

İpekböceği Yetiştiriciliğine Güncel Bir Bakış: Diyarbakır Silvan Örneği

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ÖZ

İpek, dünyada tekstil kullanımında çok düşük bir orana sahip olmasına rağmen önemli bir ticaret ürünüdür. Bununla birlikte üretim ve ihracatta az sayıda ülke söz sahibidir. Türkiye için geleneksel bir faaliyet olarak görülen ipek böceği yetiştiriciliğinin canlandırılmasına yönelik çalışmalara rağmen geçmiş yıllardaki seviyesine ulaşamamıştır. Yürütülen çalışmada dünya ve Türkiye ipek böceği yetiştiriciliğine yönelik genel bir değerlendirme yapılarak ülkenin mevcut durumunu ortaya koyacak Diyarbakır ili Silvan ilçesi örneği verilmiştir. Bu amaçla ilçede üretime devam eden yedi, üretimi bırakmış 46 ve üretim yapmamış 49 kişi ile anket yapılmıştır. Anketler sonucunda üretime devam edenlerin büyük oranda (85.72) çiftçi olduğu ve aralarında kadın üretici kalmadığı belirlenirken üretimi bırakmış olanların % 65.22'sinin 10 yıldan fazla üretim yaptıktan sonra bıraktıkları ortaya çıkmıştır. Daha önce üretim yapmamış olanlardan yarısından fazlasının (%55.10) ipek böceği yetiştiriciliği hakkında bilgi sahibi oldukları belirlenen araştırmada şartlar uygun olsa da sadece %24.49'u üretim yapabilecekleri tespit edilmiştir. Silvan örneği ile yapılan değerlendirmeler ile üretim eğilimin azaldığı günümüz koşullarında kırsal alanda istihdama da olanak sağlayacak ve yetiştiriciliği canlandıracak planlamalara ihtiyaç olduğu sonucuna varılmıştır.

Anahtar kelimeler: *Bombyx Mori L.*, ipekböceği yetiştiriciliği, sosyo-ekonomik yapı, Silvan

A Current Perspective on Silkworm Breeding: The Case of Diyarbakır Silvan

ABSTRACT

Although silk has a very low share in textile use in the world, it is an important trade product. However, few countries have a say in production and export. Despite the efforts to boost silkworm breeding, which is seen as a traditional activity for Turkey, it has not reached the level of the past years. In the current study, a general evaluation of the world and Turkey silkworm breeding was made and the example of Silvan district of Diyarbakır province was given to reveal the current situation of the country. For this purpose, a survey was conducted with seven people who continue production in the district, 46 people who stopped production and 49 people who did not produce. As a result of the surveys, it was determined that the majority (85.72) of those who continue production are farmers and there are no female producers among them, while 65.22 percent of those who have quit production have stopped after more than 10 years of production. It was determined that more than half (55.10%) of those who had not produced before had information about silkworm breeding and only 24.49% of them would be able to produce even if the conditions were suitable. With the evaluations made with the Silvan sample, it is concluded that there is a need for planning that will provide employment in rural areas and revitalise breeding in today's conditions where the production tendency has decreased.

Keywords: *Bombyx Mori L.*, silkworm breeding, socio-economic structure, Silvan

INTRODUCTION

Silk, which is a valuable and expensive weaving industry raw material, is produced by the silkworm (*Bombyx mori* L.), which is the caterpillar of the butterfly that produces the best silk among its species from the Bombycidae family and feeds on mulberry leaves (İmer, 2005). Silk is a soft and durable fibre that can be easily dyed and obtained by being drawn from the cocoon that the silkworm weaves by meeting its need for heat and moisture and feeding on mulberry leaves. It shows a wide variety in terms of usage areas and has an important place especially in the textile industry.

Taxonomically, there are many silkworm genera in the Bombycidae family (Rebel, 1927; İmer, 2005). Among the 4 different types of silk produced for commercial purposes in the world, mulberry silk produced by *Bombyx mori* constitutes 90% of silk production. The main reason for this situation is that the mulberry silkworm is more domesticated and at the same time, produces better quality silk than other silk species (INSERCO, 2022).

