



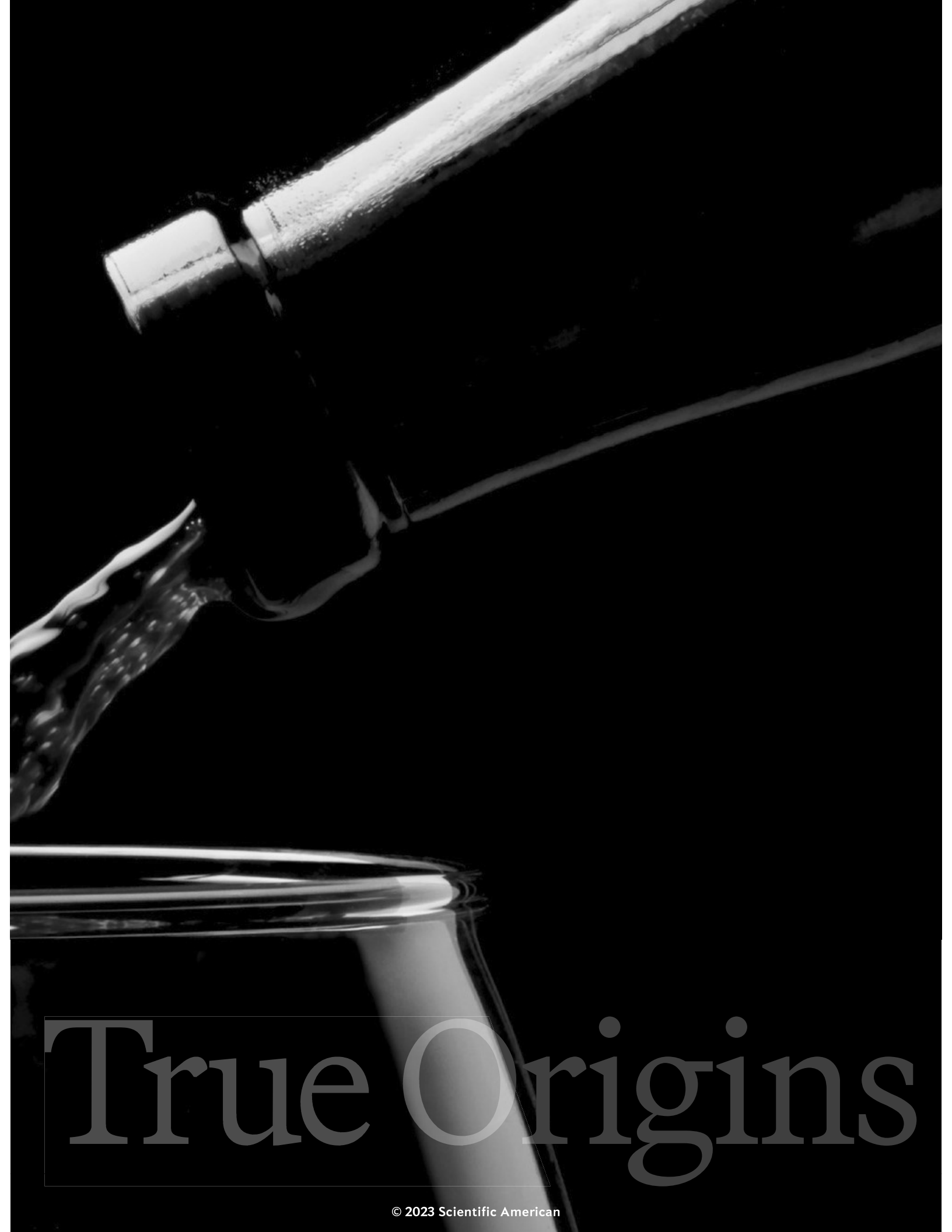
FOOD

**A broad genetic study
has revised the prevailing narrative
about how wine grapes
spread around the world**

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Wine's



True Origins

W

ITH JUST A sniff and a sip, trained sommeliers can often tell what region a wine came from: Douro in Portugal, Barossa in Australia, Napa or Sonoma in California. Experts in a specific locale can name the hillside—even how far up the hill—where a wine’s grapes were grown because of the terroir, the combination of soil, topography and microclimate that imparts a characteristic taste. The geographic and genetic journeys that brought those grapes to those places, however, have been poorly understood.

