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THE USE OF THE ROMANOV BREED IN DIFFERENT CROSSBREEDING PROGRAMS

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Abstract

Ewe reproductive rates are under 100 percent in most sheep breeding countries. The efficiency of the sheep industry together with the production of lambs needs to be improved. A great potential exists to increase sheep productivity and efficiency by increasing reproductive rate, largely through the exploitation of genetic variation among breeds. Profitability mainly depends on lamb production and various genetic and management methods exist to increase lamb output which depends on fecundity, prolificacy, lamb survival, and the number of lambings per lifetime. There are a few highly prolific sheep breeds available in the present and the challenge is to exploit this potential commercially. The aim of this paper is to review the Romanov prolific sheep breed and its use in different crossbreeding programs. The fastest way to improve prolificacy in local sheep breeds is by crossing them with rams from prolific breeds, like Romanov breed. Internally, within the I.C.D.C.O.C - Palas Constanta, the Prolific Line - Palas was created, following the crossing of Merinos de Palas sheep with rams from Romanov, Friesian, and Finnish Landrace breeds, which are characterized by an average prolificacy of 160-180%. The Romanov breed can be used in practice differently depending on the purpose pursued, namely use in purebred, use for the creation of new populations or lines with high prolificacy, use in simple industrial crosses to increase meat production (Romanov females x males meat), or use in double or triple industrial crosses (obtaining prolific hybrid females F1 in the year I - females of local breed x male of Romanov breed, which in the second year are crossed with males of specialized breeds of meat).

Key words*: crossbreeding, litter size, prolific breed, reproduction rates, Romanov breed.*

INTRODUCTION

Sheep breeding and exploitation is an ancient activity, with great traditions in Romania, it represents a basic branch of animal husbandry that has developed in different pedoclimatic areas, depending on the biological particularities of the exploited breeds and market requirements (Ștefănescu et al., 1973).

At the national level, the reconsideration of the directions of sheep exploitation and the orientation of the breeding activity of this species on the principles of the market economy have stimulated the concerns for the increase of milk and meat production (Pascal, 2015).

At present, sheep farming is increasingly geared towards meat production, which will become the main production in some areas of the country in the near future. Increasing the production of sheep meat and increasing the economic efficiency of this activity are largely conditioned by the intensification of the breeding process.

The orientation of the breeding and exploitation of sheep for meat production worldwide, imposed a basic technological element, namely the intensification of the breeding process, as obtaining as many lambs as possible, is the most important goal in increasing this production (Taftă, 1983; Pădeanu & Voia, 2010).

Reproduction intensification includes a series of measures and methods whose main purpose is to transform seasonal polyestricity into annual polyestricity, facilitating the installation of gestation, including in the anestrus phase, as well as advancing the age of the entry of reproduction from 18 months to approx. 8-10 months, which will increase the prolificacy, the possibility of organizing births throughout the year, and obtaining 1-2 lambs every 7-8 months (Răducuță, 2000).

Assisted reproduction, shortening of the birth-breeding period, deseasonalization of heat and birth as well as accelerating calving by non-hormonal and hormonal methods, can

successfully contribute to two births per year or three birth in two years and increasing the prolificity of sheep (Răducuță, 2000).
The increase of the reproduction indices creates the premise of the profitability of the sheep regardless of the exploitation system practiced. The interest is channeled especially for the increase of the fertility, fertility, and especially of prolificacy indices.
The intensification of prolificacy is a major objective in the exploitation of all breeds of sheep because it leads to an increase in the number of livestock and implicitly of meat production. Twin lambs have an intense growth energy, which allows the weight of the simple ones to be equalized until the age of the first haircut, and the expenses occasioned by the maintenance of the second lamb are generally reduced (Taftă et al., 1997).
Most sheep breeds that are bred in our country are characterized by relatively low values of prolificacy (105-110%). Prolificity is largely influenced by genetic factors and especially race. There are only a few breeds worldwide that have a prolific value of over 200%, such as Romanov, Finish Landrace, Frieze, Booroola, Han Yang, Hu Yank.
The main method of increasing the prolificacy, however, remains the crossing of local sheep with rams of the prolific breeds, the obtained mestizos being characterized by a prolificacy much superior to the local breeds.
This paper aims to analyze the use of the Romanov breed in various breeding programs, both globally and nationally.