Status of silkworm breeding in the world and in Turkey

Turkey is one of the countries with high silk production potential due to its traditions and ecological conditions as well as its production/accumulation of silk products. In Turkey, which has a favourable structure for silkworm and mulberry tree farming, silkworm breeding has been carried out for about 1500 years (Şahan, 2011). Silkworm breeding, which creates the potential for an alternative source of income, prevents unemployment and migration from villages to cities by providing additional income in regions where there are lands that are not suitable for other agricultural production activities, since it does not require much investment and capital, products can be obtained in a short period of time and this can be converted into earnings. The silkworm sector is also very important in terms of utilising the labour force of aged individuals or females at all stages and supports the national economy and rural development (Kasi, 2013; Turhan and Şahan, 2020).

Silk production and silkworm breeding, which started with Istanbul in Anatolia and became widespread in the Mediterranean, Marmara, Southeastern Anatolia and Aegean regions over time, have made significant contributions to the national economy through both local consumption and foreign trade (Yurtoğlu, 2017). Considering the number of silkworm breeding enterprises, approximately 92% of the total 2021 enterprises are located in Diyarbakır, Antalya, Batman, Muğla, Ankara, İzmir, Şanlıurfa, Bolu, Bilecik, Elazığ, Aydın, Hatay, Bursa, Sakarya, Mersin, Osmaniye and Adana provinces. Diyarbakır, which has the highest number of enterprises, produces about 56% of the country's fresh cocoons, which is around 76 tonnes (TÜİK, 2023). Although cocoon yield and quality characteristics of the enterprises differ according to their capacities, larger enterprises have higher cocoon yields (Yakışan and Yılmaz, 2022).

Silk, which has a very high financial value as a textile raw material, is produced in about 30 countries today. In the world textile sector, silk products are used by 0.2% (Datta and Nanavaty, 2005). Silk, which is the 96th product in the world in terms of trade volume, is mostly imported by Italy, while most of its exports are made by 9 countries (China, Italy, Vietnam, India, Uzbekistan, Japan, Romania, France, Brazil) (OEC, 2023). On the other hand, USA, Italy, Japan, India, France, China, United Kingdom, Switzerland, Germany, United Arab Emirates and Korea stand out as the main consumer countries (Worldsilk, 2023). Based on 2020, China holds 41.7% of the export volume in the silk sector, which is subject to approximately 1.27 billion dollars of trade (OEC, 2023). According to world silk production and trade data, silkworm cocoon and raw silk production, silk import and export data have started to decrease gradually every year between 2015-2021 (Table 1). India ranks first in the world's cocoon production, followed by China, Uzbekistan, Vietnam, 16 other countries and Azerbaijan.

Table 1. World silk production and trade data (<https://www.fao.org/faostat/en/#data/TCL>) (tonne).

	2015	2016	2017	2018	2019	2020	2021
Silkworm cocoon	750309.6	717758.1	668249.3	606078	485453.3	445527.4	435471.2
Raw silk	204643	193045	178313	156538	108796	9070	no data
Imports (raw silk)	7644	8848	8128	7036	7701	4829	5413
Exports (raw silk)	9193	9981	10612	7668	8834	5798	5003

Silk has a small percentage in the global textile market and it is very difficult to access data on the silk obtained at the end of production. On the other hand, its contribution to employment is undeniable. While

approximately one million people are employed in the silk sector in China, this number has reached 7.9 million in India. Accordingly, silkworm breeding has an important place in the employment of the rural population. In order for the sector to survive and provide raw materials to the industry, it needs to be supported with small investments (Worldsilk, 2023). Turkey, which has only a 1.52% share in the world silk trade (OEC, 2023), started to decline in the sector from the beginning of the 90s caused by the Gulf War, especially with the effect of the cheap Far East market, and fresh cocoon production decreased from 2171 tonnes in 1991 to 47 tonnes in 2001. Over the years, some measures have been put into effect to keep the sector alive and revive production, and production could only reach 76 tonnes in 2021 (Figure 1) (FAO, 2023). While the export and import numbers of silk in 1988 were 2.04 and 3.30 million dollars, respectively, in 2022, the difference between the export and import values widened considerably and the same numbers were calculated as 1.50 and 22.39 million dollars (Figure 2) (TÜİK, 2023). Turkey ranks 14th in world fresh cocoon production and first among EU countries (FAO, 2023). Turkey is one of the 7 countries producing healthy silkworm eggs in the world and the only country among EU countries in this sense. In addition, cocoons and silk are produced from eggs obtained by preserving pure breeds. Turkey is one of the few countries producing silkworm seeds and also exports seeds from time to time (Şahan, 2011).

