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THE *YUGA* OF THE *YAVANAJĀTAKA*

DAVID PINGREE'S TEXT AND TRANSLATION REVIEWED

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INTRODUCTION

The *Yavanajātaka* written by Sphujidhvaja Yavaneśvara in the third century A.D. was edited and translated into English by Prof. David Pingree in 1978. The last chapter (ch. 79) of this work is called *Horāvidhi* and deals with luni-solar astronomy on the basis of a period of 165 years called *yuga* and the synodic motion of the planets. The text is marred by faulty editing, the incorrect readings being adopted and the correct ones given in the apparatus criticus, with the result that the translation is incorrect at places and the meaning really intended by the author is lost.

The object of the present paper is to study this chapter so as to bring out the meaning really intended by the author. The paper will be confined to the study of the *yuga* of the *Yavanajātaka* and its various constituents. In the process the relevant passages and their translation as given by Prof. Pingree will be reviewed and modified.

1. TIME-MEASURES

Verses 28-29 of Chap. 79 of the *Yavanajātaka* give a table of time-measures. Pingree's text and translation run thus :

Text : त्रयः पलाः स्युः कुडवोऽष्टमश्च
तत्राडिकाख्यं विदुरेकषष्टिम् ।
ताः षष्टिलिप्तापि च नाडिकाख्या
भवन्ति षष्टिर्दिनिशा क्रमेण ॥२८॥

कला निमेषाष्टशता दशोना
विदुः कलास्त्रिंश [च] नाडिका तु ।
द्विनाडिकस्तु प्रथितो मुहूर्तो
मानप्रमाणादिविधिप्रसिद्धौ ॥२९॥

Trayaḥ palāḥ syuḥ kuḍavo 'ṣṭamaśca
tannāḍikākhyaṃ vidurekaṣaṣṭim |
Tāḥ ṣaṣṭiliptāpi ca nāḍikākhyā
bhavanti ṣaṣṭirdyuniśā krameṇa || 28 ||
Kalā nimeṣāṣṭaśatā daśonā
viduḥ kalāstriṃśa [*ca*] *nāḍikā tu* |
Dvināḍikastu prathito muhūrto
mānapramāṇādividhiprasiddhau || 29 ||)

Translation : A *kuḍava* is 3⅛ *palas,* and 61 *kuḍavas* equal 1 *nāḍikā.* The *nāḍikās* are also each divided into 60 *liptās* ("minutes") ; there are 60 *nāḍikās* in a nychthemeron. One *kalā* equals 790 (?) *nimeṣas,* one *nāḍikā* 30 *kalās,* and one *muhūrta 2 nāḍikās* in the accomplishment of the rules relating to measures and standards.

Remarks :

(1) We find that according to this translation one *nāḍikā* is equal to 30 *kalās,* whereas in the formulation of the rules stated in vss. 11, 12 and 13 one *muhūrta* ("a period of 2 *nāḍikās*") is taken equal to 20 *kalās,* and in verse 31 also one *kalā* has been used in the sense of 1/10 of a *nāḍikā* or 1/20 of a *muhūrta.* This discrepancy is due to the adoption of the incorrect reading "*kalāstriṃśa* [ca]" (in vs. 29b) in place of the correct reading "*kalāstā daśa*" which has been given in the apparatus criticus. Restoring the correct reading in place of the incorrect one, we find that the text gives the following table :

3⅛ *palas*	=	1	*kuḍava*
61 *kuḍavas*	=	1	*nāḍikā*
60 *liptās*	=	1	*nāḍikā*
60 *nāḍikās*	=	1	nychthemeron
790 *nimeṣas*	=	1	*kalā*
10 *kalās*	=	1	*nāḍikā*
2 *nāḍikās*	=	1	*muhūrta* (or *kṣaṇa*).

Likewise

20 *kalās* = 1 *muhūrta*
30 *muhūrtas* = 1 nychthemeron.

