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ORIGIN OF THE ARGENTINE SUNFLOWER VARIETIES

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SUMMARY

First sunflower varieties sown in Argentina had been brought by immigrants from Russia. This germplasm was the base for both official and private nurseries to create new varieties adapted to the country by selection.

In the 1960's, many varieties were obtained from intercrosses with wild species in official nurseries. These new varieties had the characteristic of resistance to the diseases present in the crop at that time.

In the 1970's, in both official and private nurseries, re-selections on Russian varieties with black achenes were done and also, even if on a small scale, several varieties were registered.

In the 1980's the activity of official nurseries was predominant. Varieties were registered which originated from very extensive crosses, and they at are still used for the development of important lines due to their differential reaction to diseases.

Key words: sunflower, Argentina, varieties, hybrids

INTRODUCTION

Introduction of first varieties before 1960

The first sunflower sowings in Argentina were done by Jewish immigrants, with seeds they had brought from Europe. These small crops were for direct consumption and also for feeding pen animals.

These sunflower populations or races "were known as Giant of Russia or Mammoth Russian of white seed ... possibly from the south of Russia" (Kugler *et al.*, 1958).

During the period 1929/30, the sunflower acreage was 4,500 ha in Buenos Aires Province. The main areas were in the district of Carlos Casares (Etchecopar, 1946).

In the thirties this crop became important because of the demand for edible oil.

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In 1931, nearly all sunflower seed available in the south of Buenos Aires Province was the variety "Giant of Russia" (Brunnini, 1935). According to the same author, it was: "a conglomerate of different types with strong variations of vegetative and of grain type". With the objective to uniformize by selection the cycle and type of single-head plant, breeding work started in 1931 at the Experimental Farm of La Previsión, Barrow, Buenos Aires Province.

The engineer Enrique Klein started sunflower breeding in 1933 at his nursery in Pla, Buenos Aires Province. His selection was based on a local white seeded population supplied by an exporter. He selected 2,000 heads from this population and his recombination was called "Klein 7G" (O. Klein, personal communication). In 1938, he registered "Selección Klein", the first Argentine sunflower variety.

In 1939, in the Experimental Farm of La Previsión, Barrow, Buenos Aires Province, B. Schelotto published the results of the variety "La Previsión 8" (Sel. 181), "with which an improvement in yield of 9% has been managed compared with the common variety of the zone", that was, with "Giant of Russia" which gave rise to this selection (Schelotto, 1939).

Later, in 1942, the same author published the results of the variety "La Previsión 9" in Farm Gazette. This new variety came from LP138112-1 selection, which was also derived from "Giant of Russia". It was registered in the Official Registry of Supervised Seed in 1941, and its authors were V. Brunnini and B. Schelotto.

The Central Experimental Station of Pergamino started to work on sunflower breeding in 1938. J. Etchecopar and M. Illia developed the variety "Saratov Sel. Pergamino M.A." from the Russian variety "Saratovsky", the main characteristic of which was earliness (M. Illia, personal communication).

Breeding station and nursery Massaux worked in Pirovano location, Buenos Aires Province. In 1953, R. Massaux developed the variety "Massaux" from "selection in a Pirovano cultivated population". The same year, he also obtained the variety **"**Selección Massaux E.M." by selection from a common population (Simposio del Trigo, 1969).

DISCUSSION

The 1960s: interspecific crosses

The Experimental Agricultural Station in Manfredi, Córdoba Province, started its sunflower breeding program in the period 1947/48. In 1960, a provisional inscription of a new sunflower variety called "Manfredi INTA" was made. The variety came from a triple interspecific cross [(*Helianthus annuus* var. Klein × *Helianthus annuus* var. *Saratov Sel. Perg. M.A.*) × *Helianthus annuus* ssp. *annuus*], and its main characteristic was good resistance to *Puccinia helianthi*. This was the first variety in Argentina, and also in America and maybe in the world, resistant to this disease (Bauer, 1988). The authors of this variety were J. Baéz, T. Mácola and H. Bauer.