MATERIALS AND METHODS

To make this material, the following bibliographic materials have been studied: specialized books on domestic animal breeding or sheep breeding, represented either by unique textbooks specific to the profile faculties in our country, or by specialized textbooks, specialized brochures, specialized courses, papers presented at various national and international symposium.
The methodology of the work consisted in presenting a history of the emergence, development and spread of the Romanov breed, the presentation of the evolution of the average production characteristics and current ones, as well as the presentation of how to use the breed in different breeding programs, both nationally and worldwide, and finally the presentation of the conclusions arising from the researched material.

RESULTS AND DISCUSSIONS

The emergence, development and spread of the Romanov breed. The first official records of the Romanov race date back to 1802, in the town of Romanov (now Tutayev), Yaroslavl region. Breeders were looking for a fast and easy breed of sheep, even in the absence of special conditions. The selection was made on the basis of local sheep breeds, by simple breeders, without special scientific methods. But the result was exceptional. Romanov sheep are currently among the top meat breeds in Russia but also in other parts of the world. According to the official standard, Romanov sheep have the following characteristics:

- Average height - 70 cm;
- Robust constitution;
- Strong skeleton and muscles;
- Wide chest;
- Straight back;
- The sacrum slightly lowered;
- Strong and straight limbs.

The presence of horns in both sexes is not allowed, as this is an indication that the breed is not pure. The tail of the Romanov sheep is short. At birth, the lambs are black, with white spots on the head and sometimes on the limbs or tail, which depigment after the age of 1-3 months, becoming gray in various shades, but the embers remain black throughout life.

Presentation of the evolution of the average and current production characteristics. The most important characteristic of Romanov sheep is their prolificacy. A female gives birth to 2-3 viable lambs. Cases of 7 or even 9 lambs per calving were also recorded. In addition, sheep have 2 calves per year, or 3 times in 2 years without special stimulation, which would easily mean 4-6 lambs per year in a female (Răducuță & Tăpăloagă, 2010).

Productivity indices:

- Morpho-productive type - meat prolificacy;
- Average weight of 50-60 kg in sheep and 75-90 kg in rams;
- Birth weight: 2.5-3.0 kg;

- Weight at 90 days - 17-20 kg;
- Weight at 180 days: lamb - 30-35 kg;
- Prolificacy 250-300%;
- The age of introduction of females at reproduction - 7 months (or reaching a body weight of 40 kg);
- Duration of gestation - 145 days (less than in other breeds);
- Slaughter yield - 50%;
- Weight of the wool coat (at 3 haircuts per year): 1.4-1.8 kg for sheep and 2.5-3.5 kg for rams;
- Milk production is 80-150 liters in 90-120 days of lactation.

The breed is also characterized by a highly developed maternal instinct, very good fertility, hardiness, high vigor of lambs at birth, entry into breeding from the first year of operation, very long duration of the breeding season, respect-tively almost all year round. calendar, being able to successfully organize two calvings per year, or three calvings in 2 years (Răducuță & Tapaloaga, 2010). In addition, 30-40 days after calving, the sheep return to the heat, thus being able to organize a new reproductive cycle.

Presentation of the ways of using the Romanov breed in different crossing programs at national level.

The hybridization of local sheep with prolific Romanov and Finnish Landrace breeds to increase prolificacy was tested in our country at the National Research Institute for sheep and goat breeding (ICPCOC Palas Constanța), the mestizos obtained being characterized by a prolificity far superior to local breeds. Ionescu et al., 1985). The data obtained for the use of the Romanov breed show us that the highest value of prolificacy was the F1 Romanov x Merinos de Palas (196.9%), and the lowest was recorded at the F1 Romanov x Ţurcană breed (164.7%) (Table 1).

Table 1. The effect of hybridization of local sheep with the Romanov breed to increase prolificacy (Ionescu et al., 1985)

Sheep breeds	Average prolificacy (%)	
	Maternal breed	Half-breed F1
Romanov x Merinos de Palas	127.3	196.9
Romanov x Spancă	135.7	170.3
Romanov x Ţurcană	102.9	164.7

The purpose of crossbreeding sheep of less prolific breeds with rams of breeds with this pronounced trait is to obtain F1 females with hereditary substrate enriched with genes for prolificacy. Mixed females are then crossed with rams of the meat breeds to obtain an increased number of lambs for meat (Taftă et al., 1997).