It is these two relations that have been used in verses 11, 12 and 13. The same relations were given by Suśruta[1] and Parāśara.[2]

(2) It is noteworthy that according to the *Vedāṅga Jyautiṣa*[3] too,

$3\frac{1}{8}$ *palas* = 1 *kuḍava*
and 61 *kuḍavas* = 1 *nāḍikā.*

But there

$$1 \text{ } nāḍikā = 10\frac{1}{20} \text{ } kalās.$$

It seems that Sphujidhvaja Yavaneśvara has taken

1 nāḍikā = 10 kalās

to avoid fractions, or he has followed Suśruta or Parāśara.

2. TITHIS IN THE YUGA

Verse 6 gives the number of *tithis* in the *yuga* ("a period of 165 years"). Pingree's text and translation run thus :

Text : क्रमेण चन्द्रः क्षयवृद्धिलक्ष्य-
स्तिथिश्चतुर्मानविधानबीजः ।
षट्पंचकाग्रे द्विशते सहस्रं
तेषां युगे बिन्दुयुतानि षट् च ॥६॥

Krameṇa candraḥ kṣayavṛddhilakṣya-
stithiścaturmānavidhānabijaḥ |
Ṣaṭpañcakāgre dviśate sahasraṃ
teṣāṃ yuga binduyutāni ṣaṭ ca || 6 ||

Translation : The Moon is to be characterized by waning and waxing in order. The *tithi* possesses the seed of the principles of the four (systems of time-) measurement. There are 60,265 (days) in a *yuga.*

[1] See *Suśruta Saṃhitā, Sutrasthāna,* ch. vi. 4.
[2] See *Bṛhat Saṃhitā* with Bhattotpala's Commentary, Sudhakara Dvivedi's edition, p.24, lines 3-5.
[3] See *Yajuṣa Jyautiṣa,* vs. 24.

Remarks :

The last sentence of this translation is wrong. The number 60,265 as well as its designation as "days" both are incorrect. The word *ṣaṭpañcaka* means 6×5 *i.e.* 30, not 65 ; and the word *"teṣāṃ"* refers to *tithis,* not to civil days. Moreover, the number of civil days in a *yuga* is 60,272, not 60,265. See below.

The second half of the text really gives the number of *tithis* in the *yuga,* not the number of civil days in the *yuga* as supposed by Pingree. The error is due to faulty editing of the text. The adoption of the incorrect readings "°*kāgre dviśate*" and *"bindu"* in place of the correct readings "°*kāgrā dviśatī*" and *"viddhya"*, respectively has spoiled the text. It is noteworthy that the correct readings are given in the apparatus.

The correct reading of the text is :

क्रमेण चन्द्रक्षयवृद्धिलक्ष्य-
स्तिथिश्चतुर्मानविधानबीजः ।
षट्पंचकाग्रा द्विशती सहस्रं
तेषां युगे विद्ध्ययुतानि षट् च ॥६॥

Krameṇa candrakṣayavṛddhilakṣya-
stithiścaturmānavidhānabījaḥ |
Ṣaṭpañcakāgrā dviśatī sahasraṃ
teṣāṃ yuge viddhyayutāni ṣaṭ ca || 6 ||

meaning : "The tithi, which is the indicator of the gradual waning or waxing of the Moon, is the seed of the principles of the four (systems of time-) measurement. Know that there are 60000 plus 1000 plus 200 and 6×5 (*i.e.* 61,230) of them (in a *yuga*)."

