VĪṆĀ KEYBOARDS - ORIGIN

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Many stringed, wind, percussive and solid musical instruments were used in ancient India and are mentioned in the Vedas. Among them, the stringed instruments were generically named *Viṇā*. They have always played an important role in defining and shaping the melodic content of Indian music. A vital aspect of this is the fixation, standardisation, rationalisation, comparison and normalisation of the musical intervals of the system. This is accomplished in terms of string lengths. Conceptualisation, Quantification and Measurement of the system are the very essence to scientific temper. This paper presents, in a historical perspective, the problems involved in this task and the solutions found for them in India.

Key words: *Āghāṭī viṇā, Deśi kinnarī, Ekarāgamela, kinnarī viṇā, Musical instruments, Sarvarāgamela, Viṇā*

VĪṆĀ

Numerous references to musical instruments are found in India for the first time in Vedic literature. These include all four classes viz. chordophones, aerophones, percussives and idiophones. Some ten chordophones comprising both monochords and polychords are widely mentioned in the Vedas and their ancillary texts. They were used with the voices and other instruments in Vedic sacrificial rituals such as the *soma yajña*. They were named, by and large, after the shape of the heads or bodies of various animals, and some after the number of playing strings. Thus, for example, the *bāṇa* or *vāṇa* was a harp of the hundred strings; some were plucked, some were strummed, some played with bow. One text, the *Aitareya Āraṇyaka* describes a chordophone on the analogy of human anatomy (3.2.5). Vedic texts refer to every chordophone by the generic name *viṇā*.

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The *Āghāti vīṇā* is mentioned in *Ṛgveda* (9.147.2) and *Taittirīya Brāhmaṇa* (2.5.523). *Vāṇa* (= *bāṇa*), the most prominent *vīṇā* is mentioned in *Ṛgveda* (1.85.10; (7.97.8; 9.51.1; 10.32.4 etc.), *Taittirīya Saṃhitā* (7.5.1; 7.8.9), *Tāṇḍya Brāhmaṇa* (5.6-12; 6.13,14), *Aitareya Āraṇyaka* (5.1.4), *Jaiminīya Brāhmaṇa* (2.4.15), *Baudhāyana Śrautasūtra* (16.21), *Āpastamba Śrautasūtra* (21.17.1; 21.17,18). The *Śāṅkhāyana Śrautasūtra* refers to the *picchora* (-la), *śatatantrī* and *tāṇḍya vīnās* (17.3.1-17). The *Lāṭyāyana Śrautasūtra* mentions the chrodophones *alābu, vakrā kapiśṛṣṭi, mahāvīṇā* and *apāghāṭalikā* (4.2.1-8); *Kātyāyana Śrautasūtra* mentions *vāṇa, godhā* and *kāṇḍa vīṇā* (13.3.15-19); *Āpastamba Śrautasūtra* makes reference to *vīṇās apāghāṭalikā, stambala* and *picchola* (27.17.16; 21.19.3); *Vārāha Śrautasūtra* refers to the chordophones called *śatatantu* and *kāṇḍa vīṇā*; *Baudhāyana Śrautasūtra* mentions *āghāṭī, picchola* and *karkaṭikā, Satyāsāḍha-hiraṇya Śrautasūtra* mentions *apāghāṭalikā, tāluka, kāṇḍa, picchola, alābu* and *kapiśṛṣṭi vīṇās* (Fig. 1).