In the 1990s, the Prolific Line - Palas was created within the ICDCOC Palas, following the crossing of Merino de Palas sheep with Romanov and Finish Landrace rams, which is characterized by an average prolificacy of 175% (Vicovan et al., 1995, quoted by Taftă, 1998).

This Prolific Line started from the native Merinos de Palas breed, within the ICDOC Palas, through a complex program of crosses during the years 1973-1988, when a sufficient number of combinations between this breed and the prolific breeds were applied and tested: Romanov (200-250%), Finnish Landrace (230-250%), Border Leicester (190-210%), Friesland (180-225%) and Ile de France (150-180%).

Based on a large number of cross-breeding variants and applying the selection, mainly after prolificacy and adaptation to local conditions, in 1989 the animals of the desired type were obtained.

The number of sheep of this type, since 1990, has been reproductively isolated for 7 generations (the interval between generations of 4.4 years), having as main objectives the improvement by selection of prolificacy (over 150%), breastfeeding capacity and limitation inbreeding below 1% per generation. The genetic similarity with the founding breeds is 39.7% with the Romanov breed, 28.13% with the Merinos de Palas breed, 15.63% with the Friesian breed, 9.36% with the Border Leicester breed, 6.25% with the Ile de France breed and only with 1.56% with the breed Finnish Landrace.

The purpose of forming this line was to obtain a new type of sheep with high prolificacy. The current herd is characterized by several productive and reproductive characters and traits, namely:

- prolificacy - 160-180%;
- lambs weaned at 100 sheep - 140-160 heads;
- long reproductive season, with maximum peaks placed in the spring and early autumn months;
- total milk production - 160-180 liters.

This type of sheep can be used in various cross-breeding schemes, especially those aimed at the production of lambs. The practice of crossbreeding with local breeds shows a good degree of transmission of prolificacy.
The Palas Prolific Breed, approved as a purebred local breed in 2020, gives breeders a solution to increase meat and milk production, depending on the direction of exploitation they want (Pădeanu, 2021).
In 2015, within the ADER 5.1.2 Project - Efficiency of family farms with Merino sheep by increasing the prolificacy and increasing the quality of products according to the requirements of the EU market - within ICDCOC Palas, experiments were carried out on 60 sheep hybrid F1 Romanov x Merinos de Palas and 60 sheep Merinos de Palas control group), all at calving I, and at the Project Partner the works were carried out on 62 sheep F1 Prolific Breed Palas x Merinos and 64 sheep Merinos (control group) (MADR, 2018). These herds were registered at calving and their products were registered and weighed individually at calving, at one month, at two months and at weaning, the average age being between 75-80 days.
For each population of sheep studied, the lactation capacity, the average gestation time, the reproduction indices and the average number of lambs weaned per calved sheep (the most important reproduction index) were established. The F1 Romanov x Merinos de Palas hybrid sheep achieved a prolificacy of 169.62% at the first calving compared to the Merinos de Palas sheep in which the prolificacy was 105.0% (Table 2).

Table 2. Reproduction indices at first birth

Specification	Fecundity (%)	Prolificacy (%)
Sheep F1 Romanov x Merinos de Palas	91.23	169.62
Sheep Merinos de Palas	96.77	105.00

The gestation period was 147.23 days for hybrids and 148.79 days for Merinos, in accordance with the provisions of O.M.1045 / 2018 (Table 3).

Table 3. Pregnancy duration (days)

Sheep F1 Romanov x Merinos de Palas	147.23
Sheep Merinos de Palas	148.79

The average body weight at weaning in hybrids (males + females) was 19.51 kg / head and in Merinos de Palas lambs it was 20.68 kg / head, the difference of approx. - 6% being statistically insignificant. F1 hybrid sheep had a lactation capacity of 122.66 liters of milk / head, which was higher by approx. 42% compared to Merinos de Palas sheep that had a lactation capacity of 86.58 liters of milk / head, the difference being very significant. F1 hybrid ewes at first calving weaned 1.52 lambs per calved sheep compared to Merinos de Palas sheep weaning only 1.05 lambs per calved sheep, the difference being significant
The aim of the project was to streamline family farms with Merinos sheep by increasing the prolificacy and increasing the quality of products according to the requirements of the EU market.
In conclusion, research has shown that hybrid sheep of Romanov blood in different proportions had much higher reproductive performance (prolificacy, earliness and survival rate of lambs) compared to domestic breeds.