That is,

one *yuga* = 61230 *tithis* (or 2041 synodic months, as stated in vss. 9 and 20c-d)

3. CIVIL DAYS IN THE *YUGA*

Verse 7 gives the number of civil days in the *yuga.* Pingree's text and translation run thus :

Text : त्रिंशन्मुहूर्तं दिनरात्रमुक्तं
सूर्योदयात् कालबुधास्तदाहुः ।
तेषां शते द्वे त्रिंशदेककाग्रे
षट् खायुतान्यर्कयुगं वदन्ति ॥७॥

Triṁśanmuhūrtam dinarātramuktaṃ
sūryodayāt kālabudhāstadāhuḥ |
Teṣāṃ śate dve triśadekakāgre
ṣaṭ khāyutānyarkayugaṃ vadanti [| 7 [|

Translation : A nychthemeron is said to consist of 30 *muhūrtas ;* experts on time say that it begins with sunrise. They say that a *yuga* of the Sun consists of 61,230 *(tithis).*

Remarks :

The second sentence of this translation, though mathematically correct, is not the correct translation of the second half of the text. The number 61330 and its designation as *"tithis"* both are wrong. The word *"triśat"* means 300, not 30 ; and it is difficult to interpret *"ekakāgre ṣaṭ khāyutani"* as meaning 61000. Also, the word *"teṣāṃ"* refers to nychthemera or civil days, not to *tithis.*

The second half of the verse really gives the number of civil days in a *yuga,* not the number of *tithis* in a *yuga* as supposed by Pingree. The error is due to the faulty editing of the text. The adoption of the incorrect readings *"triśadekakāgre"* and *"ṣaṭ khā©"* in place of the correct readings *"trikṛdaṣṭakāgre"* and *"ṣaṭkhā°"* respectively has marred the text. It is noteworthy that the correct readings are given in the apparatus.

The correct reading of the text is :

त्रिंशन्मुहूर्तं दिनरात्रमुक्तं
सूर्योदयात् कालबुधास्तदाहुः ।
तेषां शते द्वे त्रिकृदष्टकाग्रे
षट्कायुतान्यर्कयुगं वदन्ति ॥७॥

Triṁśanmuhūrtaṃ dinarātramuktaṃ
sūryodayāt kālabudhāstadāhuḥ
Teṣāṃ śate dve trikṛdaṣṭakāgre
ṣaṭkāyutānyarkayugaṃ vadanti [| 7 [|

meaning : "A nychthemeron (civil day) is said to consist of 30 *muhūrtas ;* experts on time say that it begins with sunrise. They say that a *yuga* of the Sun consists of 60000 plus 200 plus $3^2 \times 8$ (*i.e.* 60,272) of them (*i.e.* civil days)."

That is,

one *yuga* = 60272 civil days.

The word *"trikṛt"* means 3^2 *i.e.* 9, and the word *"trikṛdaṣṭaka"* $3^2 \times 8$ *i.e.* 72.

Further remarks on vss. 6 and 7 :

Pingree is aware of the fact that the second half of vs. 6 should contain the number of *tithis* in a *yuga* and the second half of vs. 7 the number of civil days in a *yuga,* but his text has landed him in trouble and he remarks : "A more logical order might be achieved by interchanging 6c-d with 7c-d." He also complains about Sphujidhvaja Yavaneśvara's way of expressing numbers in verse : "The extreme clumsiness with which Sphujidhvaja expresses numbers is a reflection of the fact that a satisfactory and consistent method of versifying them had not yet been devised in the late third century." But these remarks are uncalled for, as it is all due to the faulty edited text.

4. CIVIL DAYS IN A SOLAR YEAR

Verse 34 gives the number of civil days in a solar year. Pingree's text and translation run thus :

Text : सपंचषष्टिं त्रिशतं दिनानां
द्युनं द्विभिन्नं तु दिनांशकानाम् ।
त्र्यूनं शतार्धं दिनकृत्समा स्याद्
यया भवर्गं सविता भुनक्ति ॥३४॥

Sapañcaṣaṣṭiṃ triśataṃ dinānāṃ
dyūnaṃ dvibhinnaṃ tu dināṃśakānām |
Tryūnaṃ śatārdhaṃ dinakṛtsamā syād
yayā bhavargaṃ savitā bhunakti || 34 ||

Translation : A year of the Sun consists of 365 days and 14 ; 47 sixtieths *(aṃśas)* of a day, in which the Sun traverses the signs.