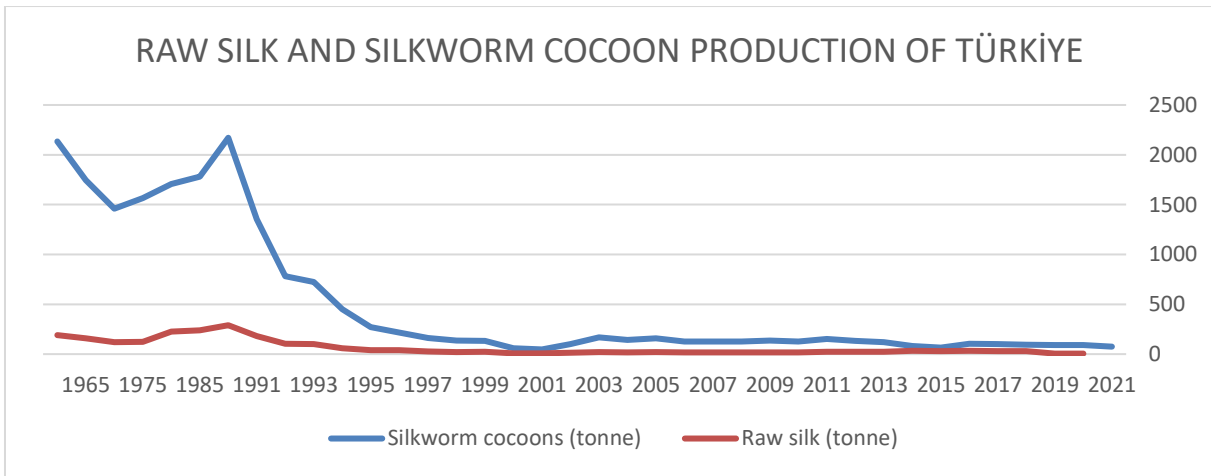


Figure 1. Changes in raw silk and silkworm cocoon production in Turkey (1965-2021).

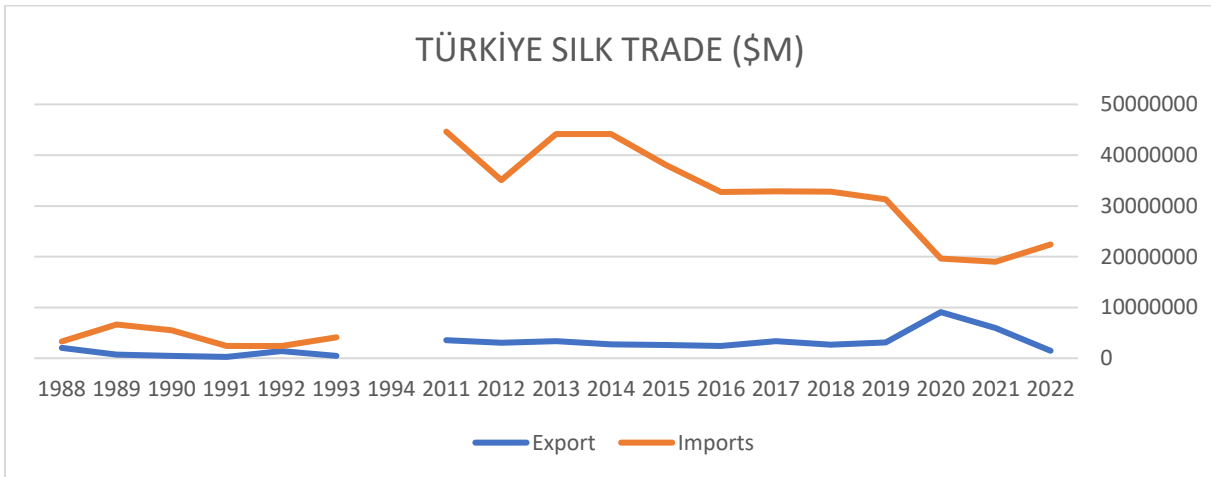


Figure 2. Silk import and export data in Turkey between 1988 and 2022.

