



Mirza Gökgöl: Plant Scientist, Seed Collector, Agronomist, Breeder and Archaeo-Botanist

Alptekin KARAGÖZ

Aksaray University, Vocational School for Technical Sciences

Corresponding author e-mail: akaragoz@aksaray.edu.tr

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ABSTRACT

Mirza (Hacızade) Gökgöl (1897-1981) was an outstanding scientist with multiple talents and he had worked as plant scientist, seed collector, agronomist, plant breeder, botanist and archaeo-botanist. Despite the many challenges, he faced during his education and business life, he made many innovations, published several books and articles in the area of seed science, agronomy, wheat systematic, plant breeding and even archaeo-botany. The purpose of this review article is to recognize and appreciate Mirza Gökgöl's contributions to the scientific world.

After completing his Ph. D. program in Germany, M. Gökgöl established Istanbul Yeşilköy Agricultural Research Station, performed extensive seed collecting missions for landraces and wild relatives of cultivated crops, mainly of cereals, performed characterization and breeding programs with the collected germplasm, contributed to development of Crop Domestication Theory (Gene Centres Theory), published numerous scientific research papers and books on Turkey's plant genetic resources, highlighting their significance and adverse effects of their likely loss. His publications are still among the mostly credited references in the area of plant genetic resources.

Most of the bibliographic information cited here is extracted from his personal file kept at the archive of the Ministry of Agriculture and Forestry, Turkey. Apart from the archival information, I have also referred to members of his family through personal communications, to his publications and all the available published materials about Gökgöl.

Keywords: Seed, seed collecting, genetic resource, biography, plant breeding

Introduction

Mirza (Hacızade) Gökgöl was born into the family of a merchant in Ganja City of today's Azerbaijan on September 14, 1897. As he indicated in his handwritten Turkish CV, his mother was Yakut and father Yusuf Hacızade (Figure 1).

He started elementary school education in 1906 in Male High School of Ganja and graduated in 1915. After elementary school, Mirza went on his education in the Novoaleksandriysk Institute of Agriculture and Forestry, Kharkov, Ukraine in autumn 1916. Almost simultaneously, the Russian Revolution broke out at the beginning of 1917. Young Mirza had to return home late 1917 due to turmoil during the revolution. Then he enrolled in High Agriculture School of Portici

town of Italy at the beginning of 1919 (Figure 1). The same year Azerbaijan Government decided to send some students abroad for higher education (Zencirci *et al.* 2018). Young Mirza was one of them. Finally, he went to Berlin Agricultural College in November 1920 and graduated in 1924. He worked with professor of genetics Dr. Erwin Baur and professor of general agriculture Dr. Kurt Opitz at Berlin, and got the title of Doctor of Agriculture in 1926 and received his Ph.D. diploma, signed by Rector Prof. Aereboe on 15 April 1930 (Figure 2).

While Mirza continued his education in Berlin, problems began to arise in communication as well as in money transfer with Azerbaijan. After April 1920, the Turkish Republic took on his expenses to

complete his education. Mirza Gökgöl's son Demir K. Gökgöl (1937-2012) informed on a telephone call from Germany that his father experienced serious financial difficulties those days (personal communication 1999).

After completing Ph.D. study, Mr. Süreyya of the Ministry of Agriculture, on behalf of the Minister Sabri Toprak, sent a letter to Halkalı High School of Agriculture on 26.08.1926, stating that "a very well educated person, trained by Prof. Bauer and several other distinguished Professors, scientifically capable of accomplishing the missions, Mirza Hacızade, who is of Azerbaijan origin, is appointed as "seed breeder" for Halkalı High Agriculture School". Additionally, he asked the director (in the document, director is mentioned as rector) of the School to allocate him necessary amount of land, equipment, tools for seed breeding activities, and sufficient budget for basic expenses. It was also stated due to the reason that he was of Azerbaijan origin, he might have linguistic difficulties in the beginning, but it was expected to speak Turkish properly in a short time. It was requested from the president to open a "plant breeding" course in the curriculum to be given by Dr. Mirza Hacızade, when he improves his language (Figure 3). In 1931, Halkalı High Agriculture School was relocated in Yeşilköy and was later transformed into the Yeşilköy Research and Experimenting Institute.