Some passages in Vedic literature are suggestive of chordophonic keyboard (e.g. *Ṛgveda* 10.32.4) but there is no explicit reference to a keyboard instrument. It is probable that such instruments existed when Bharata wrote the *Nāṭyaśāstram*,(c.2nd
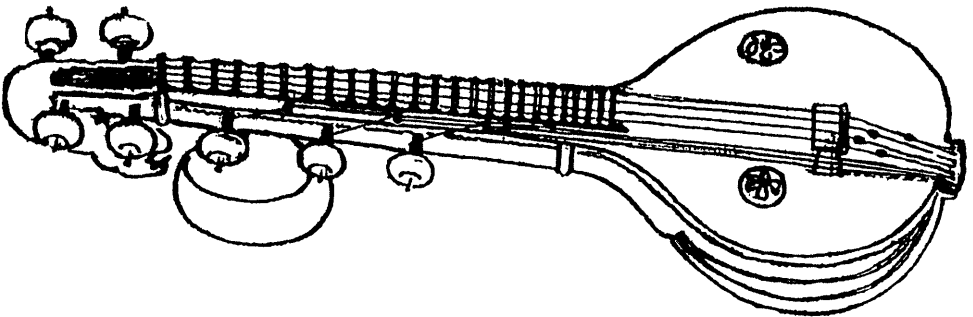

Fig. 1.   *Vīṇā*

cent. AD), which mentions polychords but no keyboards. The earliest reference to a *viṇādaṇḍa* with frets is found in *Haripāla* (3.79-94ab,11th cent. A D) who states that the neck of the *kinnarī-vīṇā,* called *sāraṅga- vīṇā* in vernacular (3.79cd) had a neck forty *aṅgulas* long on the upper side of which are set fourteen frets, called *bhittis,* the first of these, next to the meru (nut) is two *aṅgulas* across the neck; the fourteenth is one inch in length. Those in between are progressively shorter. They are fixed with beeswax mixed with charred cloth. They are progressively of steel tubes shaped like the claws of an eagle. They are placed in accordance with the sizes of the respective notes.

KINNARĪ-VĪNĀ

Someśvara III (c. 1131 AD) describes the *kinnarī* in similar terms (4.166.666-687ab:93-94) as possessed of fourteen frets, shaped like the back of tortoise, made from the breast bone of an eagle, tapering from two *aṅgulas* to one *aṅgula.* They are fixed at the respective positions of *svaras* to exact measure, on the neck with beeswax. The key (fret) is called *nalika* (tube).

Śārṅgdeva (c. 1230 A.D.), as usual, gives detail and quantitative description of the keyboards of the *kinnarī.* He describes the *ekatantrī-vīṇā* (6.29-64: 233-238) as an exemplar for all monochords (6.53; 237); but this was not a fretted instrument; it was played with a *kamrā,* as the modern *gottuvādya* or *vicitravīṇā.* He includes keys (*sārikā*) as a part of the *vīṇā* (6.56d; 237) here because the instrument is taken as model (*prakṛti*) and, therefore, should include theoretically (and nucleally) whatever is contained in its *vikṛtis.* His *ālāpinī* (6.241-257ab; 282-284) includes 'sārikas' also (6.247d: 282) but it is not clear what part they played in the keyboard.

The *kinnarī* is the prototype of the Indian monochord keyboard (Fig.2). Śārṅgdeva delineates its classical and folk forms. The former had two varieties: small (*laghvī*) and large (*bṛhati*). The *laghvī kinnarī* consisted of a neck of red sandal or *Acacia catechu,* smooth, round, forty-one *aṅgulas* long, five *aṅgulas* in cirumference. A bridge of *saka* (teak, *Tectona grandis,* or *Capparis trifoliata*), five *aṅgulas* long and two and half *aṅgulas* wide was placed on it. Its string was of steel, thick as the hair of an elephant. This *vīṇā* had fourteen frets called *sārīkā,* which were tubular (*nalika*) made of the breast bone of an eagle, steel or bronze and were as long as the little finger (of the performer). They were fixed to the neck with the soot of charred (cotton) cloth, at positions appropriate to the fourteen *svarās* (seven each in two registers). The first key was placed below the *nisada* of the second register, a
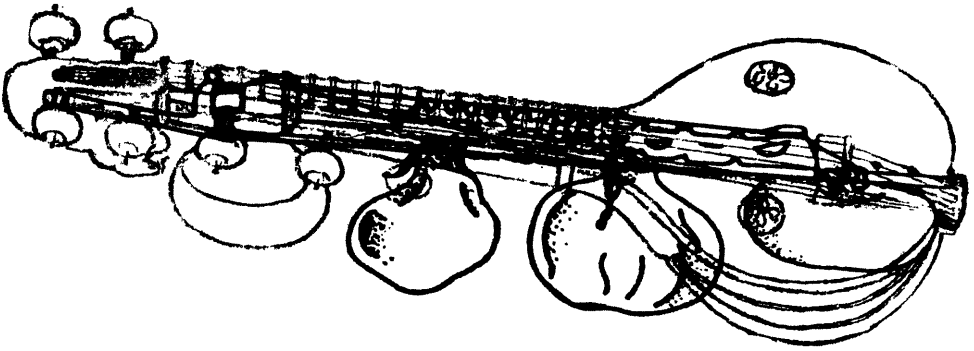
Fig. 2. *Kinnarī Vīṇā*