Remarks :

This translation is incorrect, because "14;47 sixtieths" does not yield the value of the solar year according to Sphujidhvaja. For, according to this translation

one sōlar year = 6,5;14,47 days,

whereas according to Sphujidhvaja

one solar year = 6,5;17,5,27,16 days.

The error is due to the adoption of the incorrect reading *"dyūnaṃ dvibhinnaṃ"* in place of the correct reading *"yugādvibhinnaṃ"* given in the apparatus.

The correct reading of the text is :

सपंचषष्टिं त्रिशतं दिनानां
युगाद्विभिन्नं तु दिनांशकानाम् ।

त्र्यूनं शतार्धं दिनकृत्समा स्याद्
यया भवर्गं सविता भुनक्ति ॥३४॥

Sapañcaṣaṣṭiṃ triśataṃ dinānāṃ
yugādvibhinnaṃ tu dināṃśakānāṃ |
Tryūnaṃ śatārdhaṃ dinakṛtsamā syād
yayā bhavargaṃ savitā bhunakti || 34 ||

meaning : "A *yuga* of the Sun consists of 365 days and a fraction of a day equal to fifty minus three divided by (the number of years in) a *yuga*, in which the Sun traverses the signs."

That is,

$$\text{one solar year} = 365 + \frac{50-3}{165} \text{ civil days}$$
$$= \frac{60272}{165} \text{ civil days,}$$

This result confirms the statement of vs. 7 that there are 60,272 days in a *yuga* (consisting of 165 years).

5. CIVIL DAYS IN A SOLAR MONTH

Verse 11 defines a civil month and gives the number of civil days *etc.* in a solar month. Pingree's text and translation run thus :

Text : त्रिंशद्दिनाः सावनमास आर्क-
स्त्र्यग्रैर्विशिष्टा दशभिर्मुहूर्तैः ।
कलाचतुष्केण च पंचषट्कै-
स्त्र्यग्र्यांशकैश्च द्विगुणैश्चतुर्भिः ॥११॥

Triṃśaddināḥ sāvanamāsa ārka-
stryagrairviśiṣṭā daśabhirmuhūrtaiḥ |
Kalācatuṣkeṇa ca pañcaṣaṭkai-
stryagryāṃśakaiśca dviguṇaiścaturbhiḥ || 11 ||

Translation : A civil month equals 30 days, a solar month equals (a civil month) plus 13 *muhūrtas* and 4 *kalās* and 56 thirds and 2 fourths.

Remarks :

Here the text is correct[1] but the translation incorrect. For, "*pañcaṣaṭka*" means

[1] Read °*rviśiṣṭo* in place of °*rviśiṣṭā*.

5×6 *i.e.* 30, not 56 ; also *"tryagryāmśaka"* does not mean third, nor *"catur"* fourth. Moreover, according to this translation,

one solar month = 30;26,9,52,4 days

whereas, according to Sphujidhvaja,

one solar month = 30;26,25,27,16 days.

The correct translation is :

"A civil month equals 30 days, a solar month is greater (than that) by 10+3 *muhūrtas*, 4 *kalās* and $\frac{2\times4}{5\times6+3}$ of a *kalā*."

Thus

$$\text{one solar month} = 30 \text{ days} + 13 \textit{ muhūrtas} + 4\frac{8}{33}$$

$$= \frac{60272}{1980} \text{ civil days,}$$

because 20 *kalās* = 1 *muhūrta* and 30 *muhūrtas* = 1 civil day.