A massive new study gives us the clearest picture yet of the prehistory of wine, overturning several commonly accepted narratives about when and where humans cultivated grapevines to make the world’s wines. A large international group of researchers collected and analyzed 2,503 unique vines from domesticated table and wine grapes and 1,022 wild grapevines. By extracting DNA from the vines and determining the patterns of genetic variations among them, they found some surprises.

For centuries grape growers in different communities passed down lore about where their grapes came from. Some governments, particularly in Europe, designated appellations—strictly circumscribed regions with rules on how and where a varietal such as burgundy, rioja or barolo was legally allowed to grow and be produced. But genetic studies to discover where vines originated thousands of years ago began in earnest only 10 or 15 years ago.

One theme that emerged from these studies was that wild grapes grew in central Asia and dispersed westward as early humans migrated in that direction. But the genetic data in the huge study correct this story, says Wei Chen, a senior research scientist at Yunnan Agricultural University in

vines in the central Mediterranean Sea region, cleaving vine habitat into two isolated areas: one to the west of the sea (today Portugal, Spain and France) and one to the east (roughly Israel, Syria, Turkey and Georgia). Around 56,000 years ago the eastern region separated again into smaller isolated areas: the Caucasus (Georgia, Armenia and Azerbaijan) and western Asia (Israel, Jordan and Iraq).

Until recently, researchers also thought humans domesticated grapevines from wild progenitors as long as 8,000 years ago as an early agricultural revolution spread across what is now western Asia and Europe. Some experts thought vines were first cultivated in Iberia (primarily Portugal and Spain) around 3,000 years ago. Other investigators thought domestication first happened in the Caucasus. To make matters murkier (not a good trait in wine), there was disagreement on whether grapes were used first for food (“table grapes”) or for fermentation.

The recent study settles this debate: humans in western Asia domesticated table grapes around 11,000 years ago. Other people, in the Caucasus, domesticated wine grapes around the same time—although they probably didn’t master winemaking for another 2,000 or 3,000 years.

Early farmers, the revised story goes, migrated from western Asia toward Iberia and brought table vines with them. Along the way the farmers crossbred the table vines with

local wild grapevines. The earliest crossbreeding probably happened in what is now Israel and Turkey, creating muscat grapes, which are high in sugar—good for eating *and* fermenting. Gradually the table grape was genetically transformed into different wine grapes in the Balkans, Italy, France and Spain.

But if people in the Caucasus already had wine grapes, why didn’t they bring them to Europe? “We just don’t know yet,” Chen says. People migrating from there—notably Yamnaya nomads 4,000 to 5,000 years ago—might have brought vines, but the genetic analysis shows that Caucasus grapes have had very little influence on the makeup of European wine grapes.

Once farmers did begin cultivating wine grapes in Europe, they developed many of the varieties we enjoy today. Some grapes, such as cabernet sauvignon, have the same name everywhere they are grown. Other varieties farmed in different regions took on different names even though the grapes are genetically identical, such as zinfandel and primitivo. Sadly, it is almost impossible to trace a current varietal back to western Asia or the Caucasus, the two early domestication centers. Over the centuries grape growers crossbred table and wine grapes, as well as domesticated and wild grapes, and even back bred offspring with parents. “Once they had a superior vine, they usually destroyed the prior vines,” Chen says, making it hard to construct a family tree. You may never know where your favorite wine came from—really came from. In that sense, the mystique lives on. ●

Mark Fischetti is a senior editor for sustainability at *Scientific American*.

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


Primitivo grapes are harvested in Puglia, one of Italy's famous wine regions.

