



இனம்

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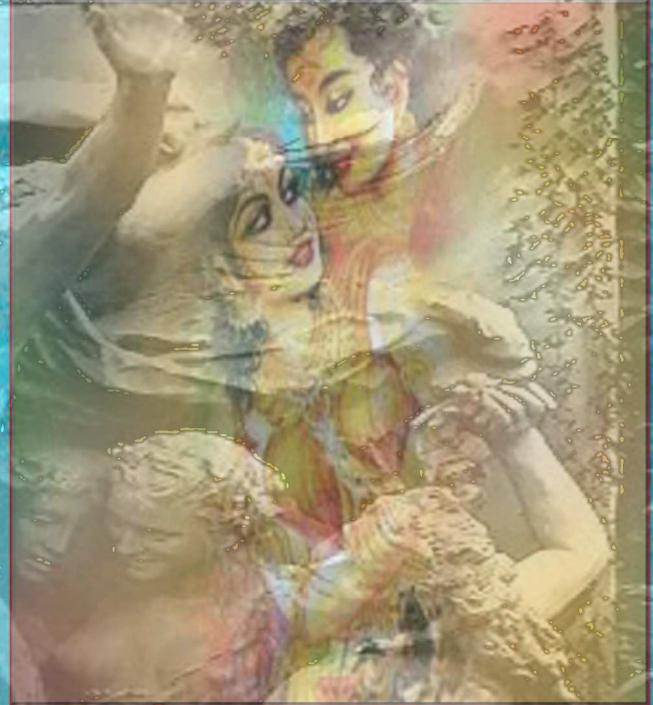
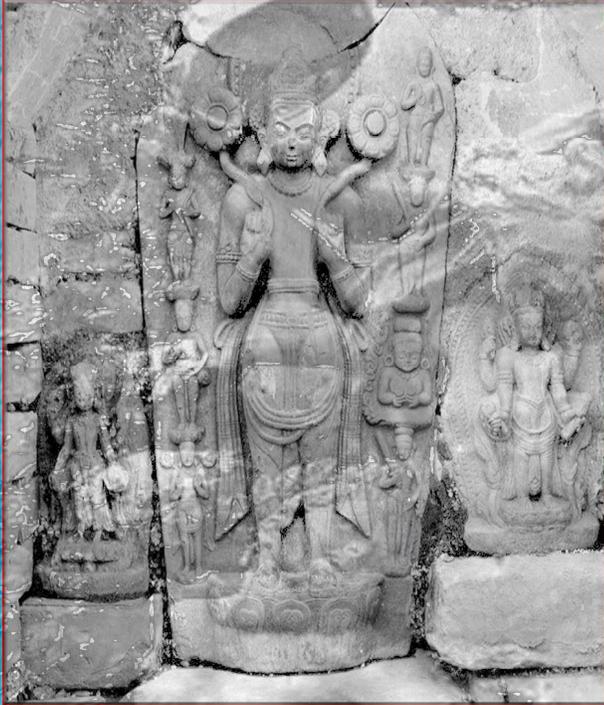
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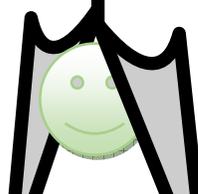
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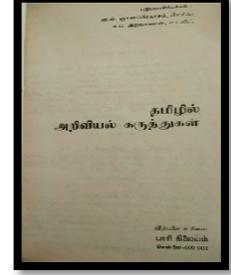


SCIENCE IN THIRUKKURAL

N.S.Gnanapragasam

1. Introduction

The literature of an era often provides an insight into the state of knowledge of the people living in that period. Viewed from this angle, Thirukkural is a veritable mine of information on the progress of civilization in ancient Tamilnadu. That Thirukkural- considered by many scholars to have been composed about 2000 years ago-is an excellent treatise on social ethics and morality is well known; not so well recognised is the fact that it also represents a compact encyclopedia of science, agriculture and medicine.



In this article, an attempt is made to collect all those couplets in Thirukkural which have a scientific back-ground, and to classify them under several headings in physical and biological sciences. In the sections that follow, the serial numbers of the couplets under reference are given in parentheses.