This result also confirms the statement of vs. 7 that there are 60272 civil days in a *yuga.*

6. CIVIL DAYS IN A SYNODIC MONTH

Verse 12 gives the number of civil days *etc.* in a synodic month. Pingree's text and translation run thus : :

Text : अहनस्तु षट्पंचकमेकहीनं
क्षणाष्टकौ द्वौ द्विकलाविहीनौ ।
कलालवाः सप्त शतं विदिष्टः
समासभिन्नः शशिनः स मासः ॥१२॥

Ahnastuṣaṭpañcakamekahīnam
kṣaṇāṣṭakau dvau dvikalāvihīnau |
Kalālavāḥ sapta śataṃ vidiṣṭaḥ
samāsabhinnaḥ śaśinaḥ sa māsaḥ || 12 ||

Translation : A (synodic) month of the Moon, which ends with a conjunction, consists of 29 days and 32 *kṣaṇas* minus 4 *kalās* and 107 sixtieths of a *kalā.*

Remarks :

This translation is based on misinterpretation of the text and does not accord to the teaching of Sphujidhvaja. For, according to this translation,

one synodic month = 30;3,55,34 days,

whereas according to Sphujidhvaja,

one synodic month = 29;31,50,14,24 days.

The error is really due to the adoption of the incorrect readings *"ahnastu" "śataṃ vidiṣṭaḥ"* and *"samāsabhinnaḥ"* in place of the correct readings *"ahnāṃ tu", "śatī dviṣaṣṭā"* and *"svamāsabhinnā"* respectively which are given in the apparatus.

Thus the correct reading of the text is :

अह्नां तु षट्पंचकमेकहीनं
क्षणाष्टकौ द्वौ द्विकलाविहीनौ ।
कलालवाः सप्तशती द्विषष्टा
स्वमासभिन्ना शशिनः स मासः ॥१२॥

Ahnāṃ tu ṣaṭpañcakamekahīnaṃ
kṣaṇāṣṭakau dvau dvikalāvihīnau |
Kalālavāḥ saptaśatī dviṣaṣṭā
svamāsabhinnā śaśinaḥ sa māsaḥ || 12 ||

meaning : "6×5−1 days, 2×8 *kṣaṇas (muhūrtas)* minus 2 *kalās,* and a fraction of a *kalā* equal to 762 divided by (the number of) its own (*i.e.* synodic) months (in a *yuga*) : this is (the length of) the (synodic) month of the Moon."

That is,

one synodic month = 29 days+(16 *muhūrtas* minus 2 *kalās*)+ $\frac{762}{2041}$ *kalā,*

because there are 2041 synodic months in a *yuga,* = $\frac{60272}{2041}$ civil days,

because 20 *kalās* = 1 *muhūrta* and 30 *muhūrtas* = 1 civil day.

This again confirms that there are 60272 civil days in a *yuga.*

7. CIVIL DAYS IN A SIDEREAL MONTH

Verse 13 gives the length of a sidereal month in terms of civil days, *etc.* Pingree's text and translation run thus :

Text : ऋक्षस्तु कृत्तिर्द्विगुणस्तु कृच्च
क्षणाः क्षणार्धं च कलाश्च तिस्रः ।
कलांशकानां च त्रिसप्तकाग्रं
शतं विभक्तो दलितैः समाशैः ॥१३॥

Ārkṣastu Kṛttirdviguṇastu kṛcca
kṣaṇāḥ kṣaṇārdhaṃ ca kalāśca tisraḥ |
Kalāṃśakānāṃ ca trisaptakāgraṃ
śataṃ vibhakto dalitaiḥ samāsaiḥ || 13 ||

Translation : A sidereal month consists of 27 days plus 8½ *kṣaṇas* and 3 *kalās* and 137 sixtieths of a *kalā* : it is separated by half-conjunctions (?).

Remarks :

The first line of the text is corrupt and the translation is arbitrary and wrong. "*Trisaptaka*" does not mean 37 ; it means 3×7 or 21. It is difficult to understand how the first line has been interpreted in that way.

