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INDO-ARYAN AND SLAVIC LINGUISTIC AND GENETIC AFFINITIES PREDATE THE ORIGIN OF CEREAL FARMING

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Abstract

Linguistic comparisons between Indo-Aryan languages, Vedic Sanskrit in particular, and Slavic languages show evidence of remarkable similarities in words of elemental nature and those describing the process of domestication of animals specially the terminology regarding the sheep and the cattle. Similarly, Haplogroup (Hg) R1a1 (HG3 in Rosser's nomenclature), the male lineage Y-Chromosome genetic marker found at high frequencies both in the Slavic and the Indo-Aryan male populations points to a common genetic origin of a large percentage of speakers of Slavic and Indic languages. Judging from the linguistic evidence, the separation of these Indo-European branches appears to predate the advent of cereal domestication. Applying Alinei's 'Lexical Self-Dating' (LSD) methodology to date the linguistic and the genetic evidence, we estimate that the split between Indo-Aryans and the ancestors of Slavs occurred, after the domestication of the sheep and cattle, about 10,000 years ago, but before cereal farming became a common industry amongst the ancestors of Slavs in Europe and Indo-Aryans on the Indian sub-continent. Moreover, the genetic evidence does not indicate that there were any major migrations of people from Europe, including the ancestors of the present day Slavs, to the Indian sub-continent during the last 8,000 years. The migration appears to have come from the Indian sub-continent to Europe. However, there is a record of many military incursions over the millennia into the sub-continent.

Furthermore, based on the linguistic, genetic, zooarchaeological and population growth evidence, the coalescence of R1a1 in an ancestor common to many Indo-Aryans and Slavs, probably occurred during the hunting-gathering era and there is evidence that the close contact between the ancestors of Indo-Aryans and Slavs continued during the sheep and cattle domestication, up to and including the nomadic pastoral age. Based on this evidence, the major population expansion from the Indian sub-continent into Europe appears to have come, before the age of cereal farming.

Also the patrilineal Y-Chromosome genetic marker Hg R1a1, that accompanied this expansion, appears to be more than 100,000 years old, based on its relative high frequency, diversity and wide distribution extending from the Balkans to the Bay of Bengal. This estimated age, based on the reproductive rates of historical individuals, is considerably older than the molecular ages calculated on the basis of mutation rates as reported in the literature.

Introduction

The earliest evidence of Paleolithic human presence in the Indo-Pakistani sub-continent consists of stone implements found in the Soan River Valley in northern Pakistan. These tools appear to indicate the presence of hominids in the sub-continent as early as 200,000-400,000 years ago (Qamar et al. 2002). However, according to C. Renfrew, when W. Jones first spoke of the early literature of India he had absolutely no idea of the antiquity of Indian civilization. For many years, the material record did not go back much before the time of King Ashoka in the 3rd century BC, and the brief accounts of north India left by the commentators upon Alexander the Great travels and conquests in the previous century. It was in 1921 that the great discovery of the Indus Valley civilization was made, with the investigation of two of its great cities at Mohenjodaro and Harappa. This civilization was already flourishing shortly after 3000 BC. Other archaeological excavations in western Pakistan have found evidence of the cultivation of cereal crops such as barley, einkorn, emmer and bread wheat preceding 6000 BC (Renfrew 1987: 183, 190).

Based on archaeological evidence, it is generally accepted that the agriculture originated in the Fertile Crescent of the Near East about 12,000 years ago and that new cereal crops, as well as domesticated sheep, goat and probably cattle spread via Anatolia all over Europe. It has also been suggested that the global expansion of farming included also the dispersal of genes and languages (Haak 2005, Renfrew 1987: 266). However, genetic evidence suggests firmly that there were at least two independent domestications of cattle, sheep, pig and water buffalo. In addition to the Fertile Crescent, cattle and sheep were also domesticated on the Indian sub-continent (Loftus 1994, Bradley 2000). In this paper, we will attempt to demonstrate that there is genetic and linguistic evidence that the expansion of herding, from the Indian sub-continent, was also accompanied by the dispersal of genes and languages.

From the Greek historian Herodotus, who was describing notable events occurring during his lifetime and the times before ~2,500 years ago, we learn that the Indians were more numerous than any other nation that he was acquainted with and paid tribute exceeding that of every other people, 360 talents of gold-dust, to the Persian king Darius. From his accounts we also learn, that in his day, the tribes of Indians were numerous and did not all speak the same language; some were nomads others not (Herodotus 1942: 259-264).

It is noteworthy how little have things changed in the last 2,500 years, since Herodotus. Even now, the population of the Indian sub-continent, including Pakistan, Nepal, Bangladesh, Sri Lanka and India proper, is the largest on the planet and totals nearly 1.5 billion humans, representing ~23% of the world's population. This is higher than the population of China or any other nation. Many languages are still spoken in India; Hindi speakers being the largest population

Similarly for the Slavs in Europe: Herodotus writes, »The Thracians are the most powerful people in the world, except, of course, the Indians; and if they had one head, or were agreed among themselves, it is my belief that their match could not be found anywhere, and that they would very far surpass all other nations. But such union is impossible for them, and there are no means for ever bringing it about. Herein, therefore, consists their weakness. The Thracians bear many names in the different regions of their country, but all of them have like usages in every respect, excepting only the Getae, the Trausi and those who dwell above the people of Creston« (Herodotus: 374). Alinei has advanced a hypothesis based on the historical and linguistic evidence that Thracians was the name Herodotus gave to the Slavs owing to the fact that the Thracians were one of the most powerful and representative elites of the Slavic speaking Eastern Europe (Alinei 2003). Modern day relative population numbers appear to reflect those of the ancient world. The population on the Indian sub-continent is still the largest in the world and the Slavic speakers form the most numerous language group in Europe and they occupy more than one half of the landmass of Europe (Rand McNally 1980).

Linguistic comparisons

It is necessary to mention that over the millennia many changes occurred in Indian languages and that these changes resulted in the origin of a number of tongues, for many of which Sanskrit can be regarded as proto-language. The changes of this type (ancestor-descendent) are illustrated below by Sanskrit and Hindi correspondences. It is obvious that through the ages many changes were happening in the Slavic proto-language as well, which resulted in the formation of modern Slavic tongues. The differences of this type (sister-sister) are illustrated below and in the Appendix by the comparison of Russian and Slovenian. The tables in the Appendix also allow the comparison of the two Slavic languages with their more remote cousin Hindi together with their ancestor Sanskrit. We cite here the most striking similarities from elemental and agro-pastoral vocabulary (for more complete lists see Skulj et al. 2006) and semantically structured comparisons of cereal farming terminology. The corpus for farming comparisons was initially extracted from Russian proverbs related to agriculture collected by V. I. Dal' (1994: 563-567) and later completed with semantically and morphologically related words.

C. Renfrew notes that, despite the confusion which surrounds the question of the origins of the Indo-European languages, there remains much value in the comparative method, and the approach is indeed one of the most useful ways to study the relationship between them. If the languages with the related words are geographically far apart, the linguistic palaeontologist can argue that borrowing from one by another is unlikely. Thus the basic principle of linguistic palaeontology is that if the Indo-European can be shown by linguistic analysis to have had the name of a specific thing within their proto-lexicon, then they can be assumed to have been acquainted with the thing itself (Renfrew 1987: 183).

M. Alinei has taken this concept, in an innovative way, a step further, naming it 'lexical self-dating' and has shown that it can be applied to the dating of historical events (Alinei 2004).

It is evident from the linguistic comparisons as shown in the Appendices that, Sanskrit and Slavic languages share many cognates of the pre-pastoral and pastoral terminology, which would indicate a common origin or a common homeland prior to and during the domestication of the livestock such as cattle and sheep. However, this close linguistic affinity does not continue with the domestication of the cereals. At the cereal farming stage of their development, this linguistic similarity ends abruptly.