little longer than one *aṅgula*. The eighth was fixed at a distance of three *aṅgulas* from the seventh. The intervening six were placed four *aṅgulas* apart from each other, each slightly longer than its predecessor. The two registers were rekoned from the *sthayi* (*meru*? *sthāyi* or *aṃśa* note of the *rāga* performed). The string was plucked with the right three fingers beginning with the forefinger; *svarās* were expressed by pressing the string between the appropriate frets with (one or more of) the forefinger, mid finger and ring finger of the left hand (6.258-276: 285-287). The *bṛhati kinnarī* differed from the *laghvī* only in that it was larger (i.e. fifty-three *aṅgulas* long and six inches in circumference), and carried three gourds (*tumba*) instead of two (6.277-278: 287-288).

Śāraṅgdeva describes three varieties of *deśi-kinnarī bṛhatī* (large), *madhyamā* (mddle) and *laghvī* (small), which differed from each other only in length (50, 43 and 35 *aṅgulas* respectively) and quantifies their keyboards exactly (6.321-325: 294-295; *madhyamā*: 6.307-317ab: 312-317; 293-294; *laghvī*: 6.321-325: 2940295). Table 1. gives the distance of each of the fourteen frets from its predecessor in *yavas* for the three *kinnarī*s; (for the first fret, distance is from *meḍhaka* i.e. *meru* or nut); *yava* means one sixth of *aṅgula* (63280ab: 288).

Table 1. Distribution of keys in the *kinnarī* according to Śāraṅgdeva

Fret	Svara	Bṛhati	Madhyamā	Laghvī
1	ra	31	27	25
2	ga	24	19	14
3	ma	23	20	11
4	pa	23	18	16.5
5	dha	19	16	11.5
6	na	11	10	8.5
7	sa	13	16	11
8	ra	15	14	9
9	ga	8.5	11	8
10	ma	12	11	11
11	pa	11	7.5	7.5
12	dha	7	7.5	5
13	na	8	7.5	5
14	sa	6	ù	ù

The following remarks of Śāraṅgdeva are worthy of note:

i.   The *kinnarī* should not be longer than fifty and shorter than thirty *aṅgulas*, if it is, its *rakti* (aesthetic appeal) and *mādhurya* are lost (6.326cb-327ad: 295).

ii.   The *kinnarī* has, altogether fifteen notes: fourteen in two registers (*mandra* and *madhya*) and one extra for *tāra* (6.304d: 292). Siṃhabhūpāla interprets this to mean 16 notes: note on the open string, notes due to fourteen frets and one note of the *tāra* register (on SR.Loc. cit.: 292): '*vimuktayā tantrayā jātam prathamam svaram ca kṛtvā sārṇām caturdaśabhir antaraiḥ madhyapradeśair antye caturdaśa svarāḥ syuḥ/ evam pañcadaśabhiḥ svaraiḥ mandrasaptakam, madhyasaptakam syāt/ tārasaptakasya ekasvaro 'dhiko bhavati*'

iii.   According to a different schools of thought, there are only thirteen, not fourteen frets (6.306cd: 292).

iv.   Exact quatification of the *svarasthānas* in the *madhyamā* and *laghvī - kinnarī* was left to the *vīṇā* player himself; he has to achieve exact intonation by placing the key at the precise required position (within a small latitude), which was a measure of his skill and taste (6.327cd - 328ab: 295-296).