Presentation of the ways of using the Romanov breed in various cross-breeding programs worldwide. Romanov breed has 1.85-2.90 lambs obtained per birth, depending on location and nutrition, as well as other influencing factors (Table 4 and Table 5). The average birth weight is between 2.5 and 3.0 kg. Meat production capacity differs place to place. From the data presented, it appears that the use of this breed significantly increases the prolificacy of other breeds. In the USSR, Shatskii et al. (1976; 1978), cited by Kukovisc (1984), stated in their experiments that the use of the Romanov breed in crosses increases the prolificacy and fattening percentage. The production of meat of three cross breeds has been studied by Sallam (1978), Antonova (1979) and Erokhin et al. (1981), cited by Kukovisc (1984), and reported fairly good results (Table 4).
In Russia, the crossing of Romanov sheep with rams resulting from the crossing of Romanov x Argali breeds (3/4 R x 1/4 A) had positive influences in increasing the performance and musculature of newborn lambs (7/8 R: 1 / 8 A). Therefore, the male newborn lambs had a high survival rate, growth performance and a high digestibility of nutrients, the males thus obtained

being 4.8 kg heavier at the age of 8 months (Kukovisc, 1984).

Czechoslovak researchers (Jakubec 1975, Jakubec et al. 1978, 1979; Machacek and Jakubec, 1981), cited by Kukovisc (1984), also improved the prolificacy of their breeds (Czigaja, Valashka and Sumava), but reported some disadvantages in terms of concerns wool production.

Many cross-breeding tests have been carried out in Spain to improve the breeding rate of local breeds. Sierra (1978; 1980) reported several experiments. According to these data, Romanov × Aragon F1 sheep produced 25-70% more lambs than pure Aragon sheep, depending on the time of the first mating. The number of products obtained by calving F1 sheep after the autumn mating was 2.12, after the spring mating only 1.65, while the purebred had 1.39 and 1.17, respectively.

Sierra (1983), cited by Kukovisc (1984), reported on a new Spanish breed of synthetic sheep, which has 50% of the blood of the Romanov and Aragon breeds. Its fertility is 86%, and the litter size is 1.87 and 2.13 after the spring and autumn mating. Espejo et al. (1977; 1982), reported reports on acceptable meat production of the Spanish crosses Merinos and Romanov (Table 5). In Spain, there was a hybrid program in which the first Aragon × Romanov crossbred sheep were mated with Ile de France rams to obtain first-class lambs for slaughter.

In France, Romanov is preferred as a prolific breed due to its high prolificacy (250%), long breeding season (8 months / year), excellent fertility, strong maternal behavior and good product viability (Răducuță & Tăpăloagă, 2010).

According to Ricordeau et al. (1976), Romanov purebred lambs produced 2.88 lambs per sheep and the best combination, Romanov × Berrichon du Cher, had a number of 2.05 calving products (Cotentin breeds were used in the study, Border Leicester, Berrichon du Cher and Romanov. Ricordeau et al. (1977) reported that the mixed F1 and F2 sheep of the Romanov x Berrichon du Cher combination had a number of products obtained at calving 0.66% higher than that of purebred Berrichon du Cher sheep. The growth rate of the Berrichon du Cher × Romanov, 1/2 Berrichon du Cher × 1/4 Cotentin × 1/4 Romanov and 1/2 Berrichon du Cher × 1/4 Border Leicester × 1/4 Romanov combinations exceeded o that of purebred Berrichon du Cher sheep with 0.57, 0.30 and 0.36 respectively (Tchamitchian et al., 1976).

The design rates for F1, F2, F3 and F4, Berrichon du Cher × Romanov crosses were 86%, 82%, 97% and 99%, respectively, while the corresponding farrowing rates were 1.67, 1.87, 1.98, and 2.01 (Ricordeau et al., 1982).

The INRA 401 maternal line was produced by the crossing of the Romanov and Berrichon du Cher breeds, which was done by Tchamitchian et al. (1979) for INRA cross-cutting programs.