In the Appendix under Farming, it is very apparent that there is no obvious similarity in the cereal farming terminology between Slavic and Indo-Aryan languages. This lack of resemblances in the terminology describing the cereal farming instruments, methods and products is evident, despite an attempt to select the words that are closest in sound and meaning. Some similarities would be expected, particularly in the names of the plants and cereals used for food, given that wild grasses (wild cereals) were utilized by Levantine foragers as early as 19,500 years ago and have been inferred to have been used by aboriginal Australians perhaps as far back as 30,000 years ago (Fuller 2002). Herodotus writing ~2500 years ago also reports: »There is another set of Indians whose customs are very different. They refuse to put any live animal to death; they sow no corn, and have no dwelling-houses. Vegetables are their only food. There is a plant which grows wild in their country, bearing seed about the size of millet-seed in a calyx: their wont is to gather this seed and having boiled it, calyx and all, to use it for food« (Herodotus 1942: 61).

All of this gives credence to M. Snoj who in his etymological dictionary proposes that Slovenian '**žito**' meaning *grain, cereals* has its origin in '**živež**', '**živilo**' meaning *food, provisions, foodstuff* and ultimately in '**živeti**' (pron. zhiveti) *to live*; this corresponds to '**žiti**' (zhiti) meaning *to live* (Snoj 1997). This is analogous to Sanskrit 'jīv (jīvati)' meaning *to live*; 'jīvātu' meaning *life* (RV) and also *victuals, food* and 'jīvala' meaning *full of life, animating* (AV).

Renfrew cites W. Lehmann, who concluded that on the basis of modern linguistics, the terms for 'herd', 'cow', 'sheep', 'wolf', 'grain' etc. and the lack of specific terms for grains or vegetables indicates a heavy reliance on animals for food. This led to the notions that the Proto-Indo-Europeans were nomads. The Comparative Method has also been applied to the localization of their homeland by focusing on the features of the natural environment such as names of certain animals and trees. This method has also been used to make chronological inferences (Renfrew 1998: 78-82).

Similarly, we are making analogous chronological inferences, based on linguistic and genetic comparisons between Indo-Aryans and Slavs, that the ancestors of Slavs and Indo-Aryans had a common pre-pastoral sojourn involving hunting and gathering, followed by domestication of sheep and cattle and then nomadic pastoral society. The split between them appears to have occurred during their nomadic pastoral stage, before the development of agriculture. Slavs were also known historically by other names such as Sclavenes, Antes and also Venedi, Venethi (Curta 2001: 7); Wenden, Winden, Winedas (Little 1957); Veneti>Windisch, Vandals (Priestly 1997); Sarmati (Ramusio 1604). In addition, the Macedonians and the Veneti both belonged to the numerous family of nations that was usually designated by the collective term *Thracian* (Sotiroff 1971). Furthermore, the cultures of Scythians and Sarmatians are believed to have been Slavic (Šavli 1996: 74), but most linguists consider the languages to have belonged to north-eastern Iranian family.

We know that three-quarters of the population on the Indian subcontinent speak the I-E languages, which are based on Sanskrit. Also in Europe, Slavic languages share many linguistic and grammatical similarities with Sanskrit, particularly Vedic Sanskrit. It is enigmatic that the Slovenian language, bordering on Italy and Austria, still shares more linguistic similarities with the Sanskrit, than with the neighboring languages. In addition, Slovenians also have greater genetic similarity, with respect to R1a1 frequency, to the extant Indo-Aryan speaking populations of India, than to their European neighbors to the west. Furthermore, Slovenian language, due to its archaic character, still preserves many lexical and grammatical forms present in the Sanskrit, but no longer used in the present day Indic languages and most I-E languages. The still active daily usage of the dual in the grammatical forms of the nouns and the verbs is noteworthy. The conjugation of the verb '*to be*' is illustrative of this similarity with Sanskrit (Skulj & Sharda 2001, Narale 2004 p.101).

Table 1. The Present Tense Conjugation and the Imperative of the verb 'to be'

	Sanskrit	Slovenian	Russian	OCS*	Hindi	English
Sing.	asmi	sem	ja jest'	iesm'	maim hum	I am
	asi	si	ty jest'	iesi	tu hai	you are
	asti	je	on jest'	iest'	va hai	he is
Dual	svaḥ	sva	x	jesve	x	x
	sthaḥ	sta	x	jesta	x	x
	staḥ	sta	x	jeste	x	x
Plural	smaḥ	smo	my jest'	jesm	ham haim	we are
	stha	ste	vy jest'	jeste	tum ho	you are
	santi	so	oni jest'	sut'	ve haim	they are

* OCS is a common abbreviation for the Old Church Slavonic (or Slavic)

Transliteration Legend:

Russian transliteration generally follows the guidelines of *The Random House College Dictionary*.

Slovenian pronunciation is similar to Russian: c is pronuciated as TS; č as CH; j as Y; š as SH; ž as ZH.

Sanskrit transliteration of Devanagari follows primarily *A Sanskrit-English Dictionary* compiled by M. Monier-Williams and *Sanskrit for English Speaking People* by A. Ratnakar, where English is used as the base but: ć is pronounced as CH; ś as SH; dot under a letter denotes a cerebral letter.

Hindi transliteration follows the Sanskrit.

In the Appendix: m. means masculine; f. feminine; n. neuter; f.p. feminine plural; v. verb

Table 2. Imperative of Sanskrit verb 'bhū, bhavati' meaning to be, become

	Sanskrit	Slovenian	Russian	OCS	Hindi	English
Sing.	bodhi	bodi	bud'		ho	be
Dual	bhavatām	bodita	x		x	x
Plural	bhavata	bodite	bud'te		hovo	be

Slovenian language shows more similarity with Sanskrit than Russian and Hindi: it kept all the forms and the dual closer to Sanskrit. A very similar picture can be observed in the comparison of noun declensions. The Sanskrit noun 'mātṛi', chosen as a typical example and shown below declined in singular number, has eight forms. In all compared languages, same or similar endings and suffixes are used to construct declension forms but both modern Russian and Hindi lack several forms if compared to Sanskrit. Once again Slovenian language shows more similarity with Sanskrit than Russian and Hindi: it kept more forms and also the dual along with the plural.

Table 3. Declination of the Sanskrit noun 'mātṛi'

	Sanskrit	Slovenian	Russian	Hindi	English
nominative	mātā	mati	mat'	mātā	mother
accusative	mātāram	mater	mat'	mātā ko	mother
instrumental	mātrā	materjo	materju	mātā ne, se	by mother
dative	mātre	materi	materi	mātā ke liye	to mother
ablative	mātur	matere	-	mātā se	from mother
genitive	mātur	matere	materi	mātā ka	of mother, mother's
locative	mātari	materi	materi	mātā meṅ	on mother
vocative	mātar	mati	-	he mātā	mother

Furthermore, in addition to similarities in vocabulary (see Appendix), declensions and conjugations, there are also additional morphological similarities, as reflected in many derived forms.

Table 4. Verbs > nouns (Suffixes -sna, -nje, -n'; -ti, -tje)

Sanskrit Verb	Sanskrit Noun	Slovenian Noun	Russian Noun	Hindi Noun	English Noun
bhī	bhiyas	bojazen	bojazn'	bhay	fear, apprehension
bhū	bhūtī	bitje	bytije	hastī, astitva	being, existence
jīv	jīvana	živenje(arch.)	žizn'	jīvan	life
jīv	jīvitva	živetje (arch.)	žitje (arch.)	astitva (*living*)	life
jīv	jīvina	živina (*cattle*)	životina	jīv	living being
jñā	jñāna	znanje	znanie	jñāna	knowledge
mṛi	māra	mor, mora	mor	maran	death, pestilence
mṛi	mṛitaka	mrtvak	mirtvjec	mritak	dead man, corpse
prach	praśna	(v)prašanje	vopros	praś	question, query
prach	prāśā	priča	pritča (*fable*)	pričcha	statement in debate
snā	snāna	snaženje	x	snāna	bathing, cleansing
sthā	sthāna	stanje	sostojanije	sthiti	state, condition
sthā	sthāna	stan	stan(ica)	sthān	abode, dwelling
utthā (udsthā)	utthāna	vstanje	vstavanije	utthān	rising, resurrection
utthā (udsthā)	utthāya	vstaja	stoja (p.p.)	utthanā	standing up
udvās	udvāsa	odveza	otvjaz (yvanije)	muta karnā	setting free

(p.p.) - past participle

The examples above show that many derived Slovenian nouns formed on verbal stems use derivative suffixes that are very similar to the corresponding suffixes in Sanskrit. Both Slovenian and Russian kept one of the most archaic suffixes '-tih' (Cf. Meillet 1964 p.273) in the noun 'bitje-bytije' corresponding to Sanskrit 'bhūtī'. However in other verbal nouns, Russian often appends on more suffix in addition to the initial form of the verbal noun: it can be the suffix '-nije' corresponding to the very characteristic Sanskrit suffix '-na' (stojanije, otvjaz(anije)) or the typical Russian suffix '-, ec, ic(a) (mertvjec, stan(ica)). Some corresponding Russian words changed their meaning or have to be qualified as archaic. Hindi often has no corresponding noun at all or uses a verbal periphrase (hastī, astitva, muta karnā).