Silkworm breeding in Diyarbakır

As of 2021, 1854 of the total 2021 enterprises in Turkey are located in the 18 provinces with the highest production. Among these provinces, Diyarbakır has the highest number of enterprises (TÜİK, 2023). Diyarbakır has favourable climatic conditions for silkworm breeding. Eskişehir and Diyarbakır are the cities where silk drawing and twisting facilities with an annual cocoon processing capacity of 200 tonnes at a time are located

(TEPGE, 2022). With the opening of the 'Regional Silkworm Breeding Station' by the Ministry of Agriculture and Forestry in the past years, there was a significant level of silkworm breeding in Diyarbakır provincial centre, especially in Silvan, Lice, Kulp and Hazro districts. With the reverse migration from villages to cities, the inclusion of women in production and the increase in the production values of silkworm breeding and silk weavings, alternative income opportunities have been created in the region. In addition to taking the first place in silkworm breeding, Diyarbakır meets almost half of the total fresh cocoon production and all of the cocoons are turned into thread and marketed (Firat Development Agency, 2020). Silkworm breeding is carried out in Diyarbakır province, mainly in Kulp district (98% of the production), Hazro and Silvan districts. Kulp is the district with the highest production with 596 enterprises. Kulp is followed by Hazro district with 25 enterprises and Silvan district with 5 enterprises. Silvan has an older history of silkworm breeding compared to both districts. However, various unfavourable events in the recent past have caused the production to decline considerably. In this study, which is thought to contribute to achieving the goal of revitalising production in the district, it is aimed to reveal the current situation in silkworm breeding on the one hand, and on the other hand, solution offerings that will pave the way for orientation towards breeding have been brought. In addition, it is also aimed to evaluate the social and economic aspects of the silkworm production activity in the district, to reveal the status of the enterprises regarding the silkworm activities, to identify the problems and to present solution offers. The research is important in terms of providing data for local policies to be produced for the development of sericulture in the region.

MATERIALS AND METHOD

The survey study was conducted between May and June 2022. While the questionnaire forms filled face to face with a total of 102 subjects constituted the material of the research, it was tried to ensure that the subjects participating in the survey gave clear answers to the questions by expressing that the study was purely for research purposes. The questionnaires were applied to three different groups: those who continue breeding (7 subjects), those who quit breeding (46 subjects) and those who did not make breeding before (49 subjects). Frequency tables were used in the evaluation of the data. In addition, χ^2 (khi-square) test was applied to the features that were thought to be correlated.

RESULTS AND DISCUSSION

In the study carried out to reveal the current structure of silkworm breeding in Silvan district, firstly, socio-economic characteristics were determined for each group (continuing silkworm breeding, quitting silkworm breeding and not making silkworm breeding before) and the data obtained are given in Table 2. Then, different questions were asked to the groups and the aim of the study was tried to be achieved.

As seen in Table 2, those who continue production are between the ages of 36-45 and 46-55. Of the 46 people who stopped production, 38 (80.43%) were aged 46 and over. According to this, it is seen that the young and middle-aged groups do not engage in production and the majority of those who quit production are middle-aged and above.