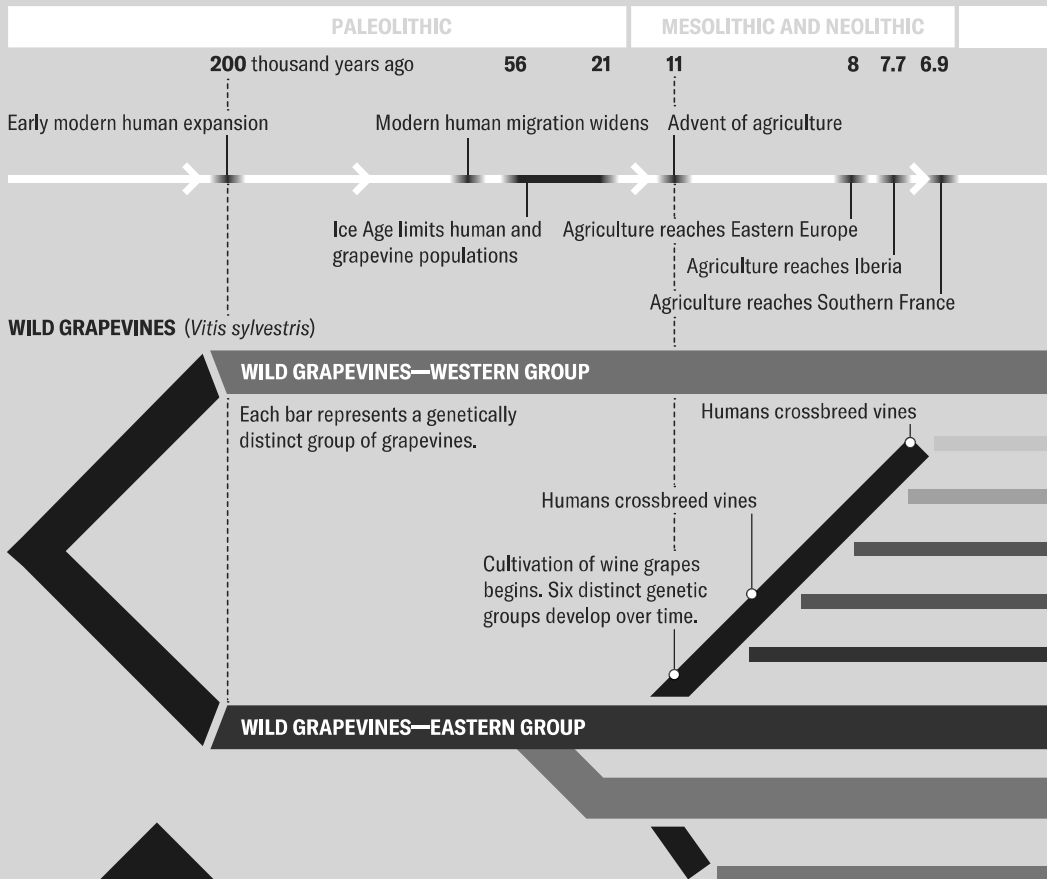
How Grapevines Evolved

Wild grapevines from antiquity split about 200,000 years ago into two primary genetic lines, named western and eastern, and spread naturally across Eurasia. Humans who migrated there first domesticated wine and table grapes around 11,000 years ago as agriculture began to develop. Subsequent cultivation and crossbreeding led to six geographic lineages that largely make up the varietals we enjoy today.

PHASE

The three primary waves of grapevine evolution are indicated with line thickness.

-  Wild vines separate into two geographic regions
-  Domesticated wine vines migrate with humans
-  Cultivated vines diversify genetically

