Ancient Iranian Calendars

Mohammad BAGHERI*

Ancient calendars were usually based on the phases of the moon, which was the most apparent phenomenon in the sky. However, since this calendar was not appropriate for agricultural activities, lunisolar and later, solar calendars became popular. The same happened to Iranian calendars. In this paper, I have given an account of the early Iranian pre-Islamic calendars and the Iranian calendars that were used after the advent of Islam in Iran. Since lunar and solar years do not include an integer number of days, in both types of years, there are fractions of days which, after accumulation, result in extra days. The years with the extra days are called leap years and the process of adding the extra day is called intercalation. Different intercalation systems have been used among different people in different ages. I have explained methods of defining intercalary days in different Iranian calendars. A very important source for the study of the ancient Iranian calendars is Abu Rayhan Biruni's Arabic treatise *Chronology of Ancient Nations*. This unique work was composed around 10 centuries ago and has been translated into Persian, English and Russian. After the establishment of Islam in Iran around 12 centuries ago, the Arabic lunar calendar became popular in Iran. However, since it was not proper for economical purposes, several reforms were suggested. In 1079, a solar calendar named Jalali or Maleki was devised by a group of astronomers including Umar Khayyam. The present official calendar used in Iran is based on the Maleki calendar.

Keywords

Iranian Calendars, Pre-Islamic Calendars, Islamic Period Calendars, Intercalation Systems, Leap Years

Early humankind used natural phenomena to keep an account of time. The consecution of day and night was the most natural phenomenon to adjust the rhythm of human activities. On a smaller scale, the position of the sun in the sky, shown by the shadow of a vertical gnomon was used. For larger time-spans, the apparent phases of the moon, from crescent to full moon and vice versa, were quite useful. It was noticed that after about twelve full cycles of the moon, nature returns to its initial position, so a year was defined as twelve lunar months. However, records over a long time showed that a real year or returning of nature to its initial situation takes longer and depends on the position of the sun in the background of the fixed stars. This was, for example, noticed by the heliacal rising of Sirius.

Therefore, we had natural lunar months and solar years. On the other hand, we had conventional solar months and lunar years. Agricultural activities depended

* Institute for the History of Science, University of Tehran

on the seasons and hence, necessitated using solar years. However, a solar year did not contain an integer number of lunar months, so lunisolar calendars were devised. Again, the pure solar calendars did not contain an integer number of days, so intercalation was needed to keep the solar calendar fixed relative to the seasons. For lunar calendars, the length of a lunar month was not an integer number of days. The combination of these incommensurable parameters led to different intercalation systems in different ages and among different societies. Despite the extensive investigations of experts in the history of calendars, some ambiguities remain about which a commonly accepted idea has not yet been achieved. This is due to the complexities of the intercalation systems, a lack of sufficient data from past times, and different interpretations of the existing texts relating to calendars. Computer simulation of the situation of the sun and the moon in the sky at any time in the past helps to solve some of these problems.

For all these reasons, in the chronological texts, the interval between different epochs are given in terms of days to avoid the ambiguities due to different intercalation systems. These intervals in terms of days are usually very large numbers and sometimes we have difficulty with the wrong numbers found in the manuscripts written by the scribes. The beginning of a lunar month is not always a certain observation, because it depends on the astronomical parameters, the eyesight power of the observer and the clearness of the sky in the locality of observation. To avoid this uncertainty, the correctness of conversions of dates between different calendar systems is controlled by checking the weekday of the given day.

A very informative and reliable text about the ancient Iranian calendars was composed by Abu Rayhan Biruni, the Iranian polymath scholar who lived in Khwarazm (Central Asia) about ten centuries ago, and has been recognized as the greatest scholar in the whole of Islamic civilization. His book *al-Āthār al-bāqiya ʿan al-qurūn al-khāliya* has been translated into English with the title *Chronology of Ancient Nations* (London, 1879) by the German scholar Edward Sachau. He had also edited the original Arabic text in London in the previous year. Besides the Iranian calendar, Biruni also imparts some valuable information about the Greek, Christian, Jewish, and Arabic calendars that has come to us exclusively thanks to Biruni's accurate and documented presentation of the data. He has also included a short chapter on calendars in his famous book *al-Tafhīm li-awāʾl ṣanāʿat al-tanjīm* (*Introduction to astrology*) which is extant both in Persian and Arabic versions. It was translated into English by R. Ramsay Wright (London, 1934) and a Russian version was published (Tashkent, 1975). A Japanese translation by M. Yano and our late colleague K. Yamamoto appeared in three parts in the *Kyoto Bulletin of Islamic Area Studies* (2010–2013). There is also an unpublished Italian version of this work translated by Claudio Cecotti, a historian of astronomy from Udine in Italy.

In ancient Iran, the eras were defined as the year in which the first king of a dynasty acceded to the throne. Later, they chose the first year of the kingdom of each king as the beginning of their calendar. The last Iranian pre-Islamic king Yazdigird acceded to the throne in the year 632 AD. After the advent of Islam in Iran, the year in which the prophet Mohammad emigrated from Madina to Mecca (622 AD) was adopted as the Hejira era. I will return to Hejira calendars at the end of my talk.

Before the Achaemenian dynasty, which emerged in the sixth century BC, the intercalation system for adjusting the year with the seasonal changes was as follows. In eastern Iran, each year had 360 days (12 months, each having 30 days). Then at the end of each period of six years, they inserted one intercalary month to compensate the extra 5 days of the solar year (6 x 5 = 30), and at the end of each period of 120 years, an extra month (actually two months, because 120 is a multiple of 6) was intercalated to compensate for the extra one-quarter of a day (120 x ¼ = 30). In western Iran, there was a lunisolar calendar influenced by the Babylonian calendar. This calendar had a regular lunar year of 354 or 355 days (12 lunar months) and a leap year of 383 or 384 days. The intercalation system involved inserting 7 months every 19 years (19 x 11= 209 days ≈ 7 months) and, in some cases, 3 months every 8 years (8 x 11= 88 days ≈ 3 months). This is in accordance with the factor

2.7 which Prof. Ram mentions in his paper (7 x 2.7 = 18.9 ≈ 19 and 3 x 2.7 = 8.1 ≈ 8).