The Surname Law of the Republic of Turkey was adopted on June 21, 1934. The law requires all citizens of Turkey to adopt the use of hereditary, fixed surnames. His son Demir K. Gökgöl stated on a telephone call from Germany (personal communication 1999) that, his father was frequently mentioning the lake Göygöl nearby Ganja and chose "Gökgöl" as last name (Figure 4) on 17.12.1934 ("*Göygöl*" in Azerbaijani language stands for *Gökgöl* in Turkish. It is a combination of two words. "*Gök*" means "blue" and "*Göl*" means lake. Altogether it can be translated as "Blue lake"). Göygöl in Azerbaijan was declared as National Park in 2008.

Mirza Gökgöl and his wife Zühre Gökgöl had one daughter (Şule) and three sons (Selçuk, Oğuz Yusuf and Demir Kayhan). After retirement, he served as a visiting professor in Istanbul and Izmir universities. He was offered a position at the Göttingen University (Gökgöl and Taşan 1970; Karagöz 2012), but he preferred to take short term positions at several German universities. Gökgöl retired on 7 June 1961 and passed in 1982. His grave is in Istanbul Sultanahmet Cemetery.

Mirza Gökgöl's contributions to agriculture and plant science

Mirza Gökgöl and the well-known Russian scientist, N.I. Vavilov (1887-1943) were born in the same year and their path coincided many times. Both

of them acknowledged the importance of genetic diversity in crop improvement, so they began collecting genetic material. Russian scientist P.M. Zhukovsky (1888-1951) commission by Vavilov conducted three expeditions to Anatolia during 1925-1927 and collected 10.000 samples. From time to time Gökgöl provided logistic support to Vavilov's teams during their missions. Zhukovsky compiled his work in a book (Zhukovsky 1951) and acknowledged Gökgöl and his colleagues in the foreword for their cooperation during the missions. The book gives detailed information on the performances of 17 Turkish origin crop species tested at various parts of Russia. He declares that "From the researches, it is understood that Anatolia is the origin of many valuable cultural plants. Due to its location at the confluence of three continents, it is certain that Anatolia is the origin of seeds such as summer soft wheat, pulses, best sesame types, carrots, anise, melon, cucumber, alfalfa, poppy, fruit and grape which are grown all over Europe". Turkish material exceeded the yield and quality in several parts and has been the basis for breeding studies in Russia (Zhukovsky 1951).

Gökgöl collected seeds from all over Turkey between 1925-1950 with a support by the Turkish Government and the Ministry of Agriculture. He not only collected himself but also received landrace samples from locally organized government offices on his request. Finally, he succeeded to collect huge amount of material from all over Turkey. Gökgöl considered his wide diverse collection covered all genetic variation needed for wheat breeding in Turkey without any need for introductions from other regions or countries (Gökgöl 1935; 1939).

Gökgöl concentrated considerable part of his studies on cereals, mainly wheat. After characterizing and evaluating thousands of accessions, he published his two volumes of books "Wheats of Turkey" (Gökgöl 1935; 1939). In these books, all the material has been botanically identified and morphologically evaluated. Among the evaluated material, he identified and published 256 new wheat varieties (Gökgöl 1955) out of 18.000 accessions. He first released "Karakılıçık" durum wheat and "Zafer" barley varieties out of the material. A picture taken while Gökgöl was working in field is given in Figure 5.

Several years after the publication of Wheats of Turkey (1939), Gökgöl published classification key for all Turkish wheat varieties in full details with illustration in Gökgöl (1955). A selection of some of his publications are given in Figure 6.

Food needs of the growing population of young Turkish Republic were increasing rapidly. Being aware of this fact, Gökgöl conducted various researches on

crops other than cereals such as forages, pulses, oil crops, industrial crops, potato, tobacco and so on. During his scientific career, Gökgöl managed to publish 37 papers and books (Karagöz 2012; Zencirci *et al.* 2018) on a large group of plants, but mostly concentrated on cereals. Out of the published material 18 of them were about wheat. Apart from wheat, he published on barley (1), rye (3), oats (1), rice (1), foxtail millet (1), sugar beet (1), sunflower (1), tobacco (1), castor bean (1), poppy (1), potato (2), ground nut (2), luffa (1), sweet clover (1), subtropical crops (1). There were 5 more works that Gökgöl prepared for publication but failed to publish. These were written about lentils, chickpeas, peas, beans, and faba beans. Apart from his scientific publication, he finally published a book (Gökgöl and Taşan 1970) summarizing all the work done from the establishment of the research station to his retirement (Figure 7).