Table 1: Origin of the Argentine Sunflower Varieties

YEAR	VARIETY	ORIGIN	AUTHOR
1938	Selección Klein	Local Population	E. Klein
1939	La Previsión 8	Giant of Russia	V. Brunnini B. Schelotto
1941	La Previsión 9	Giant of Russia	V. Brunnini B. Schelotto
1942	Saratov Sel. Pergamino	Saratovsky	J. Etchecopar M. Illia
1953	Massaux	Local Population of Pirovano – Buenos Aires Province	R. Massaux
1953	Selección Massaux E.M.	Common Population	R. Massaux
1960	Manfredi INTA	[(*Helianthus annuus* var. Klein x *Helianthus annuus* var. Saratov Sel. Perg. M.A.) x *Helianthus annuus* ssp. *annuus*]	J. Baez T. Mácola H. Bauer
1962	Impira INTA	(*Helianthus argophyllus* x *Saratov Sel. Perg. M.A.*)	J. Baez H. Bauer
1964	Guayacán INTA	[(Sunrise x 953-102-1-1-22-4) x Sel. Klein]	A.Luciano M. Davreux W. Kugler
1964	Ńandubay INTA	[(Saratov Sel. Perg. M.A. x Sel. Klein) x *Helianthus debilis* ssp. *cucumerifolius*]	A.Luciano M. Davreux W. Kugler
1965	Cordobés INTA	[(*Helianthus annuus* var. Saratov Sel. Perg. M.A. x *Helianthus annuus* var. Sel. Klein) x *Helianthus annuus* ssp. *annuus*]	J. Baez H. Bauer
1969	Pehuén INTA	{VNIIMK 6540ł x [CA3 x (9-2-5-4 x M688-1)]} x [VNIIMK 8932ł x (Sunrise x 953-102-1-1-22-4)]	A.Luciano M. Davreux
1970	Norkinsol	VNIIMK 1646	F. Saura
1971	Riestra 70	VNIIMK 1646	J. San Martín J. Sequeira S. Espada
1972	Norkinsol 2	Norkinsol	F. Saura J. Dolinkue
1972	Negro Bellocq	VNIIMK 1646	N. Pereyras
1972	Forestal Cambá	Pehuén INTA	A. Luciano
1976	Teguá INTA	(Kruglik Sel.10 x VNIIMK 6540)	H. Bauer C. Areco D. Alvarez
1977	Klein Casares	(VNIIMK 6540 x Sel. Klein)	E. Klein O. Klein
1979	Guayacán 2 INTA	Guayacán INTA	M. Davreux P. Ludueña A.de Romano C. Farizo
1980	Charata INTA	(Pozo Genético Rusos x Silvestres) (Genetic pool Russian x Wilds)	F. Tcach M. Davreux
1982	Aguaribay INTA	PGRK	M. Davreux
1984	Calchín INTA	(Cordobés INTA x Ienisei)	H. Bauer C. Areco D. Alvarez
1985	Caburé INTA	(PGRK x Mezcla Precoz x Comp. Pergamino 4) (PGRK x Early Mix x Pergamino 4 Compound)	F. Tcach
1990	Antilcó	Compuesto Pergamino 4 (Pergamino 4 Compound)	E. Ducós E. Ducós

In 1962, EEA INTA from Manfredi inscribed provisionally the variety "Impira INTA", obtained from the cross *Helianthus argophyllus* × *Helianthus annuus* var. Saratov Sel. Perg. M.A. It was one of the most popular varieties in Argentina. It was resistant to the races of *Puccinia helianthi* present in the 1960s and tolerant to *Sclerotinia sclerotiorum* and drought. Also, it was resistant to *Plasmopara halstedii* in about 70% of the inoculated plants. The authors were J. Baez and H. Bauer (Bauer, 1988).

The line HA-R2, derived from Impira INTA in the USDA, Fargo, ND (Gulya, 1985), is used as the international differential line for *Puccinia helianthi* (Gulya and Maširević, 1995).