It is a remarkable finding that the average age of those who continue production and those who quit production is high. In the study conducted by Yıldız et al. (2017) in Yenice district of Çanakkale, it was observed that the average age of the majority of the breeders was 42 and above. In the study of Taşkaya Top et al. (2015), in which the socio-economic structure of silkworm breeding enterprises in Turkey was determined, the average age of silkworm farmers was determined as 53.3 years and it was emphasised that the breeders were generally from the high age group. It was determined that 83.8% of the breeders were over 40 years old, 75.4% were 45 years old and over, and 20.3% were over 65 years old. In the study conducted by Üstündağ (2010) on Bursa silk cocoon enterprises, it was stated that 93.2% of the breeders were over 40 years old. The mentioned studies and the results of this study are compatible in terms of age distribution. This harmony can be interpreted as the fact that silkworm breeding is not carried out by young producers, but it is an activity of middle-aged and older people. In addition, the shift from rural to urban areas due to reasons such as easy access to social security, health and education opportunities may emerge as another reason for the loss of young labour force. In addition to these, in the study conducted by Barıtcı et al. (2017) in Kulp and Hazro districts of Diyarbakır, unlike the findings of the research and other studies, it was found that the average age of most of the producers was low and 67.14% of the breeders were in middle age (26-45 years), 14.29% were in the 46-55 age range and 7.14% were in the 56-65 age range. These findings show that the efforts to increase production in Kulp and Hazro districts have been partially successful.

Table 2. Socio-economic characteristics of the groups included in the study (continuing production, discontinued production and non-production).

	Continuing production		Discontinued production		Non-production	
	Number	Rate (%)	Number	Rate (%)	Number	Rate (%)
Age group						
Below 25	-	-	1	2.17	3	6.12
25-25	-	-	-	-	10	20.41
36-45	3	42.86	7	15.22	8	16.33
46-55	4	57.14	21	45.65	18	36.73
56-65	-	-	10	21.74	6	12.25
66-75	-	-	4	8.70	3	6.12
Over 75	-	-	3	6.52	1	2.04
Gender						
Female	-	-	16	34.78	11	22.45
Male	7	100.00	30	65.22	38	77.55
Education status						
Illiterate	-	-	10	21.74	10	20.41
Literate	-	-	15	32.61	7	14.29
Primary school graduate	3	42.86	13	28.26	13	26.53
Secondary school graduate	4	57.14	5	10.87	9	18.37
High school graduate	-	-	2	4.35	5	10.20
Associate/Bachelor's degree	-	-	1	2.17	5	10.20
Main occupation						
Farmer	6	85.72	13	28.26	11	22.45
Officer	1	14.28	7	15.22	8	16.33
Tradesman/Trader	-	-	8	19.56	8	16.33
Retired	-	-	-	-	3	6.12
Self-employment	-	-	2	4.35	10	20.41
Other	-	-	15	32.61	9	18.37
TOTAL	7	100.00	46	100.00	49	100.00

Another noteworthy finding in our study is that there are no female producers who continue production. The number of female producers who had previously produced but quit is 16, which is equal to 34.78%. According to the survey results of Barıtcı et al. (2017), it was determined that the majority of the producers were male individuals and that silkworm production was generally carried out as an additional branch of work. While it is observed that male individuals are generally active in works related to leaf cutting and transport, it is known that women and children can fulfil different responsibilities related to production. On the other hand, although silkworm breeding is an activity in which women can also work actively, these results indicate that the participation of women in production is much less than that of men.

According to the survey results, 3 of those who continue production are primary school graduates and 4 are secondary school graduates. The majority (43 people; 93.48%) of the people who had previously engaged in production but quit (43 people; 93.48%) have secondary school and lower secondary school education level. According to the general evaluation to be made in the light of the findings, it is possible to say that both those who continue production and those who quit production have low education level. Camuz and Gül (2022) reported that 46.1% of the operators were primary school graduates, 43.6% were secondary school graduates and 10.3% were high school graduates in their survey study in Hatay districts. In a similar study conducted by Şahinler and Şahinler (2002) in Hatay province, it was determined that 40% of the producers were primary school graduates and 12% were secondary school graduates. Barıtcı et al. (2017) indicated that the majority (75.71%) of the producers engaged in sericulture were primary and secondary school graduates. In the same study, while the rate of illiterate producers was 21.43%, the rate of producers who completed higher education

was found to be 2-3%. According to the results of Taşkaya Top et al. (2015), although the literacy rate of the breeders was 86%, it was declared that 58.5% had primary school education and 15.9% had secondary school, high school and higher education. Considering the present study and the previous studies, it is seen that the education level of the breeders is very low in general. The possible disadvantages that the breeders with low education level may experience in applying new techniques related to production and following the developments in the field will bring along low yields.