In France, on the basis of the Romanov breed and following the successive crosses between Romanov x Berrichon du Cher, the Romane breed was formed, which arose as a result of the desire to develop a new breed, the result being a breed of sheep with white and short wool, which has a good prolificacy and a good conformation to produce quality lambs.

The Romane breed is characterized by the following parameters (Răducuță & Tăpăloagă, 2010):

- Morpho-productive type – meat and prolificacy;
- Average weight of 60-70 kg in sheep and 90-100 kg in rams;
- Prolificacy - 200-230%.

In a comparison of Limousine and Limousine × Romanov F1 sheep, Marzin & Brelurut (1979) found that the number of products obtained during calving was 1.63 and 2.25, the birth weight was 3.56 and 3.40 kg, and the mortality was 10.4 and 12, respectively, 8% for the two genotypes. Although the sheep had lambs three times in two years, the lambs born per sheep per year were 2.15 and 3.06, and the weaning rate per sheep per year was 1.92 and 2.66, respectively.

In South Africa, Faure et al. (1983) cited by Kukovisc (1984) tried to improve the prolificacy of Karakul sheep. They produced crossbred sheep with 25, 50 and 75 percent Romanov blood, and the number of products obtained by calving these genotypes was 1.17 and 1.74, respectively. The first genotype does not differ significantly from the purebred Karakul.

In Hungary, a research program developed the so-called "Fertile Merinos" by crossing the Romanov breed with the Hungarian Merinos. The purpose of this program was to produce a

genotype of 1/4 Romanov × 3/4 Merinos (Veress and Lovas, 1978, cited by Kukovisc 1984; Veress, 1982). This sheep population produced Merinos wool 20% longer than the original Merinos wool, without colored fibers. These sheep had 20–30 percent more lambs per year (1.3 - 1.4) and a 20–30% higher number of products obtained at calving (1.50–1.60) than Merinos. The wool production data of this breed are as follows: thigh length 9–11 cm, wool weight 4.8 - 5.2 kg, yield 49%, fiber diameter 23–24 microns (only wool weight data are less favorable than those of Merinos).

Table 4. Number of products obtained at calving of the Romanov breed and of the half-breed resulting from crossbreeding with the Romanov breed (Kukovics, 1984)

Source	Breed or cross	Litter size (prolificacy)
Jakubec, 1975	Romanov	1.86 – 2.34
	Romanov × German Merinos	1.29
Shatskii et al., 1976	Precoce	1.1
	Romanov	2.3
	Precoce × Romanov	2.36
	Romanov × Precoce	1.1
Veress, 1976	Romanov	2.42
Ricordeau et al., 1976	Romanov	2.88
Sierra, 1977–78	Aragon	1.17 – 1.39
	Aragon × Romanov	1.65 – 2.12
Sierra, 1978	Romanov × Aragon	1.29 – 1.72
Shatskii et al., 1978a	Romanov	2.52
	Romanov × Precoce	1.27
	Precoce × Romanov	1.93
Shatskii et al., 1978b	Precoce	1.06
	Romanov × Precoce	1.26
	Romanov	2.52
	Precoce × Romanov	1.93
	Finn × Romanov	2
Jakubec et al., 1978	Tzigaja	1.11
	Romanov × Tzigaja	1.72
Jakubec et al., 1979	Romanov × Improved Valashka	1.74
Flamant et al., 1979	Romanov	2.16
Marzin et al., 1979	Limousin	1.63
	Romanov × Limousin	2.25
Antonova, 1979	Romanov × Russian Merinos	1.57 – 2.00
	Romanov × Tzigaja	1.10 – 1.71
Sierra, 1980	Romanov	1.96 – 2.96
	Aragon	1.07
	Romanov × Aragon	1.96
Faure et al., 1983	1/4 Romanov - 3/4 Karakul	1.17
	1/2 Romanov - 1/2 Karakul	1.74
	3/4 Romanov - 1/4 Karakul	1.74
Machacek and Jakubec, 1981	Improved Sumava	1.05 – 1.29
	Romanov × I. Sumava	1.50 – 1.56

Table 5. The influence of the Romanov breed on meat production in half-breed resulting from different breeds (Kukovics 1984)

