فيه فى قمتى المنحنى فى المجموعة الثانية بالنسبة للمجموعة الأولى • كما ظهرت هناك قمة ثالثة حوالى اليوم العاشر الى الثانى عشر من بدء التفريخ •

هذا وقد تبين أيضا أن عملية خلط الدجاج البلدى بالديوك الرودايلند او اللجهورن تساعد على خفض نسبة النفوق الجنينى فى القمة الثانية • وكان هذا أوضح ما يمكن فى حالة الخلط بين الفيومى والرودايلند •

وقد لوحظ وجود علاقة بين سمك القشرة ومقدرة الجنين على النقر والخروج من البيضة فالأجنة التى فقست مبكرة كانت من بيض ذى قشرة أرفع سمكا كما أن سمك القشرة فى البيض الذى نقرت أجنته ولم تخرج كان بدوره أقل من سمك القشرة فى البيض الذى تكامل فيه نمو الجنين ولـكنه لم يستطع النقر أو الخروج •