Gökgöl kept herbarium specimen of all of the material he studied. He visited the Aegean Agricultural Research Institute's (AARI) Gene Bank in İzmir after his retirement and donated over 4500 of them (Tan 2010; Maggioni *et al.* 2011). Among the herbarium specimen some are the type materials of newly identified varieties by him. One of Gökgöl's herbarium specimens is given in Figure 8 (No: 1029. Ankara Province, Kızılcahamam Town).

Mirza Gökgöl's contributions to Gene Centres Theory

During his stay in Berlin, one of his instructors was plant geneticist Elisabeth Schiemann (1881-1972). Prof. Schiemann was one of the leading plant scientists of twentieth century with many studies on the history of cultivated plants, phylogeny of the wheat-*Aegilops* group and of barley (Kilian *et al.* 2013). Schiemann and Gökgöl were deeply interested in Vavilov's theory on the centres of origin of cultivated plants and they were discussing this issue among themselves. Vavilov was considering the abundance of morphological variation in an area as the main indication for the area to be a gene centre. Hence Vavilov presumed Anatolia as gene centre for diploid einkorn wheat, Ethiopia for tetraploid wheat, Afghanistan and Iran for hexaploid wheats. To develop such a conclusion towards the definition of gene centres, Vavilov conducted extensive research on a huge number of materials. As mentioned above, Gökgöl was partly engaged in these missions, he also performed systematic collecting and characterization activities.

Based on the data derived from his field studies, Gökgöl declared that the number of botanical varieties grown in Turkey considerably exceeds the number grown in other regions of the World. Thus, Gökgöl (1939) concluded that, Anatolia and adjacent regions of Iran, Syria, Palestine and Southern Caucasus

formed the centre of diversity and origin for diploid, tetraploid and hexaploid wheats. A few months later, Flaksberger came to the same conclusion using Vavilov and Gökgöl's collections (Zencirci *et al.* 2018).

Mirza Gökgöl's contribution to archaeo-botany studies

Mirza Gökgöl's expertise in plant identification has occasionally attracted the attention of archaeologists. The seed samples extracted from some excavations were identified by Mirza Gökgöl. He identified both the seeds of cultivated and wild plants unearthed from the excavation, and revealed the similarities and differences between the cultivars grown in the past and those grown at that time. In an archaeo-botany paper, Gökgöl (1938) gave the following information (translated from German) about the seeds extracted from the Alacahöyük excavation area (Figure 9):

"Seeds unearthed during the excavations at Alaca Höyük in 1936

I. Wheat. *Although the seeds found were generally charred and badly damaged, there were many seeds in which the shape was well preserved. We compared the excavated material with the rich collections of our seed farm in Yeşilköy near İstanbul, which came from Çorum and Yozgat, and it could be seen at first glance that at the time of the origin of these seeds, they were very large in terms of size and shape were more mixed than now, when on the one hand there were seeds that were the same size as today, but on the other hand there were also small grains that can no longer be found today. You can see from this that humans have been making a selection for thousands of years, probably by picking the largest ears, which has resulted in a certain balance of seed sizes and also varieties. The examination of the material shows that there was no selection and balanced varieties 5-6 thousand years ago.*

II. The remaining seeds. *Very well-preserved rye -(Secale cereale L.)- grain and two-row barley (Hordeum distichum) are recognizable among the seeds.*

Weed seeds are the easiest to recognize:

1. *From the Leguminosae family – Lathyrus hirsutus*
2. *From the Boraginaceae family - Cerinthe minor*
3. *From the Liliaceae family - Ornithogalum*
4. *From the family Caryophyllaceae - Gittago segetum (today's name: Agrostemma githago)*
5. *From the Umbelliferae family - Bifora*

Dr. Mirza Gökgöl

Director of the Institute for Plant Breeding at Yeşilköy - İstanbul"

Conclusive remarks

Despite the many problems he had experienced and unfavourable working conditions, Mirza Gökgöl managed to be a globally important scientist, accomplishing worldwide significant works in the field of collection, evaluation and utilization of plant genetic resources. He is a scientist who has made an indelible signature on the area of plant genetic resources.