Around the year 500 BC, after the conquest of Egypt by the Iranians, the simple and regular Egyptian calendar was introduced in Iran. It was used in Egypt for 3000 years and was purely solar, because it was based on the heliacal rising of Sirius at the time when the Nile overflowed. This calendar had 12 month, each with 30 days and 5 extra days at the end of the year.

In the first century AD, a group of knowledgeable Zoroastrian priests from Sistan, the southeastern province of Iran, immigrated to India. They were called Sun-worshipper *Sistani*s or *Mugh-Brahman*s. They took their beliefs, rituals, and knowledge to India where they exchanged and mixed them with Indian traditions. In Sanskrit they were called *Shak-Dipy*, which refers to their ethnicity (*Shaka* or *Saka*) and the fact of being a minority. Their calendar system became recognized as Shaka calendar, which is still in use, and its radix is March 3rd of 78 AD. The same calendar system with a shift starting from February 23rd of 57 BC was known as the Vikrami calendar and became the formal Indian calendar after the independence of India in 1950.

During the Sassanid dynasty (gov. 226–651 AD), the same Egyptian calendar system was used. In this Iranian version of the Egyptian calendar system, each day of the month had a name taken from the angels of the Zoroastrian religion. Whenever the name of the day was the same as the name of the month, it was celebrated as a festivity. At the end of the year, five extra days were named after the titles of five sections of *Avesta*, the sacred book of Zoroastrians.

In this calendar, to compensate for the extra fraction of the day in a true solar year, they inserted an intercalary month at the end of each period of 120 years (120 x ¼ = 30). However, this rule was not implemented regularly because of the long period between intercalations. Moreover, since this intercalation was established by the royal authorities, after the conquest of Iran by the Arabs, the intercalation was not implemented.

The seventh and eighth centuries AD are called “the two centuries of silence” in Iranian history, because, during these two centuries, Iranians were defending their land and religion against the Arab invaders. Therefore, in these two centuries, cultural activities decreased or stopped due to the resistance wars throughout Iran. Either no treatise was composed, or no composed treatise was preserved in this period. Even the existing manuscripts were burned either by Arabs or by the Iranians themselves to save their lives. So we know very little about this two-century period in Iran. Fortunately, an Armenian scholar named Anania of Shirak, who lived in the seventh century, and is known as the greatest scholar of Medieval Armenia, imparted precious information about the calendars of 14 nations including Jews, Arabs, Macedonians, Romans, Syrians, Greeks, Egyptians, Ethiopians, Athenians, Bithynians, Cappadocians, Georgians, Albanians and Persians. These unique data are preserved in the Armenian manuscripts extant in the Mesrop Mashtots Matenadaran library in Yerevan (Armenia). According to Anania, the first month of the Iranian calendar (Farvardin) started on August 6th. In present comparative tables, Farvardin starts on March 21st. This shows that due to the cessation of intercalations, the beginning of the Iranian year had moved in the seasons by more than four months. The trace of such displacements remains in local Iranian calendars. For example, in the mountains of Gilan province in the south of the Caspian Sea, the New Year festivities (*Nowruz*) falls around the August 5th (instead of the formal date March 21st).

After the establishment of the Islamic government in Iran, the Arabic lunar calendar with the Hejira epoch became popular. However, the solar Iranian calendar was still necessary for agricultural activities. The slow shift in the solar calendar due to curtailment of the intercalations created problems for tax affairs, so some calendar reforms were suggested to solve this inconsistency. The most important reform was implemented at the request of Malekshah king of the Saljuk dynasty in the year 1079 AD by a group of astronomers including Umar Khayyam (who was also a famous poet). This calendar was based on solar years starting from the vernal equinox. It was called the Maleki or Jalali calendar after the name of the king. In this ingenious calendar, the six months of spring and summer had 31 days. The next five months had 30 days and the last month had 29 days or, in leap years, 30 days. This arrangement was

defined based on the astronomical calculation regarding the mean motion of the sun on the ecliptic. They had noticed that when the sun is close to its apogee (from the geocentric point of view) it moves slower, so it traverses the 30 degrees of a zodiacal sign over a slightly longer time. Another important aspect of this calendar was its system of defining leap years. For solar years of 365 days, we should have a leap year of 366 days every four years and sometimes after 5 years. In all other intercalation systems of the years with 365 days, special cycles are defined for deciding which years have the extra intercalary day. For the Jalali calendar, there is a rule based on astronomical calculation: The first day of the Jalali New Year is the day in which the sun enters Aries (first zodiacal sign, vernal equinox) between the noon of the previous day and the given day. With this astronomically defined system, the beginning of the year will always remain near the vernal equinox. In other systems (Julian or Grigorian) there will be a discrepancy of about three days every 10,000 years. Moreover, in the Jalali calendar, the variations of the years' length, which amounts to 20 minutes, will not affect the intercalation process.

In 1925 the Iranian parliament approved a new calendar that was based on the Jalali calendar but its radix was the emigration of the prophet Mohammad to Mecca in 622 AD. In this solar calendar, the names of the month are taken from pre-Islamic Persian months' names. This one is now the formal Iranian calendar, however, the lunar Hejira calendar and the Christian calendar are used in parallel for religious and international affairs, respectively.