Concluding Remarks

Some important conclusions may be drawn from the foregoing account:

1. The *kinnarī* was the forerunner of *ekarāgamela- vīṇā*.

2. All notes were obtained on the same single string. This is the reason offered by Venkatamakhin (VM) to prefer *madhyamela vīṇā* to *śuddamela-vīṇā* to demonstrate the twenty-two *śrutis* in the octave (3.18-27).

3. The number of notes employed i.e. range was elastic. This situation prevailed even in the 17th century AD in which VM flourished (1.118 -129, 150 -152).

4. The gamut was originally regarded as a heptad (*saptaka*); that is, the scale was open. In course of time, it was regarded as an octave i.e. a closed scale, encompassed by the tonic and its octave. This ambiguity is indicated by the optional provision of key for the tonic in the *tāra* register. Somanātha mentions this from modern contemporary musical practice of his times (2.37-41: 69- 72). VM also confirms the inclustion of *tāra ṣaḍja* in the performance of *caturdaṇḍī* music by both *sāraṇi* and *pakkasāraṇī* methods (1.125, 149).

5. The number of notes (and hence the keys) employed varied between thirteen and fourteen keys in Śāraṅgdeva's times. This continued in the *ekarāgamela- vīṇā* until 17th century AD and is reflected in the omission of *dha* or *ni* in the *mandra* register of VM (1.126).

6. The tone range of performed music changed from *mandra, madhya* (and *tāra ṣaḍja*) in Śāraṅgdeva to *madhya, tāra* (and *atitāra ṣaḍja*) in Somanātha and VM for the selfsame single, 'playing' string. However, the range extended to *anumandra* register with *Rāmāmātya* (3.22: 15) and to *anumandra* and *atitāra* register with Somanātha (2.18-23: 62-64; 2.37, 69-70). The range was extended later in the 17th century AD even beyond *tāra ṣaḍja* e.g. Somanātha (2.69-50; 75-76) records the use of *sa, ri, ga, ma* and *pa* in the *atitāra* register. VM mentions the use of *sa, ri, ga* etc. of the *tāra* register (1.150-151). These two ranges are analogous and appear different only because the corresponding base notes differ by an octave.

7. Correct or exact intonation in the *kinnarī* was left to the performer's skill and (within small limits) preference. An objective criterion or uniform method does not seem to have been developed at this time for tuning the intervals. These are described in Indian music only in the 16th century AD.

If it may be assumed that the available text of SR on the three *kinnarīs* is correct, some anomalies of their keyboards become evident. These are pointed out below:

1. SR gives only the total lengths of the three instruments but not the total, speaking lengths of their strings without which it is not possible to calculate the intervals of the fourteen *svaras*. The total length of the string of the *mandra sthāna* is given by the sum of the lengths of all the notes in it. The speaking length of the whole string is obtained by doubling this length. The lengths of the strings for the *mandra* register (i.e. *ṣaḍja* to *niṣāda*) are 131 *yavas* (*bṛhati*), 110 *yavas* (*madhyamā*) and 86.5 *yavas* (*laghvī*). The corresponding octave lengths (*ṣaḍja* to next higher *ṣaḍja*) are 144, 126 and 95 *yavas* for the three keyboards. These are approximately in the radios 3:2, 5:2.

2. In any stringed instrument the first octave (*mandra*) is covered by the first half of the total speaking length, and the second higher (*madhya*)octave is covered by the next one quarter of the total speaking length, leaving the final quarter unfretted. Therefore, the *madhya* (middle) octave of the string is half as long as that of the *mandra* octave. Therefore, the length of the *madhya* (middle) octave may be calculated as 72 *yavas* (*bṛhati*), 64 *yavas* (*madhyamā*) and 49 *yavas* (*laghvī*) respectively. Actually, however, these lengths are found to be 74.6, 74.5 and 53 *yavas* respectively, giving a positive, approximate error of 3.5, 17.5 and 8 percent respectively. The first two values are almost identical, but the distributing of the keys is quite different and is quite disproportional to the respective total speaking lengths.