Acknowledgements

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Mirza Hacızade Gökgöl (1897-1982)



Figure 1. Mirza Gökğöl's hand written CV submitted to the Ministry of Agriculture (1927)

| T. C. MEMURLARA MAHSUS TERCÜMEİHAL VARAKASI | | |
|---|---|----------------|
| Şahsî hüviyet | Şimdiki memuriyeti | |
| Adı ve samı <i>Ş. Haçizade Mirza</i> | <i>Yeşilköy Tohum - İslah</i> | |
| Babasının adı <i>Yusuף k.</i> | <i>- istasyonu müdürü</i> | |
| Anasının adı <i>Yakut k.</i> | | |
| Doğduğu yer <i>Gence (Azerbaycan)</i> | | |
| Doğduğu tarih <i>14/9/1897 (313) k. üçyüz on üç senesi</i> | | |
| Tahsilinin derecesi <i>yüksek (ziraat doctoru)</i> | Vesikalarının | |
| <i>Tercümeihali:</i> | Cinsi | Tarihi |
| <i>Ben Ş. Haçizade Mirza, Azerbaycanın Gence</i> | <i>tervellü vesikası</i> | <i>1</i> |
| <i>Lise tahsilime Gence lisesinde 1906 dan 1915 kadar devam ve</i> | <i>Berlin yüksek s. i. hak. dipl.</i> | <i>3</i> |
| <i>1915 de liseyi ikmal ederek lisenin 514 numurulu diplomasını aldım</i> | <i>Ziraat doctoru dipl. ve lisenin</i> | <i>4 ve 4a</i> |
| <i>(lef #2). 1916 sonbaharından 1917 nihayetine kadar Rusyanın</i> | <i>3 k. tahsilime dair emir</i> | <i>5</i> |
| <i>Haref. pehrinden "Novoalexandriysk" ziraat institusuna devam</i> | <i>3 k. harap emri</i> | <i>6</i> |
| <i>ettim isede, kargapelin dolayısı ile orada yüksek tahsilini ikmal</i> | <i>Kırsaktağereci sureti</i> | <i>7</i> |
| <i>edemiyerek geri döndüm. 1920 iftitasından İtalyada Portişi</i> | <i>3 k. har. fotoğraf</i> | <i>8</i> |
| <i>(Napoli) yüksek ziraat mektebine kayıt edildim, fakat orada</i> | <i>Harap, şarap ve patates yetiştirme</i> | <i>9</i> |
| <i>6 ay kaldıktan sonra İtalyayı terk ederek, o sene sonbaharın</i> | <i>harap emri</i> | <i>10</i> |
| <i>dan Berlin yüksek ziraat mektebine girdim ve 1924 de ik-</i> | <i>Tarap ve harap emri</i> | <i>11</i> |
| <i>mal ederek Berlin ziraat mektebinin 390 numurulu diplomasını</i> | <i>harap emri</i> | <i>12</i> |
| <i>aldım (lef #3).</i> | <i>harap emri</i> | <i>13</i> |
| <i>1923 den 1926 martına kadar Berlin ziraat mektebi veraset ilmi profes-</i> | <i>harap emri</i> | <i>14</i> |
| <i>son Baur ve umumî ziraat prof. Opitz in nezdinde çalışdım ve 1926 da</i> | <i>harap emri</i> | <i>15</i> |
| <i>"ziraat doctoru" diploması aldım (lef #4 ve 4a).</i> | <i>harap emri</i> | <i>16</i> |
| <i>İttihattan sonra verasetci Prof. Baurin nezdinde ça-</i> | <i>harap emri</i> | <i>17</i> |
| <i>alışırken Ziraat mektebi daveti üzere 1926 ağustosunun 11 nci</i> | <i>harap emri</i> | <i>18</i> |
| <i>itibaren Halkalı yüksek ziraat mektebi nezdinde "Tohum İslahı İstasyonu"</i> | <i>harap emri</i> | <i>19</i> |
| <i>tesis ederek orada çalışmaya başladım ve 1931 sonbaharında hıncırcemuz</i> | <i>harap emri</i> | <i>20</i> |
| <i>Yeşilköyeye manul edildiği numurudur, etendim</i> | <i>harap emri</i> | <i>21</i> |