The situation is more or less the same in the formation of verbal adjectives.

Table 5. Verb > verbal adjective (Suffixes -ena, -ev ; -ta)

Sanskrit Verb	Sanskrit Adjective	Slovenian Adjective	Russian Adjective	Hindi Adjective	English
bhī	bhiyasāna	bojazen	bojazjen	bhīru	fearful, timid
jīv	jīva	živ	živ	jīvit	living, alive
jñā	jña	znan	znakom	jānnā	familiar with
mṛi	mṛita	mrtev	mjortv	mrit	dead, rigid
pā	pīta	pitan	upitan (*fed*)	piye-hue	drunk, suckled
prī	priyatva	prijeten	prijaten	priya	pleasing, being dear
prī	purna	poln	napolnen	pūrn	filled, full
snā	snāta	snažen	čiščen	snāt	washed, cleansed
siv	syūta	šivan, sešit	sšit		sewn

The verbal adjective is derived directly from the verbal root and not from a tense stem (Beekes 1995: 250). Slovenian shows most similarities with Sanskrit, Russian often adds a prefix or another suffix, and Hindi often lacks corresponding adjective.

Examples below illustrate similarities between Sanskrit and Slavic languages in formation of active and causative verbs and nouns.

Table 6. Verbs: active > causative (Prefix o-, stem change to -o-)

	Sanskrit	Slovenian	Russian	Hindi	English
jīv	jīvati	živeti	žit'	jīnā	to live, be alive
jīv	ajījivat	oživeti	oživit'	jīlānā	restore to life, make alive
pā	pibati, pāti	piti	pit'	pīnā	to drink, swallow
pā	-yayati, pīyate	pojiti	poit'	pīlanā	to cause to drink
pā	pū (*drinking*)	pupati	pit'	pīnā	to drink
pī	payate	pitati	pitat'	pālanā	to fatten, cause to swell

Table 7. Verbal nouns: active > causative (Stem change to -o-)

Sanskrit Verb	Sanskrit Noun	Slovenian Noun	Russian Noun	Hindi Noun	English Noun
mṛi	mṛityu	mrtje	umiranie	maranā	dying
mṛi	māraṇa	morjenje	morjenje	māranā	killing, causing to die
pā > pī	pīti	pitje	pitjo	pīnā	drinking
pā	pāyana	pojenje	pojenije	pīlānā	causing or giving to drink

Just as Sanskrit, Slavic languages use prefixes (oživeti, oživit') or change the stem vowel to '-o-' (pojiti, poit'; morjenje, morjenje; pojenje, pojenije) to form the causative but Hindi does not allow to discern a similar pattern.

Many prefixed verbs and corresponding nouns show similarities between Indic and Slavic languages.

Table 8. Prefixed verbs (pra-, ud-)

Sanskrit	Slovenian	Russian	Hindi	English
pra-dru (-dravati)	pridrveti	prepustit'	pradrava	to hasten towards, rush upon
pra-pat (-patati)	propasti	propast'	prapād	to fall down, lose
prati-vah (-vahati)	privesti	privest'	pravāćalānā	to lead or draw towards
ud-ā-vas (vasati)	odvzeti		udvas	to remove
ud-ā-vah (-vahati)	odvesti	otvest'	vahan karnā	to lead away; marry
ud-i (eti)	oditi	ujti / otojti	uṛa	to go, march off

Table 9. Prefixed verbs and corresponding nouns (Suffixes -va, -na, -nje)

	Sanskrit	Slovenian	Russian	Hindi	English
verb	pra-dhā (-dhatte)	prodati	predat'(*give out*)	pradān karnā	to give away, sell
noun	pradhāna	predaja		pradān	giving, donation
verb	pra-dṝ (-dīryate)	predreti (*pierce*)	prodrat'	phaṭnā	to split open
noun	pradara	prodor, predor	razdor (*quarrel*)	pradara	rout of an army, crevice
verb	pra-stu (-stauti)	predstaviti	predstavit'	prastut karnā	introduce as a topic
noun	prastāva	predstava	predstavljenije	prastut	introduction
verb	prati-budh (-budhyate)	prebuditi	prebudit'	prabodh karnā	to awaken
noun	pratibodhanā	prebud, prebujenje	probuždjenije	pratibodhān	awaking
verb	prati-jñā (-jānāti)	priznati	priznat'	pratijñā	to admit, consent
noun	pratijñāna	priznanje	priznanije	pratijñā	admission, assertion
verb	jalam-pā (pāti)	žlampati	hljupat'	jal pīnā	to drink water
noun	jalapāna	žlampanje	hljupanje	jalpān	the drinking water

Behind phonetic changes occurred in Slavic languages, it is still possible to recognize prefixes corresponding to the Sanskrit prefixes 'pra-' and 'ud-'. Russian, however, changed the meaning of derived verbs or used a different suffix to form a noun more often than Slovenian.

The morphological tendencies illustrated above are confirmed by the view from another angle. Above we were looking at the same type of derivatives from different stems. Below we show different type of derivatives from the same stem.

Table 10. Verbal family of derivatives from stem 'vid > vedati, vidati, vindati'; *to know, percieve, understand*

Sanskrit	Slovenian	Russian	Hindi	English
vid > veda (n.)	veda	vedjenije	veda	knowledge
vid > vedi (n.)	vedec	v'ed'ma (*witch*)	vidvān	wise man
vid > vedin (adj.)	veden	svedušč	vidvān	knowing
vid > vitta (adj.)	viden	vedom	gñat	known
vid > vindu (adj.)	(Vind > Venet)?		jānkār	familiar or acquainted with

(n.) - noun
(adj.) - adjective

As in all other examples, the closest phonetic and semantic correspondences can be observed between Sanskrit and Slovenian words. Two out of four Hindi words diverse more from Sanskrit than Slovenian ones in form (phonetic epenthesis 'vidvān') and one word does not exist because the corresponding adjective uses a different stem ('gñat'). Russian examples also confirm the derivation tendencies noticed earlier: it looks like the Russian language normalized its derivative suffixes (vedje-nije, (s)ved-ušč, ved-om) unlike the Slovenian that often keeps the original form of the word. Typical for the Russian examples change of meaning also occurs within this derivative paradigm. The Russian word 'ved'ma' meaning 'a witch' can be linked to the Sanskrit stem 'vid' for two reasons: first, because all other words of the family show the same phonetic change 'vid > ved'; second, because the suffix '-ma', according to Meillet (1964: 274), is known to form agent nouns in Sanskrit (Cf.: dhar-ma- 'qui tient' = 'the one who holds'; brahma- 'prëtre'='priest') and corresponds to the Indo-European suffix '-men'. The corresponding Greek noun 'ἴδ-μων' [id-mon] meaning 'the one who knows'('qui sait' in Meillet 1964: 275) also helps to link 'ved'ma' to 'vid' with the meaning 'a woman who possesses some esoteric knowledge'.

The fact that Slovenian seems to be closer to Sanskrit than other Slavic languages is important in different regards. From the linguistic point of view, Sanskrit - Slovenian - Russian comparisons provide unexpected insights into etymology. For instance, while working on this paper we were able to see many missing links that cannot be discovered by comparing Sanskrit with Old Church Slavic, as it is usually done in Indo-European linguistics (Cf.: Meier-Brügger 2003) for the simple reason that old scriptures use quite limited vocabulary. For instance, it is possible to see that the Russian verb 'hljupat' - '*make ugly noises while drinking*' can be linked to the Sanskrit compound 'jalam-pā (pāti)'- '*drink* *water*' only after coming across the Slovenian compound verb 'žlampati' with the meaning close to Russian. From the genetic point of view, this study of different degrees of language resemblance can be inspiring for a research seeking to understand to what extent linguistic affinities can be backed by genetic similarities.