Another finding obtained from the study and shown in Table 2 is the main occupation of the producers. According to this, 6 of the 7 people who continue production are farmers and the other one is an officer. Similarly, 13 of the 46 people who quit breeding are farmers, 8 are tradesmen and 7 are officers. In the study conducted by Şahinler and Şahinler (2002), it was stated that 58% of the breeders surveyed were farmers, 8% were labourers and 34% were from other occupational groups. The similar situation in Silvan shows that silkworm breeding is not a sufficient source of income on its own and accordingly, it cannot be practised as a main occupation. The fact that silkworm breeding is carried out to obtain additional income, as in many production branches, brings along the lack of permanent solutions to problems and long-term projections for the field.

Those Continuing Production

As can be seen in Table 3 prepared for the 7 subjects who continue production, there are no subjects with less than 6 years and more than 21 years of experience. 5 of the subjects have 6-10 years of experience and there are two producers with more than this experience.

Table 3. Duration of experience of those who continue production

Experience	Number	Rate (%)
Below 5 years	-	-
6-10 years	5	71.42
11-15 years	1	14.29
16-20 years	1	14.29
Over 21 years	-	-
TOTAL	7	100.00

According to the data obtained from the other questions asked to 7 people who continue silkworm breeding, six people produce with 2 and one person with 3 boxes of eggs per year and the boxes for production are supplied from Koza Birlik. In addition, only one producer has an indoor mulberry garden.

While only one of the producers who continue production stated that he did not receive training on the subject, it was recorded as another finding of the study that five producers disinfect the production room. Another remarkable finding of the study is that four producers stated that silkworm breeding is not a profitable activity. This determination is an indicator that may cause a decrease in the number of producers in the district in the near future.

Those who quit production

Determination of those who quit silkworm breeding is very important in order to make evaluations about the current structure and future of breeding. For this purpose, those who had been engaged in silkworm breeding before but left the breeding due to different reasons were considered as the other subject group. When the data obtained from the questions directed to the participants were processed, it was revealed that 19 people left the breeding after 11-20 years and 11 people left the breeding after 21-30 years of production. On the other hand, six people left breeding after a short period of experience. According to a more general evaluation that can be made with the findings in Table 4, 65.21% of the subjects left production after more than 10 years of silkworm breeding. In a way, this is an indication that silkworm breeding is an old activity for Silvan district.

Camuz and Gül (2022) found that the experience of silkworm breeders participating in the survey was between 1 year and 10 years and the average was 1.23 years. In a study covering 207 enterprises in Diyarbakır, Antalya, Bilecik and Bursa provinces, Taşkaya Top et al. (2015) determined the average experience of the breeders as 21 years, and calculated the experience periods of more than 20 and 40 years as 41.5% and 14.0%, respectively. The researchers noted that the age and experience of the operators are reflected in their activities

in different ways, and that older individuals stand out in terms of experience, while young producers are more open to innovations.

Table 4. Duration of experience of those who quit production.

Experience	Number	Rate (%)
Below 5 years	6	13.05
5-10	10	21.74
11-20	19	41.30
21-30	11	23.91
Over 30 years	-	-
TOTAL	46	100.00

In the research, the reasons for quitting silkworm breeding despite their long experience were specifically addressed and the findings obtained are summarised in Table 5. According to this, inability to earn income and change in production were the two main reasons. The question "Would you start silkworm breeding again if the conditions are favourable?" was asked to the same group and 58.70 % of them answered 'Yes'. While this rate indicates to some extent the longing of people who have produced and are familiar with silkworms, it is also interpreted as a hope for the revival of production.

Table 5. Reasons for discontinuing production.