According to the above translation,

one sidereal month = 27;17,10,34 days

whereas according to Sphujidhvaja,

one sidereal month = 27;19,18,39 days.

The correct text is :

आर्क्षस्त्रिकृत्त्रिर्द्युगणस्त्रिकृच्च
क्षणाः क्षणार्धं च कलाश्च तिस्रः ।
कलांशकानां च त्रिसप्तकाग्रं
शतं विभक्तं दलितैः स्वमासैः ॥१३॥

Ārkṣastrikṛttrirdyuganastrikṛcca
kṣaṇāḥ kṣaṇārdham ca kalāśca tisraḥ |
Kalāmśakānām ca trisaptakāgram
śatam vibhaktam dalitaiḥ svamāsaiḥ || 13 ||

meaning : "A sidereal month consists of $3^2 \times 3$ days, 3^2 *kṣaṇas (muhūrtas)* plus half a *kṣaṇa*, 3 *kalās* plus a fraction of a *kalā* equal to 121 divided by half (the number) of its own (*i.e.* sidereal) months (in a *yuga*)."

That is,

one sidereal month = 27 days + 9½ *muhūrtas* + $3\frac{121}{1103}$ *kalās*.

because there are 2206 sidereal months (or Moon's revolutions) in a *yuga*,

$$= \frac{60272}{2206} \text{ civil days,}$$

because 20 *kalās* = 1 *muhūrta* and 30 *muhūrtas* = 1 civil day.

This is true because there are 60272 civil days and 2206 sidereal months in a *yuga*.

8. INTERCALARY DAYS IN A SOLAR YEAR

Verse 19(a-c) gives the number of intercalary days in a solar year and the number of intercalary months in a given number of solar years. Pingree's text and translation run thus :

Text : एकादशैकाद[श] भागयुक्त्या
युगादगताब्दान् विहतान् विभज्य ।
षट्पंचकेनाधिकमासकास्ते
... ... ॥१९॥

Ekādaśaikāda [śa] bhāgayuktyā
yugādgatābdān vihatān vibhajya |
Saṭpañcakenādhikamāsakāste
|| 19 ||

Translation : The number of years which have passed of the *yuga* is to be multiplied by 11;11 and divided by 30 : (the result is the number of (lapsed) intercalary months.

Remarks :

The text is correct with one exception that there should be *"yutya"* in place of *"yuktyā"* in the first line. But the translation is erroneous because the number 11;11 (denoting $11\frac{11}{60}$) is wrong. There are $11\frac{1}{11}$ intercalary days in a solar year, not $11\frac{11}{60}$. The correct translation is :

"The number of years which have passed of the *yuga*, multiplied by $11\frac{1}{11}$ and divided by 30 gives the number of intercalary months (in that period)."

This is true because there being 1980 solar months and 2041 synodic months in a *yuga*, there are 61 intercalary months in a *yuga*. Likewise there are $\frac{61\times30}{165}$ or $11\frac{1}{11}$ intercalary days in a year.

9. OMITTED TITHIS IN A YUGA

Verse 5 gives length of a *tithi* in terms of civil days, the length of a civil day in terms of *tithis*, and the number of omitted *tithis* in a *yuga*. Pingree's text and translation run thus :

Text : दिनं चतुः षष्टिलवोनमाहु-
स्तिथिं प्रपञ्चयन्त्यमहस्तु सर्वम् ।
द्विषष्टिभागं नवतिः सहस्रं
युगे त्वतुनामपशुद्धशतम् ॥५॥

Dinaṃ catuḥṣaṣṭilavonamāhu-
stithiṃ praṣaṣṭyantyamahastu sarvaṃ |
Dviṣaṣṭibhāgaṃ navatiḥ sahasraṃ
yuge tvṛtūnāmapaśuddhaśataṃ || 5 ||

Translation : They say that a *tithi* equals a day minus $\frac{1}{64}$ th, but that every day equals a *tithi* plus $\frac{1}{60}$ th. In a *yuga* there are 990 seasons *(ṛtu)*, (each) consisting of 62 *(tithis)*.