In 1984, J. Miller from USDA, Fargo, ND, obtained the synthetics resistant to birds BRS-1, BRS-2 and BRS-3 from crosses between white seeds of Impira INTA and lines from that laboratory (Miller, 1984). The Canadian line CM614 was obtained from these synthetics (Kalid Rashid, personal communication).

In Argentina, E. Antonelli developed the lines "Impira Sel. 5 Magnif" and "Impira Sel. 11 Magnif" from Impira INTA, in INTA Castelar (H. Bauer, 1988). These lines are used as differential lines for *Puccinia helianthi* in Argentina.

In 1964, A. Luciano, M. Davreux and W. Kugler developed the variety "Guayacán INTA" in EERA of INTA, Pergamino. They used the Canadian variety Sunrise and crossed it with the Canadian line 953-102-1-1-22-4 which is resistant to *Puccinia helianthi*. This F_1 was crossed and backcrossed once with Selección Klein and the new variety was derived from this backcross (Antonelli, 1969). It was resistant to *Puccinia helianthi*, segregating 30% of susceptible plants.

Guayacán INTA has been sown mainly in the central region of Argentina. The line HA-R5 was developed from that variety in USDA, Fargo, ND (Gulya, 1985) and it was used as a differential line for downy mildew and *Puccinia helianthi* (Gulya and Maširević, 1995).

The line FT226 (QHP1) was developed in INRA, France, by crossing HA-R5 and PRS7; it is a fertility restorer resistant to *Plasmopara halstedii* (Agriobtentions, 2002).

In 1964, the variety "Ñandubay INTA" was developed in INTA Pergamino by A. Luciano, M. Davreux and W. Kugler. It came from the cross done in INTA Manfredi [(Saratov Sel. Pergamino M.A. × Sel. Klein) × *Helianthus debilis* ssp. *cucumerifolius*] (Luciano and Davreux, 1967).

The variety "Cordobés INTA" was developed in EERA of INTA Manfredi in 1965, from the triple interspecific cross [(*Helianthus annuus* var. Saratov Sel. Pergamino M.A. × *Helianthus annuus* var. Sel. Klein) × *Helianthus annuus* ssp. *annuus*]. It was sown because of its drought resistance and resistance to the four international races of *Puccinia helianthi* (60% of plants are free of black rust under inoculation conditions). Also, it was resistant to *Albugo tragopogonis* and *Alternaria helianthi*. Its authors were J. Baez and H. Bauer (Bauer, 1988).

The variety "Pehuén INTA", developed by A. Luciano and M. Davreux in EERA of INTA Pergamino in 1969, came from the cross {VNIIMK 6540^3 × [CA3 x (9-2-5-4 x M688-1)]} × [VNIIMK 8932^3 × (Sunrise × 953-102-1-1-22-4)]. The objective of this crossing was to obtain an early variety with high oil content and resistance to *Puccinia helianthi* (N. Mancuso, personal communication).

The 1970s: selection of varieties and other crossings

In 1970, the Northrup King nursery from Tres Sargentos, Buenos Aires Province, registered the variety "Norkinsol" obtained from a selection done by F. Saura on the Russian variety VNIIMK 1646. Norkinsol was characterized by earliness and high oil content (J. Dolinkue, personal communication).

The variety VNIIMK 1646 was also used by J. San Martín, J. Sequeira and S. Espada to develop, in 1971, the variety "Riestra 70" in the nursery called Forrajeras Bonaerenses S.A., in Norberto de la Riestra, Buenos Aires Province (J. Sequeira, personal communication). This variety was later than Norkinsol and it also had very good oil content.

In 1972, F. Saura and J. Dolinkue registered a re-selection of the variety Norkinsol which they called "Norkinsol 2" (J. Dolinkue, personal communication).

In the same year, N. Pereyras from the Bellocq Farm of the Ministry of Agrarian Matters, registered the variety "Negro Bellocq", selected from the variety VNIIMK 1646 (P. Ludueña, personal communication).

In 1972, A. Luciano, who was at the time working in La Forestal Nursery in Pergamino, Buenos Aires Province, registered the variety "Forestal Cambá", obtained by re-selection of the variety Pehuén INTA (H. Dinardo, personal communication).