2. Physical Sciences

There are many couplets in Thirukkural which indicate a high level of understanding and knowledge of the physical sciences, namely, astronomy, mathematics, physics, chemistry and geology. Some examples are given below.

2.1: Astronomy

There is a reference to lunar eclipse in couplet 1146:

கண்டது மன்னும் ஒருநாள் அலர்மன்னும்
திங்களைப் பாம்புகொண் டற்று.¹

"when the moon is devoured by the serpent, darkness spreads in the world; likewise spreads the rumour even of one chance meeting of the lovers". Although the explanation of the lunar eclipse as due to the serpent of the skies (known in Hindu mythology as *Rahu*) is now known to be incorrect, this couplet points to the fact that the ancient Tamils were keen observers of astronomical phenomena. A mention of stars is found in couplet 1116.

Another couplet (1031) indicates the possibility of the awareness of the rotation of the earth on its own axis:

சுழன்றும்ஏர்ப் பின்னது உலகம் அதனால்
உழந்தும் உழவே தலை.²

This couplet may be interpreted thus: the rotation of the earth causes an endless succession of day and night; likewise, people may move from one job to another almost

¹ One day the man saw the alarm

Makes the snake a snake.

² The rotation is so that the world is behind it

Plow the plow

endlessly, untill at last they settle down in agriculture, which therefore is the best vocation.

Meteorology must have been well- developed in ancient Tamilnadu, because a whole chapter of ten couplets (11 to 12) has been devoted to stress the importance of rain for a prosperous life on this earth. Also, refer to couplet 542:

வானோக்கி வாழும் உலகெல்லாம் மன்னவன்
கோல்நோக்கி வாழும் குடி.³

2.2: Mathematics

The use of numbers as a quantitative measure of things must have been well-known at the time of Thiruvalluvar, as indicated by the frequent use of digits one (87, 109, 974), two (374, 402, 455, 662, 674, 737, 760, 875, 992, 1022, 1247), three (383,941), four (35, 146, 382, 390, 513, 605, 766, 950, 953), five (24, 25, 27, 43, 343, 354, 632, 675, 738, 939, 983, 1101), six (381), seven (62, 107, 1269, 1278), eight (9), and ten (450, 817). The concept of fraction was also known (1037).

Large numbers are also mentioned in several Places: Seventy (639), hundred (932) and thousand (259). It is remarkable that even Such a Large number as ten thousand (or, ten million) was in use among the ancient Tamils. This number, called கோடி is mentioned in several places in Thirukkural (337, 377, 639, 816, 817, 954, 1005).

Even the concept of infinity was probably known, as shown by the Couplet 22:

துறந்தார் பெருமை துணைக்கூறின் வையத்து
இறந்தாரை எண்ணிக்கொண் டற்று⁴

"The fame of the ascetics is as the number of people who have lived and died in this World". This number must, indeed, be extremely large, because human life has been in existence on the earth for several millions of years and the world population runs in to thousands of millions!"

The ancient Tamils used a set of symbols different from the Indian or Arabic Symbols now in use to represent numbers. For example, க was used for one, உ for two, னு for three and so on. The first Letter of the Tamil alphabet is அ , which also connotes the number eight. Thus, the same symbol could denote a letter or a number, and the meaning could be arrived at only from the context. This dual role of symbols was probably in Thiruvalluvar s mind when he wrote the Couplet 392:

எண்ணென்ப ஏனை எழுத்தென்ப இவ்விரண்டும்
கண்ணென்ப வாழும் உயிர்க்கு.⁵

"Whether called as numbers or letters, symbols are useful to a living being as are the two eyes". An object is Viewed from two different angles by the two eyes of a person,

³ The whole world is a monarch

Colon wolf drink

⁴ The excellence of the abandoned pride

Count the dead

⁵ These are the number one letter

Living life

and from these sensations the mind is able to synthesise a stereoscopic vision; Likewise, people may view a symbol like க or அ from two Points of view: as letters or numbers- the exact meaning has to be inferred by the mind from the context. The use of common symbols for both letters and numbers is also in vogue in the Roman system: the Capital letters I, V, X, L, C, D and M Standing for numbers 1, 5, 10, 50, 100, 500 and 1000 respectively.

2.3: Physics

Physics is based on measurement of length, weight and time, and it deals mainly with mechanics, optics, sound, magnetism and electricity. There is ample evidence in Thirukkural to show that physical principles were well understood by the people of Tamilnadu even two millennia ago.