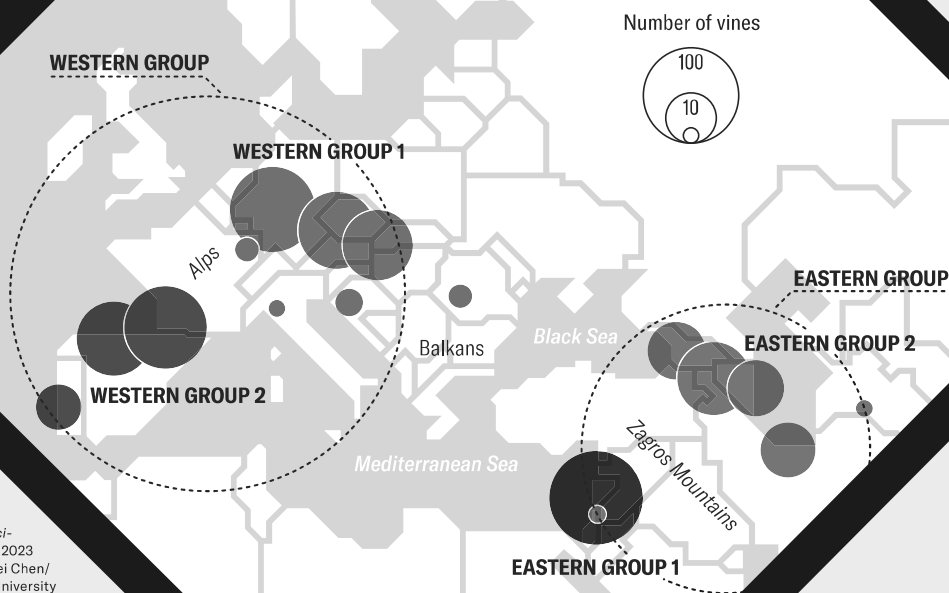


WILD GRAPES SEPARATE

Cold, dry, ice-age climates gradually killed grapevines in the Balkans between 200,000 and 20,000 years ago, leaving western and eastern groups of vines that evolved into distinct genetic lines.

DOMESTICATED GRAPEVINES MIGRATE WITH HUMANS

People domesticated vines independently in two regions, the Caucasus and western Asia, starting about 10,500 years ago and transported vines as they relocated over millennia (arrows).



Source: "Dual Domestications and Origin of Traits in Grapevine Evolution," by Yang Dong et al., in *Science*, Vol. 379; March 2023 (data); Consultant: Wei Chen/ Yunnan Agricultural University

BRONZE - IRON AGES

PRESENT

2.5

Grapevines reach northwestern China

WESTERN GROUP 2 (wild)

WESTERN GROUP 1 (wild)

WESTERN EUROPEAN GROUP

IBERIAN GROUP

BALKAN GROUP

MUSCAT GROUP

WESTERN ASIAN GROUP

EASTERN GROUP 1 (wild)

EASTERN GROUP 2 (wild)

CAUCASUS GROUP

ANCESTORS OF POPULAR MODERN GRAPES

The wines and grapes we love today have been bred from combinations of ancestral vines. Some, such as primitivo, are dominated by one set of vines (the Balkans, *dark red*). The western European vines (*yellow*) play a strong role in merlot, cabernet sauvignon and many white wines. The western, muscat and Iberian vines most greatly influence table grapes today.

GRAPEVINE ANCESTRY

- Western Group 2 (wild)
- Western Group 1 (wild)
- Western European Group
- Iberian Group
- Balkan Group
- Muscat Group
- Western Asian Group (wild and domesticated)
- Caucasus Group (wild and domesticated)

RED WINE GRAPES

Sangiovese
ITALY

Primitivo
BALKANS

Merlot
FRANCE

WHITE WINE GRAPES

Viognier
FRANCE

Sauvignon Blanc
FRANCE

Riesling
Weiss
GERMANY

Cabernet
Sauvignon
FRANCE

TABLE GRAPES

Sultanina*
TURKEY

Flame
Seedless
U.S.

Chardonnay
Blanc
FRANCE

*Also known as Thompson Seedless

Red Globe
U.S.

Crimson
Seedless
U.S.

CULTIVATED VINES DIVERSIFY

People in Europe produced wine grapes by breeding local wild grapes with table grapes that migrating farmers brought there (arrows). Four genetically distinct wine-grape groups developed in different regions (dotted circles).

Missionaries and explorers probably brought domesticated vines from Eurasia to the Americas, Argentina, South Africa and Australia between the 14th and 16th centuries.

Number of vines



Vine dispersal route

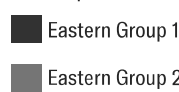


Table grapes



Wine grapes



CAUCASUS DOMESTICATION CENTER

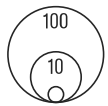
WESTERN EUROPEAN GROUP ORIGIN

Eastern Group 1 and Western European Group split about 6,900 years ago

BALKAN GROUP ORIGIN

Eastern Group 1 and Balkan Group split about 8,000 years ago

Number of vines



First crossbreeding by humans

EASTERN GROUP 2

IBERIAN GROUP ORIGIN

Eastern Group 1 and Iberian Group split about 7,700 years ago

MUSCAT GROUP ORIGIN

Eastern Group 1 and Muscat Group split about 10,500 years ago

EASTERN GROUP 1

WESTERN ASIAN DOMESTICATION CENTER