Figure 2. Mirza Hacizade's Ph.D. Diploma (1930)



Figure 3. Letter from the Ministry of Agriculture to Halkalı Agricultural School for the employment of Mirza Hacızade (1926)

Yeşilköy T.C.
~~MALİYE~~ NEBİTAT - İSLAHİ - İSTASYONU
 MÜDÜRLÜĞÜ
 İSTANBUL - YEŞİLKÖY

S u r e t
 H u l â s a

SAYI T.C.
 Ziraat vekâletinin
 Halkalı ziraat mektebi alisi Rektörlüğü
 Ziraat vekâlet 34119
 172
 22321

Yeşilköy:
 Ziraat mektebi alisi rektörlüğüne

Ziraat ve ıslahı buzur mütahassisi Azerbaycan tabaasından
 Mirza Riza Beyin mektepdeki vazifesi bervechi atıdır .

1 - Çiftlikde kendisinin irae edeceği mahalde kafi tarla ziraat
 vekâletine aid ıslahı Buzur tarlası namıle ayrılacaktır .

2 -vekâlet bu tarlanın senelik idaresine taallük eden masrafı
 ayrıca havale göndermek suretile temin edecektir . Ancak bu senenin
 bütçesi pek dar olduğundan Sermayesabıteye dahil olmayan mektep
 vesaitile ve köleksiyon Tıraktörlarile tarlalar ihzar olunacaktır.

3 - Mirza bey ıslahı büzür tarlasının idaresine müteallük bir bütçe
 ihzar ve vekâlete suâtla gönderecektir . Ancak kendisi memleketımı-
 zın ehvalıziraiyesine vakıf olmadığından rufekaniz ile kendisine
 yardım edilmesini reca ederim .

4 - Laböratuvarı olmak üzere mektepde kendisine bir oda verilecektir.

5 - Vaktile m^öşy^e Kastelanın ıslahı büzür için getirttiği aletlerde
 kalnış varsa kendisine devri , olmayanların göndereceğimiz tahsisatlı
 sipariş edilecektir .

6 - Turke şivesini zamanla düzelteceğinden şimdilik imkân derecesi-
 nde bu sene olmasa gelecek semsterde mektebinizde (ıslahı büzür)
 dersinin tesis, bu dersin bu efendi tarafından tedrisi için meclisi
 müdersine arz edilmesi . Mirza efendi almanyada iyi bir tahsil gör-
 düğü ve ıktıdarı Prof. Baver ve diğer meghur Prof.lerce temin edil-
 mekte olduğundan bu efendinin mektebiniz hey'eti ilmiye kadrosı nuk-
 sanını etmama müffak olacağını umid ve tarzı sayı hakkında vekâlete
 iş'arı keyfiyet buyurmanızı reca ederim efendim . 16/8/926
 17

Aslı gibidir 25/5/932
 Yeşilköy tohum ıslahı istasyonu
 M. Kuvvini
 Suret

Ziraat vekili namına
 Sureyya

Figure 4. "I accepted Gökğöl as my last name. My signature is below"

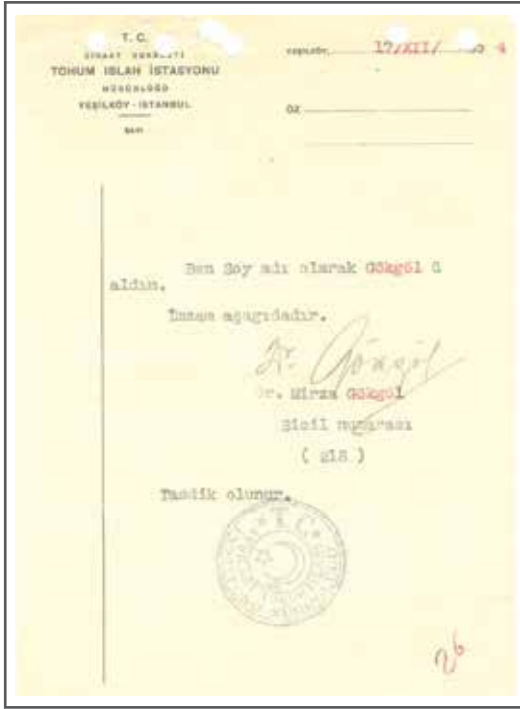


Figure 5. Gökğöl working on genetic material in the field (Source: Şule Aral)