Genetic comparisons

Two localities are considered more alike if the same haplogroups occur at similar frequencies and if the various haplogroups differ by fewer mutations. Clines are usually associated with distinct population movements. Demic diffusion, which is a combination of demographic growth, range expansion and limited admixture, is an example of a form of directional population expansion causing allele-frequency clines. Clines may be generated by loss of genetic variation or by admixture between two genetically distinct groups initially separated by a non-populated area (Karafet et al. 2001).

Bradley (2000) shows that the motif of dual domestication is a common one in livestock. On the basis of mtDNA results, he demonstrates that sheep and cattle were domesticated both in the Fertile Crescent and also on the Indian sub-continent. It can be inferred that the domestication of the sheep and cattle on the Indian sub-continent is the likely source of the linguistic similarity between Indo-Aryan and Slavic terminology relating to the sheep and cattle (Skulj et al. 2006).

In addition to linguistic similarities, the comparisons of the human genetic markers on the Y-Chromosome also indicate close relationship. Geneticists, studying the human DNA note that a Y-Chromosome genetic marker which they named, according to Y Chromosome Consortium, haplogroup R1a1 (HG3 according to Rosser 2000 nomenclature) is the most common among the Slavic populations in Europe and Indo-Aryans in India, at 47% and 30% respectively; but is found to be as high as 51% in Punjab (Kivisild et al. 2002) - (Figure 1). If we do the math, using the published statistics, we see that in Europe, ~61 million Slavic speaking males have this genetic marker, but on the Indian sub-continent, the number is almost four times higher, at ~240 million males.

Some may argue that this genetic (Figure 1) and linguistic affinity (Tables 1-9 and Appendix) is due to the recent arrival of the Vedic Aryans from India into Central Europe, Eastern Europe and the Balkans. However, such a recent migration from the Southeast Asia, would have also picked up and brought a Finno-Ugric genetic marker Haplogroup N3 (HG16 of Rosser's nomenclature) to the Balkans, since it is widely distributed in Russia and Ukraine-between Black Sea and the Baltic Sea (Rosser et al. 2000) - (Figure 3). The Uralic-speaking people are suggested to have been descendants of the hunter-gatherers who lived in the periglacial zone between the Carpathian Mountains and the Volga River during the last glacial maximum and have inhabited the Baltic area for ~10,000 years (Laitinen et al. 2002).

It is significant that this Hg N3 genetic marker has not been found either south of the Carpathian Mountains, central Europe nor in the Balkans. This would indicate that the populations carrying the Hg R1a1 came to the Balkans before the Finno-Ugric population spread into Northeastern Europe, European Russia and Ukraine about 10,000 years ago. Therefore, the R1a1 expansion from the Indian sub-continent to the Balkans must have occurred prior to this Finno-Ugric expansion ~10,000 years ago; thus avoiding an mixing with the populations with the Finno-Ugric genetic marker.

The reverse major population movement, from Europe to India, within the last 10,000 years, is highly unlikely. Such a migration would have brought a Finno-Ugric genetic marker Hg N3 and also the palaeolithic, more than 20,000 years old Hg I to India. This Hg I genetic marker is common throughout Europe; the highest frequencies have been found in the Balkans and is a likely signature of a Balkan population re-expansion after the Last Glacial Maximum (Marjanovic et al. 2005, Pericic et al. 2005). It is important to note that these two genetic markers, Hg N3 and Hg I, have not been detected in India (Cordaux et al. 2004, Sengupta et al. 2006).

Table 11. Hg R1a1 & Hg I Y-chromosome frequencies in Eurasia

Population	Hg R1a1		Hg I	
	%		%	
Basques	0	Rosser et al 2000	6	Rootsi et al 2004
Irish	1	Rosser et al 2000	11	Rootsi et al 2004
Western Europe	4	Kivisild et al 2002	3-39	Rootsi et al 2004
Germans	30	Rosser et al 2000	20	Rosser et al 2000
Poles	54	Rosser et al 2000	18	Rootsi et al 2004
Sorbs	63	Behar et al 2003	18	Behar et al 2003
Czechs	38	Rosser et al 2000	14	Rootsi et al 2004
Slovaks	47	Rosser et al 2000	14	Rootsi et al 2004
Slovenians	37	Rosser et al 2000	38	Rootsi et al 2004
Croats	29	Semino et al 2000	38	Rootsi et al 2004
Bosniacs	15	Marjanovic et al 2005	48	Marjanovic et al 2005
Macedonians	35	Semino et al 2000	30	Rootsi et al 2004
Belarussians	39	Rosser et al 2000	19	Rootsi et al 2004
Ukrainians	44	Kharkov et al 2004	22	Rootsi et al 2004
Russians/North	43	Nasidze et al 2005	5	Rootsi et al 2004
Russians/Moscow	47	Rosser et al 2000	19	Rootsi et al 2004
Russians/Tashkent	47	Nasidze et al 2005		
Anatolia & Caucasus	5	Kivisild et al 2002	0-6	Rootsi et al 2004
Central Asia			2	Rootsi et al 2004
Iran	11	Kivisild et al 2002	0	Rootsi et al 2004
Pakistan	37	Firasat et al 2007	1	Sengupta et al 2006
Burusho	28	Qamar et al 2002		
Pathan	45	Qamar et al 2002		
Sindhi	49	Qamar et al 2002		
India	30	Kivisild et al 2002	0	Sengupta et al 2006 Cordaux et al 2004
Punjab	51	Kivisild et al 2002		
Gujarat	24	Kivisild et al 2002		
West Bengal	39	Kivisild et al 2002		
Sri Lanka	24	Kivisild et al 2002		
Nepal/Kathmandu	35	Gayden et al 2007		
Bangladesh (W. Bengal)	39	Kivisild et al 2002		

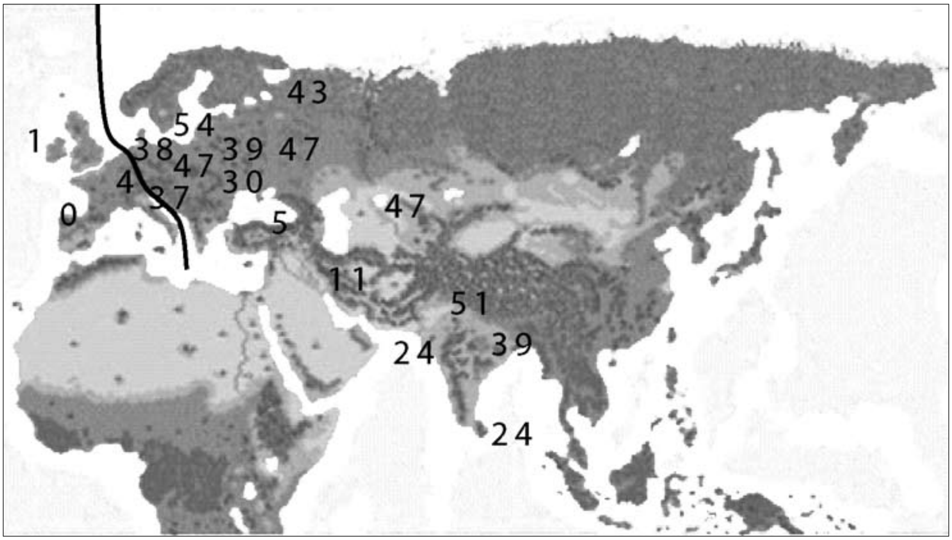

Figure 1: Hg R1a1 Y-Chromosome frequencies in Europe, West Asia and Indian sub-contintent