A rod of wood was used as a measure of length (710, 796) and in the construction of balance (118):

சமன்செய்து சீர்தூக்குங் கோல்போல் அமைந்தொருபால்
கோடாமை சான்றோர்க் கணி.⁶

"The two arms of a balance used for weighing must be equal in length; Likewise, a just person must not favour one of the contending parties but must remain neutral." Another couplet (29) refers to a unit of time called கணம்.

A Keen sense of mechanics is revealed in the reference to the important role of the axle-pin in a rolling temple car (667,1032), the axle in a cart (475) and the pillars in a building (615, 983).

The use of a dressing mirror was probably known (706):

அடுத்தது காட்டும் பளிங்குபோல் நெஞ்சம்
கடுத்தது காட்டும் முகம்⁷

"Just as the mirror reflects the object placed in front of it, the face reveals the thoughts passing through the mind". The visible phenomenon of the reflection of light by a polished mirror is here used by Thiruvalluvar to explain the subtle concept that the face is the index of the mind.

There is also a mention of how a shadow is cast by an opaque object (208, 1034) and sweet melodies are produced by flute and the lute (66).

2.4: Chemistry

The preparation of various substances and the study of their properties constitute Chemistry. The well developed state of chemical and metallurgical engineering at the time of Thiruvallvar is revealed by several references to the use of metals such as iron, copper and gold and to substances like salt, lime and yeast.

The toughness of steel (எஃகு) was known (759, 773) and so it was used for making spears (500, 546, 774), arrows (279, 597), swords (727, 882), rods (24) and files

⁶ Equal to the equation

Coding certification

⁷ The next is the shining heart of the heart

Face to face

(567, 997). Modern researches have shown that it was in Tamilnadu that steel was first produced in a large scale in India

As at present, gold was very much in use among the ancient Tamils for making jewellery (919, 1081, 1110, 1124). Goldsmiths purify gold by heating it in fire when the impurities like copper get oxidised and get removed as scales, leaving behind pure, glittering gold. This process is compared by Thiruvalluvar to the elimination of the flaws from one undergoing penance by the purifying fire of suffering (267):

கடச்சுடரும் பொன்போல் ஒளிவிடும் துன்பஞ்
கடச்சுட நோற்கிற் பவர்க்கு⁸

The purity of the gold thus prepared was checked by rubbing it with a touchstone (505, 986). It was also possible that a gold hook was used as bait in fishing, because in water gold will have a glittering appearance which will attract the fishes (931).

It was known that articles of food such as milk get spoiled when kept in vessels made of copper (887, 1000). Salt was added to food for imparting taste (802, 1050, 1302). The fermentation of food was effected by the addition of yeast (1050). The nature of poisons was also known (580) and alcoholic drinks were considered to have poisonous ingredients (926).

Lime was used as a whitener (714). The nature of combustion and the process of burning were well understood (129, 308, 435, 674, 691, 896, 1104, 1148, 1159).

2.5: Geology

The study of the various types of material found on earth's surface, such as rocks, soil and water, constitutes the science of geology. The importance given to agriculture even at the time of Thiruvalluvar is reflected in several couplets (1032, 1033, 1034). Efficient agricultural practices demand a thorough knowledge of water and soil resources (16, 17, 550, 1038, 1147).

A piece of land that is allowed to dry, such that the soil crumbles to a quarter of its initial weight, will yield without any manuring an abundant harvest (1037).

தொடிப்புழுதி கஃசா உணக்கின் பிடித்தெருவும்
வேண்டாது சாலப் படும்⁹

For the purpose of irrigation, wells are sunk in sandy soil such as found in river-beds, which will give an abundant supply of water (396).

தொட்டனைத் தூறும் மணற்கேணி மாந்தர்க்குக்
கற்றனைத் தூறும் அறிவு¹⁰

“The more one digs in a well located in sandy soil, the more is the supply of water likewise, the deeper one studies, the wiser one becomes”

⁸ Burning golden light

Take a look

⁹ Patch up the cigarette cuisine

No matter what will happen

¹⁰ Sleeping a tumor

Throwing knowledge

Rain water is stored in tanks for common use (215). In such stored water, several salts get dissolved depending upon the nature of the soil (452). When an excessive amount of, salt is present in the soil, it is unfit for cultivation (406). Also in places where rainfall is scanty, soon deserts will appear devoid of any vegetation (78).