Reason for discontinuation	Number	Rate (%)
Failure to generate income	15	32.61
Production change	13	28.27
Not being able to find people to participate in production	3	6.52
Production room problem (Use for other purposes)	3	6.52
Migration from rural areas	1	2.17
Cutting of mulberry trees	2	4.34
Other	9	19.57
TOTAL	46	100.00

Non-producers

In order to evaluate the future of silkworm breeding in the region, people who have not been involved in this production before were also included in the study. For this purpose, according to the data obtained from the questions asked to 49 subjects, 27 of them (55.10%) have knowledge about silkworm breeding. The fact that silkworm breeding has an old history in the district may explain this rate. On the other hand, only 12 people (24.49 %) stated that they could make production if the conditions are favourable. The low tendency to engage in production even under favourable conditions is interpreted as an evidence of moving away from animal production.

In the study, a comparison (χ^2 / khi-square test) was made between the questions that were thought to be related. As a result of the test, the relationship between "Having information about silkworm breeding" and "Education level" was found to be significant ($P < 0.05$) only in the group of subjects who left production, while the relationship between the other characteristics was found to be insignificant. In similar studies, working with more subjects will contribute to the expression of the relationships between the characteristics. Studies on silkworm breeding in Turkey are quite limited. However, Yakişan and Yılmaz (2022), in their study conducted in the region, emphasised that silkworm breeding should be developed in regions where there is no agricultural pesticides, socio-economic development level is low, and rural-urban migration is intense.

SUGGESTIONS AND CONCLUSION

Although few countries in the world are involved in silkworm breeding in economic terms, the silk produced is used by many countries. Silkworm breeding in Anatolia has a history of about 1500 years. While commercial breeding has disappeared in many countries, in some countries it is tried to be revived under pressure. The fact that breeding still continues in Turkey is a great value for the country and it is very important

to improve and protect the existing structure. At this stage, considering the data obtained from the study, it would be appropriate to evaluate the following suggestions:

1. In order to ensure sustainability in production, a 'National Mulberry and Silkworm Breeding Action Plan' should be prepared.
2. Mulberry leaves, which are the main input in silkworm breeding, and indirectly its production should be protected from pollutants and agricultural pesticides. Suitable production areas should be determined by creating the necessary legal infrastructures and producers should be raised awareness.
3. In mountain and forest villages, especially in areas close to the villages, mulberry gardens / forests such as honey forests should be formed and silkworm breeding regions should be established in these areas. In addition, modern feeding houses should be supported.
4. High yielding mulberry varieties should be planted and these gardens should be irrigated with drip irrigation technique.
5. Breeders and productions supported by the Ministry of Agriculture and Forestry should be monitored through a registration system.
6. In order to improve the breeding conditions especially in the regions with high production potential, applied trainings should be given by experts from Forestry Directorates, universities or private organisations and extension activities should be carried out. Difficulties in maintenance and feeding should be eliminated by introducing new technologies and providing more modern equipment to the breeders.
7. Processing of dry cocoons into final products in the country should be targeted.
8. Programmes supporting small family enterprises should be developed. Credit facilities should be offered to breeders, material support, insurance of products and retirement opportunities should be provided.
9. Activities to increase the added-value of silkworm breeding should be developed. For this purpose, new productions such as soap, cream and pharmacological products from silkworm and mulberry trees should be put on the agenda as in the countries that have an influence in breeding.

Although there is a partial decrease in both fresh cocoon and raw silk production worldwide, this change is quite high in Turkey. In fact, fresh cocoon production, which was 2134 tonnes in 1961, decreased to 1553 in 1990 and 76 tonnes in 2021. A similar structure is reflected in the export and import values of the country and the gap between them has gradually widened. In this research, the situation in national and international silkworm production and silk trade was tried to be evaluated within the scope of the study carried out in Silvan district of Diyarbakir. In this context, it is inevitable that some measures should be taken to revitalise silkworm breeding, which has become a traditional branch of production. It is assumed that the solution offerings that will alleviate the effect of the gradual decline in production tendency will also reduce the tendency towards cities. In this respect, it is important to support silkworm breeding, which will contribute to income in rural areas and provide raw materials for the textile sector.

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