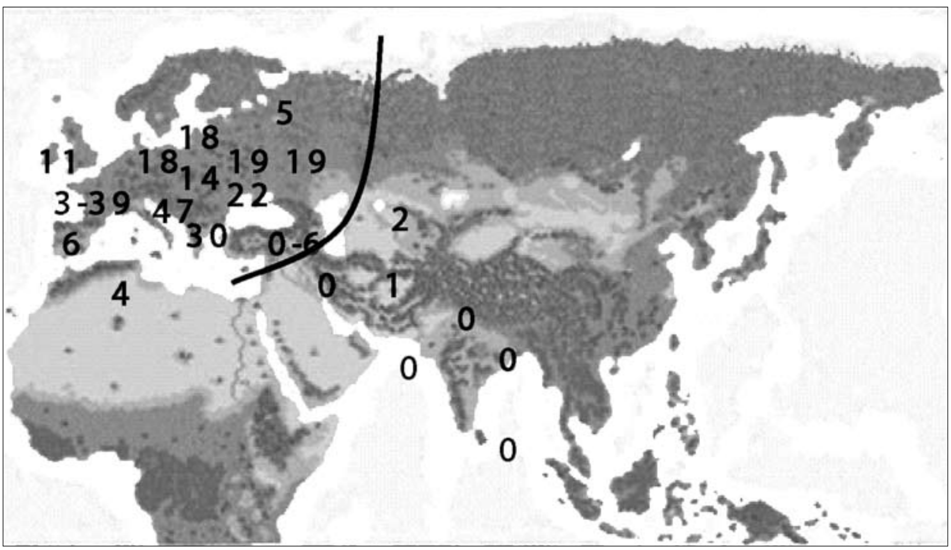

Figure 2: Hg I Y-Chromosome frequencies in Europe, West Asia and Indian sub-contintent

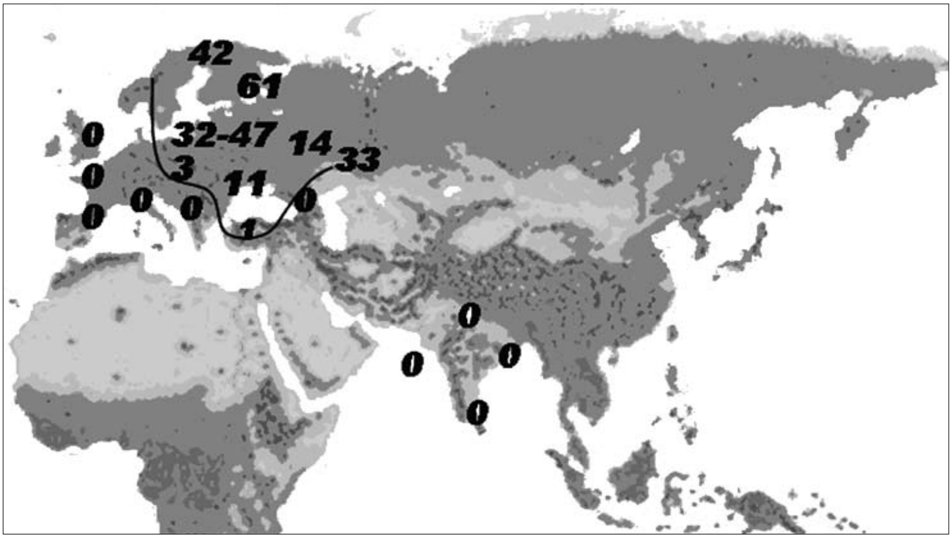

Figure 3: Hg N3 Y-Chromosome frequencies in Europe, West Asia and Indian sub-contintent

The human population growth over millennia

Until Meave Leakey of Kenya found new evidence, it was believed that the first and oldest species of our family *Homo habilis,* evolved into *Homo erectus,* and finally into *Homo sapiens.* New evidence shows that the two earlier species lived side by side about 1.5 million years ago in Kenya and that they have a common still-undiscovered ancestor that probably lived two to three million years ago. After studying the fossils, Leakey's team announced their findings and concluded that is was time to redraw the family tree and rethink other ideas about human evolutionary theory, especially about our most immediate ancestor, *Homo erectus* (Borenstein 2007).

Now the *homo sapiens* population is estimated at 6.5 billion. Over the millennia the human population growth has been closely associated with the social organization and with the technologically assisted food production. Historically, human population has grown very slowly and the exponential growth did not begin until the last few centuries.

From Hanson (2000) we learn that many authors have informally summarized world history as continually accelerating change, and that many others have described human history as sequences of specific growth modes. Human history has also been described as slow expansion of hunter-gatherers, followed by faster growth with the domestication of animals and plants and then followed by even faster growth with science and industry. The age of human population has been estimated by Hawks et al. to be 2 million years. From 2 million years ago up to about 5,000 BC hunters were dominant, then, as the world population grew to approximately 5 million to 20 million, farmers began to dominate (Hanson 2000, U.S. Census Bureau 2007).

McEvedy and Jones (1978) estimated that 12, 000 years ago the human population was at approximately 4,000,000; then it took 11,500 years of near linear growth to reach 425,000,000 in the 15th century. After 1500 AD, the exponential population growth began and it took only 400 years for the population to reach 1.6 billion in the year 1900 AD and then only 100 years for the population to reach 6 billion.

On the other hand, Kremer (1993), went back further into pre-history and estimated that 1 million years ago, there was already a human population of 125,000, which grew, albeit very slowly, and reached 4 million people 12,000 years ago and increased to 425 million in 1500 AD.

The question arises, how many male or Y-chromosome lineages were in existence or came into existence due to mutations over a span of 1 million years and how many of them are extinct now? A widely accepted hypothesis amongst the geneticists is one that places all modern humans in Africa, within the past 200,000 years, and assigns a genetic date of the ancestor of all human males at 40,000 to 140,000 years ago (Wells 2003: 54-55). At the present time, due to mutations, there are 153 different known haplogroups world-wide (The Y Chromosome Consortium 2002). Indian sub-continent shows great genetic diversity, since 36 of them are present in India and Pakistan (Sengupta et al. 2006) and Hg R1a1 being the one with the highest frequency of 30% in India (Kivisild et al. 2002, Wells 2003: 167).

Origin of 'Satem' Indo-European Languages

In our paper, we do not address the origins of human language, which some believe has its beginnings 150,000 years ago (The Economist, September 22nd 2007) nor of the Indo-European languages, which some believe that they have their beginnings in central and eastern Anatolia and others posit their origin north of the Black Sea. From Anatolia, according to some hypotheses, the distribution of the early form of the language and its successors spread into Europe in association with the farming (Renfrew 1987: 205). However, Bandelt et al. (2002) point out that, to stretch the origin of language families to the Fertile Crescent or nearby regions may not explain the real processes, which could actually have run in the opposite direction or have involved other centers of origin. In our paper, we demonstrate that the Slavs and Indo-Aryans share both genetic and linguistic affinities and that the distribution of their ancestors stretching from the Balkans, central and northern Europe, also north of the Black Sea and along north-eastern shores of the Caspian Sea and on the Indian sub-continent from Punjab to the Bay of Bengal and Sri Lanka (Table 11), is associated with the nomadic-pastoral age and that the subsequent split into Slavic and Indo-Aryan speakers predates the origin of farming.

At present, there are a number of hypotheses that propose to account for the greater similarity of Indians with western Eurasians than with the Mongoloid people to the east of India. First, there is a widely known hypothesis of an invasion of nomadic Indo-Aryan tribes around 4,000 years ago into India, either from the west or from the Central Asian steppes in the north. Second, there is a more recently proposed postulate, which is based on the fact that 8,000-9,000 years ago several varieties of wheat and other cereals reached India, presumably from the Fertile Crescent. This hypothesis is supported by linguistically based suggestions of a recent common root for Elamite and Dravidic languages (Kivisild et al. 2000, Wells 2003: 167).

In addition to the invasion theories, the theory of the indigenous origin of the Aryans on the Indian subcontinent has been advocated by a number of scholars. The indigenous theory is credible since, there is no evidence to show that the Vedic Aryans were foreigners or that they migrated into India within traditional memory. Sufficient literary materials are available to indicate, that the Vedic Aryans themselves regarded Sapta-Sindhu as their original home (Ghosh 1951: 220). Ghosh also cites H. Güntert and F.R. Schröder who have shown that Western Europe is one of those areas that were Aryanized last (Ghosh 1951: 214). This is in agreement with the frequency of R1a1; only 4 % in Western Europe, 1 % in Irish and 0% in the Basques who are the farthest from the Indian sub-continent. This is in contrast to high frequencies amongst the male Slavs in Europe at 47 % the males in India at 30 % (Kivisild et al. 2002, Rosser et al. 2000) numbering 61 million and 169 million respectively and 237 million for the whole Indian sub-continent.