In 1976, EERA of INTA Manfredi registered "Sel. 8018" under the name of "Teguá INTA". This selection came from the cross Kruglik Sel.10 × VNIIMK 6540, done by H. Bauer and C. Areco and D. Alvarez as co-authors. Under inoculation conditions, this variety had 70% of plants resistant to *Plasmopara halstedii*, and 80% of plants resistant to *Puccinia helianthi* (Bauer, 1988).

The line HA369 was derived from the variety Teguá INTA in the USDA, Fargo, ND (Miller and Gulya, 1990).

In 1977, the Klein nursey from Pla, Buenos Aires Province, registered the variety "Klein Casares", obtained from the cross VNIIMK 6540 × Sel. Klein. Its authors were E. Klein and O. Klein. The objective of this crossing was to get higher oil content (O. Klein, personal communication).

In 1979, the variety "Guayacán 2 INTA" was registered. It was obtained by M. Davreux, P. Ludueña, A. Romano and C. Farizo in EERA of INTA Pergamino, as the re-selection of the variety "Guayacán INTA" for high oil content and head weight.

The 1980s: multiple crosses

In 1980 in EERA of INTA Saenz Peña, Chaco Province, F. Tcach registered the variety "Charata INTA", derived from the "Mezcla Precoz" (Early Mix) of INTA Pergamino. This "Mezcla Precoz" (Early Mix) came from an intercross between lines from the Russian varieties VNIIMK 8883, VNIIMK 1646, VNIIMK 6540, Armavirskii 9343, Armavirskii 9345, Peredovick, Donsky 695, Smena, Ienisei and C1957, crossed to the wild species *Helianthus annuus* ssp *annuus*, *Helianthus petiolaris* and *Helianthus argophyllus* (N. Mancuso, personal communication). This multiple crossing was done by M. Davreux in INTA Pergamino, in 1955/56, and it was called "Pozo genético Rusos × Silvestres" (Genetic pool Russians × Wilds). Starting from this genetic pool, Davreux selected material resistant to *Puccinia helianthi* and so he obtained "Mezcla Precoz" (Early Mix). Later, Tcach worked with "Mezcla Precoz" (Early Mix), and did a re-selection adapted to the zone of INTA Saenz Peña, which was called "Charata INTA". The re-selection was made uniform in the cycle maturity and height and attempts were made to conserve the resistance to *Puccinia helianthi*, which is considered the main disease of the northern region.

It is important to mention that "Mezcla Precoz" (Early Mix) which was the origin of the variety "Charata INTA", has also been the origin of important lines for sunflower breeding, such as Pergamino 71/538 (INTA Pergamino), HA-R1 and HA-R4 (USDA, Fargo, ND) and MP555 and MP557 (INTA Castelar). HA-R1 is used as an international differential line for *Puccinia helianthi* races, and HA-R4 is used as an international differential line for *Puccinia helianthi* races and *Plasmopara halstedii* (Gulya and Maširević, 1995).

In 1982, EERA of INTA Pergamino registered the variety "Aguaribay INTA" from "Pozo Genético PGRK" (Genetic pool PGRK), created in 1968 by crossing lines derived from Sel. Klein and lines derived from the Russian varieties Smena, Armavirskii, Peredovick and VNIIMK 1646. The author was M. Davreux.

"Pozo Genético PGRK" (Genetic pool PGRK) was also the origin of the Uruguayan variety "Estanzuela 75".

In 1984, EERA of INTA Manfredi registered the variety "Calchín INTA", selected from the cross Cordobés INTA × Ienisei. Its breeder was H. Bauer and the selection for oil content and yield was done by C. Areco and D. Alvarez (D. Alvarez, personal communication)

In 1985, F. Tcach from EERA of INTA Saenz Peña, Chaco Province, registered the variety "Caburé INTA", developed by mass selection from a material from EERA of INTA Pergamino, by intercrossings "Pozo Genético PGRK" (Genetic pool PGRK), "Mezcla Precoz" (Early Mix) and "Compuesto Pergamino 4" (Pergamino 4 Compound).