3. The notes on any keyboard are progressively higher in pitch, so, their speaking lengths should be correspondingly smaller. In other words, the distances between the keys should generally become smaller. This is not so Table 1; e.g. nos. (3) and (4) are identical, nos. (5), (12) and (13) in the *bṛhati*, nos. (3) and (7) in the *madhyamā* and nos. (4) and (7) in the *laghvī* are larger than their immediate predecessors. The lengths between the keys in Table 1 may be compared with those in modern South Indian *Vīṇā* for the *mandra* and *madhya* registers. (VM notation of *svaras* is used; lengths are in inches, *sa* 36, *ra* 34, *ga* 32, *gi* 30.32, *gu* 28.63 and *ma* 27, *mi* 25.5, *pa* 24, *dha* 22.5, *na* 21.3, *ni* 20, *nu* 19.2). These may be further compared with the corresponding string lengths in the keyboards derived by Rāmāmātya and Hṛdayanārāyaṇa.

4. The speaking lengths of *svaras* in the *madhya sthāna* are exactly half of the corresponding ones in the *mandra sthāna*. This is nowhere found in the Table 1.

5. The frequency ratios of the *mandra svaras* calculated from their length/s (in *yavas*) in relation to the total speaking length are totally inconsistent with those of the *śuddha svaras*. Indeed, the *śuddha niṣāda* of the *mandra sthāna* of the *bṛhati* is at the position of the next higher note, viz. octave *sa*!

6.   The ratios of the lengths of any given adjacent *svaras* are not the same in all
      the three keyboards. e.g. *ra: ga* is 31/24, 27/19 and 25/14 in the long, middle
      and short keyboards of the *kinnarī* respectively. This is true of even the
      pivotal notes of the scale viz. *ma, pa* and *sa*. Thus, *śuddha madhyamā*
      marks the midpoint of the octave i.e. has half the length of the octave. But, in
      the Table 1 it is at 78/131 , 66/110 and 50/86.5 . Similarly, *pa* always
      occurs at 2/3 of the octave length. But in the *kinnarī* keyboards it occurs at
      101/131, 84/110 and 66.5/86.5. Again, the *madhya sa* occurs at the exact
      midpoint of the total speaking length, whereas it actually secures at 144, 126
      and 97.5 *yavas* respectively.

7.   The distance between any pair of adjacent keys of the *vīṇā* (free vibrating full
      string of 36 inches) has 5 inches for *ga-ma* and 3 inches for *ma-pa*. But the
      bṛhati keyboard has 23 and 23 *yavas*, the *madhyamā* has 20 and 18 *yavas*
      and the *laghvī* has 11 and 16.5 *yavas* respectively for these intervals. Other
      instances of such anomaly may also be found in their keyboards. Therefore,
      one is led to seriously doubt the correctness of the transmitted text of the SR
      in this part of the work, for this directly opposes or vitiates its theory of the
      sizes of the *svara* and *śruti* intervals.

Śāraṅgdeva does not define the accordatura for the *kinnarī* keyboard.
Nonethless, both accordatura and the intervals had to accommodate *rāgas* born of
ṣaḍjagrāma, madhyamagrāma and of both *grāmas*. That is, they had to
comprehend the consonances, *tānas, mūrchanās* of either or both *grāmas*, as well
as the appropriate tonic. The *kinnarī* was a monochord; so all the apparatus of one
or both *grāmas* had to be accommodated on the selfsame single string such that it
could be readily and rapidly changed when a succession of simple or complex *rāgas*
had to be performed on it. The *kinnarī* was equipped well to handle the task because
of (1) movable frets so that the *svarasthānas* of any desired *rāga* could be obtained
at will, (2) devices *śudh* as *sādhāraṇa,* (3) flexible accordatura so that the tonic or
keynote could be readily and rapidly changed and, therefore, the *grāma,* (4) Dattila's
(2nd to 5th cent. AD) formula (26-28:3) for interconversion of the two *grāmas,* and
(5) *mūrchanā* system enabled ready and rapid key transpositions.