Source	Breeds or cross	Body weight (kg)			Average daily weight gain	Carcass weight	Slaughter yield
		Birth	3 months	8 months	(g)	(kg)	(%)
Shatskii et al., 1976	Precoce	4.3				17.8	42.7
	Romanov	2.5				13.9	45.9
	Precoce × Romanov	2.8				17.1	43.3
	Romanov × Precoce	3.9				16.4	42.8
Espejo et al., 1977	Romanov × Spanish Merinos		19.7				
	Spanish Merinos		18.6				
Shatskii et al., 1978	Precoce	4			231		45.8
	Romanov	2.6			180		49.2
	Romanov × Precoce	4			263		45.2
	Precoce × Romanov	3.2			245		44.8
	Finn × Romanov	2.7			241		47.8
Sallam, 1978	Romanov × Tzigaja/x Suffolk	3.8		37.3			46.4
	Romanov × Tzigaja/x Romanov	3.6		33.8			45
	Romanov × Tzigaja/x lle de France	3.7		35.9			48.2

In a study conducted in South Africa regarding puberty and ovulation rate of Romanov, Dorper, and their crosses during the first breeding season, Greeff et al. (1993), found that genotype had a significant ($P < 0.01$) effect on age and mass at first oestrus and also on ovulation rate. Thus, an increase in the percentage Romanov genes resulted in a decrease in ewe mass and an increase in ovulation rate.

The performance of purebred Romanov (R) lambs and crossbred lambs of Romanov and Morkaraman breed were compared under a semi-intensive production system in Turkey (Korkmaz & Emsen, 2015). The results showed a significant improvement in early reproductive traits (age at first presence of sperm, percentage of ewe lambs showing the first sign of estrus, age at first estrus) can be obtained from crossbreeding the fat-tailed Morkaraman breed with the Romanov breed.

Recently, in Russia, Dvalishvili et al. (2015), performed a study to investigate growth performance, nutrient digestibility, carcass quality measures and some serum blood parameters of purebred and crossbred Romanov male lambs (7/8 Romanov:1/8 Argali). The results of this study revealed that, the crossbred Romanov male lambs (7/8 Romanov:1/8 Argali) had 4.80 kg more in their body weight as well as 19 g of average daily gain by the age of 8 months. Also, they had 2.8 kg more in their hot carcass weight over the purebred one, a higher lamb keeping index, growth performance and nutrient digestibility than purebred ones and a better metabolic blood profile.

Starting from the idea that the incorporation of super-prolific and less seasonal breeds of sheep such as the Romanov into domestic flocks could improve ewe productivity during suboptimal spring mating seasons was the objective of a recent experiment conducted in the United States (Freking & Murphy, 2021). Thus, crossbred ewes were generated by mating Romanov ewes to 1 of 5 ram breeds (Dorset, Rambouillet, Katahdin, Dorper, and White Dorper) and, for this experiment, were evaluated in a spring mating/fall lambing system at 4, 5, and 6 years of age. The results showed that on average, ewe fertility in spring mating (81 to 7%) and prolificacy (1.46 to 1.71 lambs/ewe/year) was greatly improved with the addition of 50% Romanov germplasm to common domestic sheep breeds.

CONCLUSIONS

Increasing prolificacy is a major goal in the exploitation of all breeds of sheep because it leads to an increase in the number of livestock and thus the production of meat.

From the presented material, it appears that the prolificacy of the local breeds of sheep is still at a very low level, being necessary its rapid increase.

The main and rapid method of increasing prolificacy is the crossing of local breeds of sheep with rams of the prolific breeds and especially with the Romanov breed.

The Romanov breed is characterized by a remarkable prolificacy (250%), long reproductive season (12 months), excellent fertility, strong maternal behavior and high viability of the products, characteristics that recommend it for its use for increasing the prolificacy of different local or foreign breeds.

The Romanov breed can be used in practice differently depending on the purpose pursued, namely use in purebred, use for the creation of new populations or lines with high prolificacy, use in simple industrial crosses to increase meat production (Romanov females x males meat), or use in double or triple industrial crosses (obtaining prolific hybrid females F1 in the year I - females of local breed x male of Romanov breed, which in the second year are crossed with males of specialized breeds of meat).

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