"Pozo Genético PGRK" (Genetic pool PGRK) was also used for the development of the variety "Aguaribay INTA".

"Mezcla Precoz" (Early Mix) also gave rise to the variety "Charata INTA".

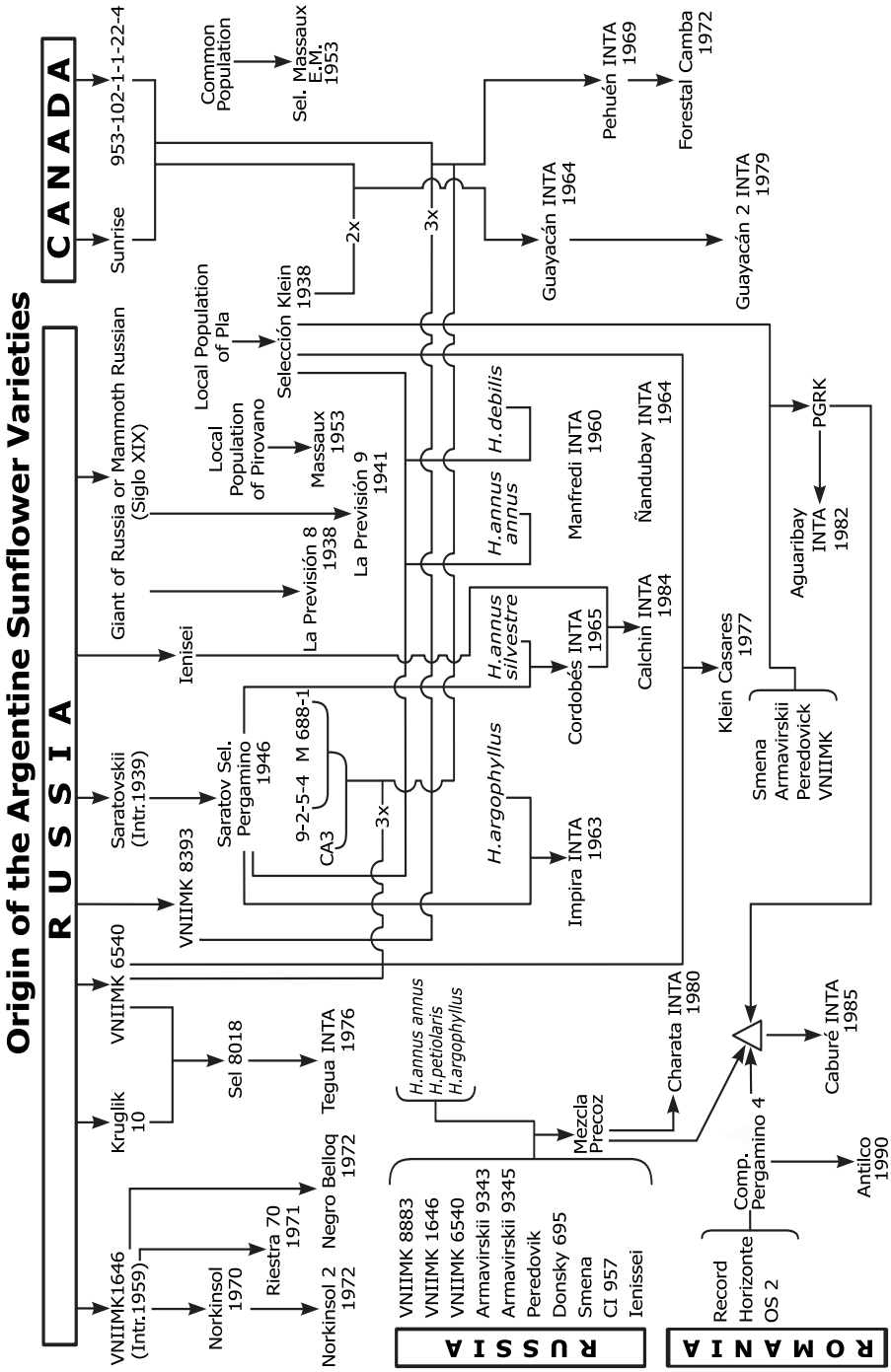

Figure 1: Origin of the Argentine sunflower varieties

The "Compuesto Pergamino 4" (Pergamino 4 Compound) was composed of lines derived from the Romanian variety Record, Sintética Horizonte and Sintética OS2.