To obtain minerals from the hard rocks, one has to dig into the earth (307, 151). The nature of the land determines the type of life it can sustain (959).

3. Biological sciences:

At the time of Thiruvallvar, the Tamil people seemed to have been well versed in the various branches of biological sciences too. The infinite variety of the flora and fauna of Tamilnadu offered wide scope to the poet to illustrate his profound thoughts with apt similes. The survey that follows deals with the biological ideas in Thirukkural.

3.1: Botany

An outstanding example of how abstract ideas can be linked to common experience is the following couplet(595):

வெள்ளத் தனைய மலர்நீர்மட்டம் மாந்தர்தம்
உள்ளத் தனையது உயர்வு¹¹

"The stem of a lotus flower is as long as the depth of the water in which it floats; similarly, the stature of a person is measured by the goodness of his heart." This couplet reveals Thiruvallur's keen sense of perception of Nature and Man! Of the several flowers mentioned in Thirukkural, lotus (595, 617, 1103) and water-lily (1114) are well-known even now; but not so is that sure and now almost obscure species called anicha (அனிச்சம்) (90, 1111, 1115, 1120) This flower is so delicate that it begins to fade even as it is smelt (90):

மோப்பக் குழையும் அனிச்சம் முகந்திரிந்து
நோக்கக் குழையும் விருந்து¹²

The small size of the millet seed (தினை) is in marked contrast to the huge size of the nut of the palm tree (பனை) (104, 144, 433, 1282) Another tiny seed is that of the sesame (889). The kurnise seed is red all over, except at its nose which is black in colours (277). Other plants mentioned in Thirukkural are sugar-cane (1078), bamboo (1113, 1272), cotton (1273), nerunchi thorn (1120) and green grass (16). Tree may bear fruits which may be edible (216) or poisonous (1008). A thorny plant is easily plucked why it is tender, but will cause injury when its roots deepen (879).

3.2 Zoology

That Thiruvallur was a keen observer of Nature is also evidenced by an anmerous references to birds, reptiles and animals. He was probably even aware of the classification of living beings into celebrate and invertebrate (72, 77, 89). Of the invertebrates says the poet (77):

¹¹ Floody water flame is changing
Increase in his own

¹² The smile of the snake
A daring party

என்பி லதனை வெயில்போலக் காயுமே
அன்பி லதனை அறம்¹³

"The sun's heat scorches the boneless worms; even so, the power of righteousness will torture a person devoid of love."

Elephants have always been treated with respect in Tamilnadu, and it is no wonder that several couples mention it (500, 597, 599, 774, 1087). There are also references to other animals: majestic lion (59, 381), ferocious tiger (273, 599), docile cow (1066), fierce ram (486), cunning jackal (500), and cowardly mouse (763), Reptiles such as hissing snake (763), cautious tortoise (126) and powerful crocodile (495) are also mentioned.

The gregarious and generous nature of the crows is worth emulating by man (527):

காக்கை கரவா கரைந்துண்ணும் ஆக்கமும்
அன்னநீ ரார்க்கே உள்¹⁴

"The crow beckons to its kind to share the food it has found; only with people of such good nature does fortune abide". That is, indeed, a good lesson in practical socialism.

Of the others birds, mention has been made of the gorgeous peacock (1081) patient heron (490), and the nocturnal owl (481). Watching a new-fledged bird flying away abandoning its own broken shell, brings to the mind of the poet the sublime thought of the soul quitting the body at the time of death (35):

குடம்பை தனித்து ஒழிய்ப்புள் பறந்தற்றே
உடம்போடு உயிரிடை நட்பு¹⁵

3.3: physics

The study of the structure and functions of the different part of the body is the aim of physiology. Almost every external part of the human body finds a mention in Thirukkural. The five senses of taste, sight, touch, sound, and smell are gradually developed in a child in the order given (27):

சுவைஒளி ஊறுஒசை நாற்றமென்று ஐந்தின்
வகைதெரிவான் கட்டே உலகு.¹⁶

Only those who know how to keep the senses under control will be able to lead a happy life in this world (6, 27).