Figure 7. Excerpt from Gökğöl and Taşan (1970)



Figure 6. A selection of Mirza Gökğöl's publications



Figure 8. One of Gökgöl's herbarium specimens in AARI Gene Bank (No: 1029. Ankara Province, Kızılcahamam Town, Source: Erdiñç Oğur)



Figure 9. Gökgöl M (1938). Samen, die bei den Ausgrabungen in Alaca Höyük im Jahre 1936 gefunden worden sind (Seeds found during the excavations at Alaca Höyük in 1936)

Samen, die bei den Ausgrabungen in Alaca Höyük im Jahre 1936 gefunden worden sind.

1. — Weizen. Obwohl die gefundenen Samen im allgemeinen verkohlt und stark beschadigt waren, gab es dabei viele Samenkörner bei denen die Form gut erhalten war. Wir haben das ausgegrabene Material mit den reichen Sammlungen unserer Saalzuchtanstalt in Yeşilköy bei Istanbul befindlichen, aus Çorum und Yozgat stammenden Proben verglichen, und es konnte auf den ersten Blick festgestellt werden, dass zur Zeit der Herkunft dieser Samen dieselben mit Bezug auf Grösse und Form viel gemischerter waren als jetzt, wenn es einerseits damals schon Samen gegeben hat, die an Grösse den heutigen gleichen, gab es andererseits aber auch so kleine Körner, wie sie heute gar nicht mehr zu finden sind. Man erkennt daraus, dass die Menschen seit tausenden von Jahren eine Auslese getrieben haben, wahrscheinlich durch Auslese der grössten Aehren, wodurch eine gewisse Ausgeglichenheit der Samengrössen und nebenbei auch Sorten entstanden sind. Die Prüfung des Materials beweist, dass es vor 5-6 tausend Jahren eine Auslese und ausgeglichene Sorten nicht gegeben hat.

Was die Arten der Weizenkörner betrifft, so kommen an erster Stelle die kurzen und runden Körner die zu den Trit. compactum Host. - Artgehören. Da es in Anatolien keine Tr. sphaerococcum Perciv. gibt, (Gökgöl, Die türkische Weizen, Bd. II, Istanbul 1939), besteht kein Zweifel, dass die gefundenen Körner zu dem Compactum - Art gehören.

An zweiter Stelle kommen die Trit. vulgare Host. - Körner. Obwohl diese Körner in Grösse und Form wenig ausgeglichen sind, kann man trotzdem aus den länglichen Körnern erkennen, dass es sich um gewöhnlichen Weissweizen handelt, während die gekrümmten sowohl Weich-, wie auch Hartweizen (Tr. durum) sein können, was schwer zu unterscheiden ist. Nur bei sehr wenigen Körnern kann man genau erkennen, dass es sich um Hartweizen (Tr. durum Defs.) handelt.

II — Die übrigen Samen. Unter den Samen sind sehr gut erhaltene Roggen - (Secale cereale L.) - körner- und zweizeilige Gerste (Hordeum disticum) ekkennbar.

Von Unkrautsamen sind am leichtesten zu erkennen:

| | | |
|----------------------|-----------------|---------------------|
| 1. — Aus der Familie | Laguminosae | — lathyrus hirsutus |
| 2. — » » » | Borraginaceae | — cerinthe minor |
| 3. — » » » | Liliaceae | — orrithogalum |
| 4. — » » » | Caryo phylaceae | — gittago segetum |
| 5. — » » » | Umbelliferae | — biforae |

Agrostemma githago
Bibbora sp.

Unter diesen sind aus der Familie Borraginaceae die cerinthe minor in der Mehrzahl vorhanden.

Gez: D. Mirza Gökgöl
Direktor des Instituts für
Pflanzenzüchtung zu
Yeşilköy — Istanbul.

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