Further, *Śāraṅgdeva* has described a generalised and uniform mode of playing
deśī rāgas (*rāgāṅga, upāṅga, bhāṣāṅga* and *kriyāṅga*) on the *kinnarī* (6.328-
399ab: 296-313) in terms of *sthāyī* and *svasthāna-catuṣṭaya*, which obviated
specified *graha, aṃśa, nyāsa* etc.a method which could be extended to all other
instruments such as the flute by extrpolating graha etc. notes suitably (6.399cd-401:
314). His arguments in counselling the discrepancy between prescription and practice

in respect of *sthāyi/graha svara* of *baṅgāla rāga* (6.333cd-343ab: 297-301) are both brilliant and illuminating.

The *kinnarī*, was therefore, the archetype of prototype of the four major keyboards; *eka-rāga*, *śuddha-mela* etc. of the 15th - 17th century AD and evolved into their accordaturae and tuning; with the discovery of the objective, acoustical phenomena such as the *svayambhū* notes (upper partials), the strings and their accordaturae proliferated and essential features of the *madhyamagrāma* were realigned into *ṣaḍjagrāma*. This was of foundational importance in the transition of the *grāma* to *mela*.

The *sarvarāga-mela* had not yet evolved in 1369 AD for, the poet Bhima (c. 1400 AD) who wrote the *Basavapurāṇam* in Kannada in the selfsame Karnataka (as Śāraṅgdeva, Kallinātha and Rāmāmātya) mentions that the keyboard of the *vīṇā* was separately set to perform each of the *battīsa-rāga* (11.6:257). Kallinātha offers in c.1440 AD no indications or implications of the *śuddhamela*, *madhyamela* or their varieties. But, these were well known enough to be included in experimentation and innovation by 1550 AD when Rāmāmātya describes them and innovates with *Acyutarājendramela-vīṇā* (3.12-78; 15-20). Therefore, the *śuddhamela*, *madhyamela* keyboards as well as their varieties *ekarāga* and *sarvarāga* must have emerged between, say 1450-1500 AD.

GLOSSARY

aṅgula: the Indian inch; 0.75 of the British inch.

aṃśa: the most important, frequent and characterising note of a *rāga*.

antitāra: register above the tāra.

anumandra: register below the *mandra*

caturdaṇḍī: the fourfold totality of the meiodic system of Karnataka music namely,
       ālāpa, *thāya*, *gita* and *prabandha*.

grāma: codified epitomy into a scale of the melodic system of ancient Indian music.

ṭāna: extension of a note into a melodic phrase.

tāra: the high register.

deśi rāga: a *rāga* of folk or exotic origin.

nisāda: seventh degree of the scale.

pakkasāraṇi: method of executing a musical note on a second, alternative string.

madhya: middle register.

madhyama: fourth degree of the scale.

madhyama grāma: *grāma* of ancient Indian music based on *madhyama*.

mandra: low register.

mūrchanā: a scale of seven notes taken in regular ascent and regular descent.

rāga: a melodic structure of Indian music, a mode.

śuddhasvara: unmodified note.

ṣaḍja: the first degree of a scale, the tonic, the fundamental note.

ṣaḍja grāma: a *grāma* of ancient Indian music based on *ṣaḍja*.

sādhāraṇā: postion of a note common to two adjacent notes.

sāraṇi: executing a note on a string.

sthāna: position of a note; register.

sthāyī: register/a note, using which as a base, several musical figures may be executed below and above it.

śvara: musical note.

ra-*śuddha ṛsabha*, **ga**-*śuddha gāndhāra*, **ma**-*śuddha madhyama*, **dha**-*śuddha dhaivaṭa*, **na**-*śuddha niṣāda*, (Venkatamakhi notation).

Notes and References

1. Documentation : Colon (:) is preceded by text division, subdivision etc. which locates the reference. It is followed by page number.

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