Kivisild et al (2000) have found that the node of the phylogenic tree of the mtDNA, ancestral to more than 90% of the present-day typically European maternal lineages, is present in India at a relatively high frequency. They estimate that the age of this ancestral node is greater than 50,000 years. They have also found that mtDNA haplogroup U is the most abundant mtDNA variety in India as it is in Europe. Furthermore, they believe that there are now enough reasons to question the recent Indo-Aryan invasion into India some 4,000 years ago and alternatively to consider India as a part of the common gene pool ancestral to the diversity of human maternal lineages in Europe.

Age of Hg R1a1 (time since coalescence)

Bandelt et al. (2002) express some caveats regarding the coalescence times, which play an integral part in historical genetics, because there has been an over-emphasis on superficial population-genetics formalizations and insufficient attention to the resources of other disciplines. In addition, geneticists are calculating the coalescence times using the model of random-mating populations of constant sizes. This can lead to potentially dramatic miscalculations of coalescence times.

Kharkov et al. (2004) attempt to clarify the ethnogenesis of the Slavs in general and Eastern Slavs in particular, by studying the Y-chromosome diversity in the Ukrainians and other populations of Eurasia. They agree with some of the published estimates, that Hg R1a1 coalesced in a common ancestor 2,500 to 3,800 years ago. Although, in their paper, they alluded to the relatively high frequency of R1a1 in India and Pakistan, they did not inquire into the significance of such large numbers of R1a1 carriers, both on the Indian sub-continent and amongst the Slavs, in Europe. They also failed to demonstrate how R1a1 could become one of the most widespread and also the most numerous genetic markers both in Europe and on the Indian sub-continent during a relatively short period of time, i.e. less than 4,000 years.

They note that haplogroup (Hg) R1a1 is the most common Y-chromosome variant among the Ukrainians at ~ 44%. Upon further analysis of the published results in the literature, it appears that Hg R1a1 is one of the most frequent genetic markers in the world. It is most frequent in the populations speaking 'satem' I-E languages, namely the Slavic speakers in Europe and the Indo-Aryan speakers on the Indian sub-continent. If we do the math, using the US Census I. P. Center population figures and the percentages published in the literature (Rosser et al. 2000, Semino et al. 2000, Pericic et al. 2005, Sengupta et al. 2006, Kivisild et al. 2002) we see that in Europe, ~61 million Slavic speaking males have the Hg R1a1 genetic marker; but in India the number is more than two and a half times higher, at ~170 million males. When considering the Indian sub-continent as a whole, the number is ~240 million or almost four times higher than in the Slavic populations. In addition this genetic marker is also present in smaller numbers in Western Europe, Scandinavia, Baltic States, Caucasus, Turkey and Central Asian countries and totals ~25.5 million. In total this represents more than 10 % of the male population of the world. Sengupta et al. (2006) also report that the R1a1 frequency in I-E speakers of Upper Castes is at 45%, which is similar to frequencies in the Slavic populations of Europe. This would indicate that a similar increase of Hg R1a1, relative to populations with other genetic markers, took place among the Slavic populations of Europe as in the caste populations of India.

In order to do a 'reality check' on the age of Hg R1a1, we will use a macro-analytical approach with a global perspective and consider the recorded genealogies of known historical individuals, some in a position of privilege, others just common men. We will then compare the results with the estimated coalescence dates of Hg R1a1-M17 lineage found in the literature, where the micro-analytical approach, based on mutation rates, is used for determining the ages of Y-Chromosome mutations.

Mutation Rate is defined as the rate at which a genetic marker mutates or changes over time (Kerchner 2007). There is as yet no general agreement on the mutation rate at an average Y-Chromosome short-tandem repeat locus; the range is quite wide; 0.00069 per 25 years (Zhivotovsky et al. 2004); 0.00069 per locus per mutation, with an intergeneration time of 25 years (Gayden et al. 2007); 0.00026 per 20 years (Forster et al. 2000); 0.002 per generation (Kerchner 2007) and 0.0018 per generation (Quintana-Murci et al. 2001). The subsequent calculated age estimates are then based on these mutation rates. Understandably, there is also no consensus on the length of time from coalescence, for the first male with Hg R1a1 mutation, which is the most recent common ancestor for the largest percentage of Indo-Aryans and Slavs. These ages vary from 1,650-4260 years (Kayser et al. 2000); 2,500-3,800 years (Kharkov et al. 2004); 3,800 years (Zerjal et al. 1999); 7,500 years (Karafet et al. 1999); 10,000-15,000 years (Wells 2003: 176) and Semino et al. (2000) posit that it expanded from the present day Ukraine after Last Glacial Maximum 20,000 to 13,000 years ago.

Passarino et al (2001) are very candid about dating: »Unfortunately, poor knowledge of the molecular basis of 49a,f system and the complete ignorance of the mutational rate do not allow any attempt to date this phylogeny. However, an attempt to date the Eu19

(R1a1 - M17) lineage was made by combining the micro-satellite variations resulting from the analysis of 243 Y chromosomes. By the two approaches used, ages of 7,654 and 13,031 years were obtained.«

For this reason, it is worthwhile to compare the age estimates, which are based on mutation rates, with the reproductive capabilities of some known historical men, since the number of their descendants, over known time period, integrates all the factors that influenced their procreation and in some cases made their progeny grow, not only in numbers, but also in relation to the population of the world. By comparing these dates with the ones obtained by the mutation rates, it is possible to test the validity of the results obtained by the mutation rate method and also to determine, what is a reasonable time interval, for more than 325 million men, representing ~10 % of the world's male population, now living with this Hg R1a1 mutation, to come into existence; starting from a single individual. For example:

A. Confucius. Year 2009 will coincide with the 2,560th anniversary of this great philosopher's birth. He now has about 3 million descendants, which includes female relatives, world wide. This number represents ~ 0.23 % of the population of China and 0.046 % of the world's population. From the growth rate it can be seen that Confucius' clan grew at a faster rate than the population of the world, which is estimated to have been 95 million in 551 BC (US Census Bureau 2007) and at birth he represented only 0.000001 % of the world's population. On the average, an individual born at the same time, as Confucius, would have only ~68 descendants now.

Assuming a linear growth in relation to the world's population, it will require 217 time periods of 2560 years or 555,520 years for the descendants of Confucius to reach 10 % of the population world's population. (10 : 0.046 x 2560 = 555,520)

B. Macedonian cavalry with Hg I-M170/M223/M379 in Pakistan - Sengupta et al. (2006) and Firasat et al (2007) report that 0.57 % and 0.3 % respectively, of the Pakistani males are identified with this genetic marker. According to Firasat et al. (2007), this genetic marker may have been brought by the Greek slaves 150 years before Alexander the Great, but more likely by the Alexander's army of 25,000-30,000 mercenary foot soldiers from Persia and West Asia and 5,000-7,000 Macedonian cavalry during the invasion 327-323 BC. Hg I-M170, which is a component of the European Y Chromosome gene pool and accounts for 18 % of the total paternal lineages, is widespread in Europe, but is absent in India. In Europe six subhaplogroups of Hg I-M170 have been reported (Rootsi et al. 2004). In Pakistan only the subhaplogroup I-M223/M379 is found. The subhaplogroup I-M223 is relatively rare in Europe, nevertheless, it is also found amongst the Slavic speakers in the Balkans at 0.4 % (Marjanovic et al. 2005). Assuming that the genetic marker was brought to Pakistan by the Macedonian cavalry of the Alexander the Great and by using the data provided by Firasat et al. (2007), it is apparent that it took ~2,300 years for this genetic marker to reach ~ 0.43 % of the Pakistani male population of 82.4 million or 354,000. From a global perspective, 354,000 males represent 0.011 % of the world's male population. However, an average individual born 2,300 years ago would now have only ~ 40 descendants.