¹³ Nick Latan is the Weipolaku Kai
Anbi Latha

¹⁴ Kaka karaa is a breakthrough
Sister.You are Rarek

¹⁵ The hut is separated by the body and the body is almost exposed
Life-Friendly

¹⁶ The taste of uriosterion
Typewriter Kate Ullak

For personal hygiene, water is essential (298). To keep the body in good health, the intake of selected food in proper amounts is very essential (942, 944, 947). In the case of sickness a proper diagnosis must precede any treatment (948).

3.4: Genetics

The science of genetics is making rapid strides now thanks to molecular biology, which attempts to explain hereditary traits in terms of DNA and RNA.

But, surprisingly enough, even at the time of Thiruvallvar, the Tamil people seemed to have known how hereditary characteristics are passed on from one generation to another (398):

ஒருமைக்கண் தான்கற்ற கல்வி ஒருவற்கு
எழுமையும் ஏமாப் புடைத்து.¹⁷

"The education acquired in one birth confers benefits even up to seven succeeding births. Similar ideas are also found in other couplets (62, 107, 538, 835). This view probably emanated from the Hindu doctrine of Karma, which emphasises the need for doing good always eschewing all forms of evil.

3.5: Psychology

The intrinsic mechanism of the human mind is not easy to comprehend. Even in this obscure field, Thirukkural provides many valuable insights. Here is an example (293):

தன்நெஞ் சறிவது பொய்யற்க பொய்த்தபின்
தன்நெஞ்சே தன்னைச் சுடும்.¹⁸

"Utter not a word which the conscience tells is false, lest your own conscience should smite you". Even to entertain the very thought of stealing is an evil to be avoided (282).

To achieve one's ambitions, one must possess besides will power and a firm mind (666), the ability to act at the proper time (484) avoiding procrastination (668) Anger must always be subdued (335). Gambling must not be indulged in, because one who lose a hundred times in the fond hope of gaining once (932).

One of the best known Thirukkural couplets is the following (391):

கற்க கசடறக் கற்பவை கற்றபின்
நிற்க அதற்கு தக¹⁹

"Learn without any flaw what is worth learning; then, act according to what has been learnt!" This noble thought is truly a master-piece of educational psychology.

4. Conclusion

This brief survey points clearly to the fact that Thirukkural, though composed about 2000 years ago, remains fresh as the pages of the scientific journal printed today

¹⁷ For a single education

Waking up the cheat

¹⁸ It's a lie to lie

Herself shoots herself

¹⁹ Learning the lesson to learn

Stand up

.This best known Tamil classic shines as a beacon light in this modern scientific era.
Times may change, but the lofty truths enshrined in Thirukkural will remain changeless!

...

இக்கட்டுரை 1975ஆம் ஆண்டு பாரிநிலையப் பதிப்பகத்தின் மூலம் பேரா.க.ப.அறவாணன், பேரா.வி.மி.ஞானப்பிரகாசம் ஆகியோரின் பதிப்பில் வெளிவந்த தமிழில் அறிவியல் கருத்துகள் எனும் நூலிலிருந்து தெரிவுசெய்யப்பெற்றது.

...

நன்றிக்குரியோர்

சீ.திவ்யதர்சினி (முதலாமாண்டு, கணிதத்துறை, இந்துஸ்தான் கல்லூரி, கோயமுத்தூர்)
ஜ.புவனேஸ்வரி (முதலாமாண்டு, கணிதத்துறை, இந்துஸ்தான் கல்லூரி, கோயமுத்தூர்)
மோ.மோனிஷா (முதலாமாண்டு, கணிதத்துறை, இந்துஸ்தான் கல்லூரி, கோயமுத்தூர்)
வெ.ரேவதி (முதலாமாண்டு, கணிதத்துறை, இந்துஸ்தான் கல்லூரி, கோயமுத்தூர்)
க.பிரதீப் ராஜா (முதலாமாண்டு, கணிதத்துறை, இந்துஸ்தான் கல்லூரி, கோயமுத்தூர்)

இவர்கள் இக்கட்டுரையைக் கூகுள் கையெழுத்துணரிவழி அச்சிட உதவியவர்கள்.



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