Remarks :

(1) This translation is incorrect, because

(i) if one *tithi* consists of $1-\frac{1}{64}$ civil day, a civil day cannot be equal to $1+\frac{1}{60}$ *tithis* ; and

(ii) if there are 990 seasons in a *yuga* and 62 *tithis* in a season, there must be 990×62 or 61380 *tithis* in a *yuga*, but according to vs. 6 there are only 61230 *tithis* in a *yuga*.

(2) The text given by Pingree is faulty, because he has adopted the incorrect reading *"dviṣaṣṭibhāgaṃ navatiḥ"* in place of the correct reading *"triṣaṣṭibhāgena yutam"* and the incorrect reading *"tvṛtūnāmapaśuddhaśatam"* in place of the correct reading *"vamānāmapasaptaṣaṭkam"*. Partially correct readings occur in the apparatus.

(3) The correct reading of the text is :

दिनं चतुः षष्टिलवोनमाहु-
स्तिथिं प्रषष्ट्यन्त्यमहस्तु सर्वम् ।
त्रिषष्टिभागेन युतं सहस्रं
युगेऽवमानामपसप्तषट्कम् ॥५॥

Dinaṃ catuḥṣaṣṭilavonamāhu-
stithiṃ praṣaṣṭyantyamahastu sarvaṃ |
Triṣaṣṭibhāgena yutaṃ sahasraṃ
yuge'vamānāmapasaptaṣaṭkam || 5 ||

meaning : "They say that a tithi is equal to a day minus $\frac{1}{64}$ of a day, correct upto the sixtieth of a sixtieth (of a day, *i.e.* up to *vighaṭīs*), and a day equals a whole *tithi* plus $\frac{1}{63}$ of a *tithi*. The number of omitted *tithis* in a *yuga* is equal to 1000 minus 42 (*i.e.* 958)."

This can be easily proved to be true. For, in a *yuga*

(i) no. of *tithis* = 61230, and
no. of civil days = 60272.

Therefore, one *tithi* $= \frac{60272}{61230} = 1 - \frac{1}{64}$ civil day,
and one civil day $= \frac{61230}{60272} = 1 + \frac{1}{63}$ tithis.
Both the results are correct upto *vighaṭīs*.

(ii) no. of omitted *tithis* = *tithis*−civil days = 61230−60272 = 958.

10. CONCLUSION

From the above discussion, we conclude that the *yuga* defined in the *Yavanajātaka* contains :

Solar years = 165
Solar months = 165×12 = 1980
Solar days = 165×360 = 59400
Civil days = 60272
Synodic months = 2041
Intercalary months = synodic months− solar months
= 2041−1980 = 61 (vide vs. 10)
Synodic days or tithis = 2041×30 = 61230
Omitted tithis = tithis − civil days
= 61230−60272 = 958
Sidereal months (or Moon's revolutions)
= synodic months−Sun's revolutions
= 2041−165 = 2206
Risings of asterisms (or Earth's rotations)
= civil days+Sun's revolutions
= 60272+165 = 60437
Risings of the Sun = Risings of asterisms−Sun's revolutions (vide vs. 8)
= 60437−165 = 60272
Risings of the Moon = Risings of asterisms−Moon's revolutions
= 60437−2206 = 58231 (vide vs. 8)
Solar year = 6,5;17,5,27,16 days
Sun's mean daily motion = 0;59,7,55,28 degrees
Synodic month = 29;31,50,14,24 days
Sidereal month = 27;19,18,39 days

According to Sūrya-siddhānta :

Solar year = 6,5;15,31,3 days
Sun's mean daily motion = 0;59,8,10,10 degrees
Synodic month = 29;31,50 days
Sidereal month = 27;19,18 days.