Therefore, the Macedonian cavalryman, perhaps there was more than one individual with this genetic marker, was reproducing faster than the population of the world over this period of 2,300 years. By giving credit to only one individual and thus increase the compounding rate, we can estimate the length of time that, it would take for the descendants to reach 10 % of the world's population. Since it took 2,300 years to reach 0.011% of the world's population and assuming a linear growth in relation to the world's population, it will take them 909 time periods of 2,300 years or 2,090,700 years to reach 10% of the world's population (10 : 0.011 x 2,300 = 2,090,700 years).

C. Giocangga. Geneticist Tyler-Smith (2005) has estimated that 1.5 million Chinese men are descendants of Giocangga, the grandfather of the founder of the Qing dynasty, from about 500 years ago. His descendants were in a privileged position and the extraordinary number is thought to be a result of the many wives and concubines his offspring took. Because of the special privileges, his children would have had a good chance of survival, but an average individual has only ~20 descendants, for that time period. This number of 1.5 million males represents 0.23% of the total male population of China, estimated at 660,926,000 males. From a global perspective, 1.5 million males represent 0.046 % of the world's male population of 3.25 billion.

Assuming a linear growth, in relation to the male population of the world, for the descendants of Giocannga, it will require 217 time periods of 500 years to reach 10% of the world's population or ~109,000 years (10 : 0.046 x 500 = 108,696 years).

Cohen (2002) in estimating the population growth modeled his estimates on the compounding interest calculations. With his model, he attempted to take into consideration natural disasters and the subsequent population bottlenecks. Consequently, when using the compounding interest calculations, he was concerned that the population growth could be greatly overstated. Recognizing this and using trial and error method he estimated that prior to the adoption of the agriculture, about 10,000 years ago, the growth rate had to be very near zero, perhaps only 0.003% (rate of 0.00003) per year. From then, to the time of Columbus, he estimated that the rate was also small, at 0.1 % (0.001); higher compounding rate would result in a historical population greater than it is. He gave an example that at the 0.1 % compounding rate, it would take a group of 500 individuals more than a thousand years to grow to 1500.

In our calculations, to estimate how long it would be necessary to reach 10 % of the global population, starting from a single individual, we used a somewhat different approach, by using the recorded reproduction statistics of the known historical individuals and going past the exponential population growth of the past century, when during this time period of 1965-1970, the growth rate was ~2.1 % (0.021) per year. As a further refinement, the simultaneous global population growth was also part of the equation used to determine the incremental growth rate of these historical men against the population as a whole. Since it is this incremental growth rate that determines the time that it would take to grow from one individual to millions of human beings representing more than 10% of the world's population.

From the above real time examples, where all the descendants grew faster than the global population, it is apparent that growth of the human populations, having specific human traits, be it a genetic marker or a surname, relative to the rest of the population, is a long term process. The process of growth, relative to the rest of the population, has to be accompanied with special attributes not present in the surrounding population. This 'reproductive fitness advantage' (RFA), can be in the form of fertility or reproductive fitness, special privileges or resistance to disease which ensures the survival of the progeny and allows the privileged population to grow faster than the surrounding population. This is analogous to the mechanics of a similar process such as language replacement, which C. Renfrew named 'elite dominance' (Renfrew 1998: 95,132).

To account for the relatively high frequency of Hg R1a1, there is no reason to believe that the Slavic populations have an inherently higher reproduction rate than surrounding populations, due to reproductive fitness. For example, the population of Russia is now decreasing and will continue to decrease into the foreseeable future, relative to other countries (The Economist, June 2007). This creates a dilemma. How could the male population with this genetic marker have grown to more than ~325 million? Obviously, higher rate of growth, relative to other populations, coupled with a long time period since coalescence was needed to achieve this. These are the only two ways that could have created the necessary conditions to have one man leave enough descendants to go from ~0 % to 10 % of the world's male population. Factors such as economic, cultural, physical, military superiority or resistance to disease must have been present to a higher degree to have a higher population growth rate and thus allowed the males with this R1a1 genetic marker to grow so dominantly and to preserve this status in relation to the other 152 Y-Chromosome haplogroups of the world's male populations, so that now one out of every ten males has this genetic marker.

It is noteworthy that the majority of the populations on the Indian subcontinent who speak the I-E languages, which are based on Sanskrit also have a high frequency of the R1a1 genetic marker. Also in Europe, Slavic languages share many linguistic and grammatical similarities with Sanskrit, particularly Vedic Sanskrit. Thus it is possible to regard R1a1 as an Indo-Aryan and Slavic genetic marker. Wells (2003: 167) calls it Indo-European as a contrast to Dravidian genetic markers.

Based on these linguistic and genetic similarities, it is not out of order to combine the Slavic and Indian populations and the relative percentages of Hg R1a1 of 47% and 30%, respectively, as reported by Kivisild et al. (2002). This means that the coalescence of the common ancestor of Hg R1a1 would have taken place considerably earlier than the Ice Age. Only the early coalescence can account for the high frequency and wide distribution of Hg R1a1 prior to modern day population migrations. This reproduction rate is in line with that of the historical personage, Giocangga, whose descendents would require ~109,000 years, to reach 10 % of the world's male population, based on their past reproduction rates. Taking into consideration the reproduction rates of historical individuals, it can be concluded that the time since coalescence of Hg R1a1 must be at least 100,000 years, but very likely much more, since this calculations is based on reproduction rate of an individual not affected by the population bottlenecks created by such events as the Toba Volcano explosion and the Last Ice Age.

This age estimate of ~100,000 years since coalescence of Hg R1a1, should not be discounted as unrealistic, since that area of the world has supported human life for more than 1 million years (Kremer 1993, Zerjal et al. 2002) and humans have been speaking for at least 150,000 years (The Economist, September 2007 p. 57). New discovery of a human lower jawbone, dated to be 1.3 million years old, in a limestone cave in northern Spain (Hurst 2008), will undoubtedly lead to reappraisal of human existence in and outside Africa.

Direction of gene flow

Some would argue that genetic and linguistic affinity between Slavs and Indo-Aryans is due to the recent arrivals from the east. However, a recent migration from the east would have also brought Hg N3 to the Balkans, since it is widely distributed in Russia and Ukraine - between Black Sea and the Baltic Sea, but this genetic marker has not been found in the Balkans. This indicates that R1a1 migration to the Balkans took place before Hg N3 arrived in European Russia and Ukraine. Hg N3 has the highest frequency amongst the Finns at 61% and has been considered a Finno-Ugric marker. Laitinen et al. (2002) estimate that Finno-Ugric tribes arrived in the Baltic region 5,000-6,000 years ago. Therefore, the Hg R1a1 migration from the east to the Balkans must have occurred prior to the Hg N3 expansion and thus avoided the contact with the populations when Hg N3 was already present (Skulj et al. 2006).

Significantly, Hg I-M170 (Figure 2), which is posited to be older than Hg R1a1-M17 and is believed to have expanded from a refuge in the northern Balkans after LGM (Semino et al. 2000), has not been detected in India (Sengupta et al. 2006). Hg I is widespread throughout Europe; from British Isles to Russia and from Baltic Sea to the Balkan peninsula. The frequency is particularly high in the Balkans, as high as ~71% in the Croats of Bosnia-Herzegovina. It is frequent in Russia and Ukraine at ~20%, and also the rest of Europe, particularly in Scandinavia. In England the frequency is 18%, Germany 20%, Denmark 39%, Norway 40%, south Sweden 40% and Estonia 19%. The estimated age of Hg I is 22, 000 years, which would give it an abundance of time for expansion, and it is also considerably more widely spread in Europe than Hg R1a1**.** It should be stressed that, despite the theories of Aryan home in Germany or Germanic lands (Ghosh 1951: 213-214), Hg I has **not** been detected in India. This would rule out Europe as the home of the Aryans after the last Ice Age. Hg I-M170 has been detected in Pakistan at 0.57 % (Sengupta et al. 2006) and at 0.3 % (Firasat et al. 2007), where it could have been brought by the army of the Alexander the Great (Qamar et al. 2002, Firasat et al. 2007). At lower frequencies, Hg I is found in the Near East, Caucasus and Central Asia but not in Iran. In the populations of Central Asia, the frequency is only 1.5% (Marjanovic et al. 2005, Qamar et al. 2002, Rootsi et al. 2004).