It should be underlined that the variety "Caburé INTA" is resistant to *Puccinia helianthi* and *Plasmopara halstedii* (J. Vrdoljak, personal communication).

In 1990, E. Ducós and E. Ducós registered the variety "Antilco" selected in El Cencerro nursery in Coronel Suárez, Buenos Aires Province. It was derived from "Compuesto Pergamino 4" (Pergamino 4 Compound), developed in EERA of INTA Pergamino. The objectives of this selection were the development of high oil content, earliness and short stature (E. Ducós, personal communication).

No new varieties have been registered in Argentina since 1990.

CONCLUSIONS

At the beginning, the sunflower crop in Argentina was dependent on the varieties introduced by immigrants.

Later, official as private nurseries started developing new varieties by selection and crossing. These varieties were adapted to the climatic conditions of the country. In the period from 1938 to 1990, 25 varieties were registered, of which 13 were made by re-selection of varieties or populations, and 12 from crossing programs. Most of the latter were interspecific crosses which passed through many selection cycles.

Official nurseries managed to register 16 varieties of which 11 were from populations made by crossings at their own experiment stations.

Among the 9 varieties registered by private nurseries, only one resulted from selection in a population made in a crossing program in the same nursery.

In any case, the genetic background in the Argentine varieties continues to be novel and useful. The introduction of hybrids, which started to be sown in the 1970s, relegated the use of varieties by the sunflower growers, but their germplasm remains in use at the international level as a valuable genetic resource.

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ORIGEN DE LAS VARIEDADES DE GIRASOL ARGENTINAS

RESUMEN

Las primeras variedades de girasol, sembradas en Argentina, fueron traídas por los emigrantes de Rusia. Esta germoplasma representaba la base que los semilleros estatales tanto como los privados, utilizaban para la formación de nuevas variedades adaptadas a las condiciones locales.

En los años sesenta del siglo pasado, muchas variedades en los semilleros estatales, se obtuvieron por el cruzamiento con las especies salvajes. Estas nuevas variedades tenían la resistencia a las enfermedades, presentes en aquel entonces.

En los años setenta, en el sector privado, tanto como en el estatal, se registraron las reselecciones de las variedades rusas, con las ajenas negras, y también se han registrado algunas variedades obtenidas por el cruzamiento, aunque en menor rango.

En los años ochenta, domina la actividad de los semilleros estatales, que registran las variedades engendradas por unos cruzamientos muy amplios, que hoy en día se utilizan para la formación de importantes líneas, gracias a su diferente comportamiento hacia las enfermedades.

ORIGINE DES VARIÉTÉS DE TOURNESOL ARGENTIN

RÉSUMÉ

Les premières variétés de tournesol semées en Argentine ont été apportées par des immigrants venus de Russie. Ce germoplasme a été la base utilisée par le secteur public et le secteur privé pour créer de nouvelles sortes adaptées aux conditions du pays.

Dans les années soixante du siècle dernier plusieurs variétés ont été obtenues dans le secteur public par le croisement avec des espèces sauvages. Ces nouvelles espèces montraient de la résistance envers les maladies présentes à cette époque.

Dans les années soixante-dix aussi bien dans le secteur privé que dans le secteur public on a enregistré une nouvelle sélection des variétés russes à akènes noirs et quelques variétés obtenues par croisements quoique moins nombreuses.

Dans les années quatre-vingts l'activité du secteur public domine et enregistre des variétés apparues par de très nombreux croisements qui sont utilisés aujourd'hui pour la création de lignes importantes grâce à leur comportement différent envers les maladies.