Furthermore, another haplogroup can provide some insights into the origins of the Indo-Aryans. It is Hg K*-M9, which is widespread in Asia and appears at high frequencies in Koreans at 69 %, Mongolians at 25 %, Uzbeks at 15 %, Kazakhs at 11 %, Tatars at 9 %, Russians/Tashkent at 6 % (Nasidze et al. 2005), Russians/Yaroslavl at 14 % (Malyarchuk et al. 2004). In India it was not detected in a sample of 728 males, but in Pakistan there was one individual in a sample size of 176 or 0.57 % (Sengupta et al. 2006). While Kivisild et al. (2002) has found that Hg K* (HG26-M9) is absent in Punjab, Andhra Pradesh and Sri Lanka, but is present at 0.8 % in India as a whole, but at 3.2 % in Western Bengal and 3.4 % in Gujarat and also in Iran at 3.6 %. From Chatterji (1988) we learn that there is a Mongoloid stratum in the Himalayas and in the tracts immediately to the south, in Assam, in North and East Bengal and that he observed Sino-Tibetan influence is still present there.

It is significant, that Hg N3 and also Hg I did not reach Iran and India. This can be taken as another indication that the migration(s) carrying Hg R1a1 did not originate in Europe. A northern, central or east European origin of Hg R1a1, and the subsequent expansions and migrations would have picked up both Hg I and Hg N3 chromosomes and the linguistic affinities with Sanskrit and taken them eastward in the direction of India. However, high frequency of Hg R1a1 chromosomes, and the high linguistic affinities with Sanskrit are primarily common only to Slavic and Indo-Aryan populations. This is not the case for other European or eastern European genetic markers such as Hg I and Hg N3, since Hg I and Hg N3 are absent from India. Also the virtual absence of Hg K* also rules out central Asia or Siberia as the homeland of the Indo-Aryans.

As mentioned before, Hg N3, which is widely distributed among Finno-Ugric populations where the high frequencies occur, is also frequent in the Slavic populations surrounding the Baltic and Black Sea, where the largest absolute numbers occur. This marker, which is considered to be as old as R1a1, has not reached the Balkans, nor has it migrated to India (Skulj 2007) (Figure 3).

Based on the above mentioned genetic markers, one has to conclude that Hg R1a1 chromosomes came from India and reached the Balkans, before Hg N3 expanded between the Baltic and the Black Seas. Also the expansion of Hg I from the Balkans was impeded and did not reach India. All of this is in agreement and supports Out of India Theory (OIT) of the 'satem' branch of the Indo-European language family. Furthermore, the domestication of cattle in the Indus valley and no indication of domestication of European aurochs (Edwards et al. 2007) further support the OIT.

That is why it is very difficult to accept the relative young age of R1a1, which Karafet et al. (1999), Kayser et al. (2000), Kharkov et al. (2004), Zerjal et al. (1999) propose to have coalesced in a common ancestor less than 10,000 years ago. If this R1a1 genetic marker is one of the youngest, why is it, in this Darwinian world, one of the most prolific and prior to the discovery of the Americas was also one of the most widely distributed haplogroups? At high frequencies, it stretches like an arc north of the Black and Caspian Seas from southern Adriatic in Europe to the Bay of Bengal and Sri Lanka on the Indian sub-continent.

However, the numerical success of the R1a1 in India and in Europe raises some obvious questions:

1) In the populations north of Black Sea and Caspian Sea where Hg I and Hg N3 are at high frequencies:
   - What has prevented the carriers of ostensibly much older genetic markers from

blossoming and taking over the planet and leaving R1a1 chromosome in a minor role?
- What prevented N3 from supplanting R1a1?
- What prevented Hg I from doing the same, or Hg P which is considered to be even older than Hg I?

2) In the populations south of Black and Caspian Seas:
   - Why have the Anatolian and Middle East agriculturists, with older haplogroups such as Hg J and Hg E, lagged behind R1a1 populations in numbers, since they would have had a head-start in time, agricultural food production and technology?
3) Was the agro-pastoral way of life the sole means to provide this advantage, or was it a combination of some other form of the 'elite dominance' in culture, warfare, technology or resistance to particular diseases that enabled the populations with the high frequency of R1a1 chromosome to surpass in frequency all others in Eurasia?

How can the high frequency of ~10 % of Hg R1a1 in the world's male population be accounted for, when the expected percentage is less than 1 %, since the lineage is just one out of 153 and at the same time considered to be one of the youngest. S. Wells (2003 p. 84) has attempted to explain why certain genetic lineages are more numerous than others. He offers a rather simplistic explanation, based on intelligence and the ruthlessness of the founder and his progeny. The progenitor was more intelligent than other members of his clan. He was also a better hunter, since he had better knowledge of the animal behavior and devised better tools to hunt them. He became their leader; members of his clan ate well, prospered and he was able to father many children. Then his children, when grown, killed or chased away other males of the clan. Thus the lineage had a head-start and was able to prosper. There are probably also other reasons.

There is anecdotal evidence that people of East Indian descent in Canada have a much higher incidence of cardio-vascular diseases than other nationalities. These diseases affect primarily individuals past their best reproductive years (Ogilvie 2008). Therefore, in light of the high population numbers with the R1a1 genetic marker, it would be reasonable to expect that people with this genetic marker may have had better resistance to other forms of disease, during their reproductive years. Such an advantage could have provided them with better survival rates with respect to other 152 lineages.

Also part of the answer will probably be found to be in the evidence that the age of Hg R1a1 is considerably older than the estimates of Kharkov et al (2004) of 2,500-3800 years. Passarino et al (2001) presented two different dates for the age of R1a1 M17 lineage, namely, 7,654 years and 13,031 years. However, they do mention that when an attempt was made to estimate the age of mutations M173 and M17, the values obtained were compatible with a Palaeolithic origin.

We estimate that mutation is in all probability much older; we estimate the age at more than 100,000 years based on compounding calculations and the results agree with the straight line estimates (Skulj 2007). In addition to the antiquity of this genetic marker, the carriers of R1a1 must also have had a tremendous Darwinian advantages mentioned above, to surpass the other Y-chromosome genetic competitors in their reproductive fitness.

Furthermore, their data shows that the highest frequency of what could be the oldest c-haplotype, namely c-Ht 17 of the M17 lineage, occurs in India, where it was observed in 10.5% of the males or ~57.5 million men. In Eastern Europe, it occurs at 9.5% or in ~12 million males, in the Balkans at 3.8%, in Western Europe at 0.3% and Middle East at 2.5%. Another haplotype, c-Ht 19 has been found almost exclusively in the Balkans, Eastern Europe and India. Here again India represents 8%, Eastern Europe 4%, Balkans 0.5% and Western Europe 0.2% of the male population with this haplotype. The percentages and absolute numbers suggest the direction of the gene flow**.** These statistics are also an indication that the gene flow appears to be from India to Europe.

Using Alinei's 'lexical self-dating', there is evidence that a common agro-pastoral origin of Sanskrit 'gopati', 'gospati' and Slavic 'gospod', 'gospodin' meaning lord/master/gentleman occurred more than 8,000 years ago (Skulj et al. 2006). Therefore, the people who invented this terminology must have had their origin prior to that period of human history when the domesticated cattle were already part of the wealth of certain individuals.

There is a common belief, primarily based on the linguistic similarities between the Indo-Aryans and the Europeans, that their original common home was Europe (Anžur 2006). However, as discussed earlier, despite the linguistic and genetic similarity between Indo-Aryans and Slavs, there is evidence to the contrary. The domestication of cattle and sheep on the Indian sub-continent, the absence of Hg I and Hg N3 in India and their high frequencies in Europe are indicators that the gene flow was not from Europe to India, but from India to Europe in the distant past - pre 10,000 years ago, along with the precursor of the 'satem' Indo-European languages.

Conclusions

In many instances, the Slovenian language appears to be gramatically closer to Sanskrit than other Slavic languages and even Indic languages such as Hindi, Bengali and Gujarati.

Genetic and linguistic affinities between the Indo-Aryan and Slavic speaking populations indicate that a large percentage of their ancestors had a common sojourn during the pre-pastoral and also during the pastoral age.

Linguistic evidence suggests that the separation of the Indo-Aryans and the ancestors of present day Slavs occurred prior to the innovation of the cereal farming in agriculture.

Hg R1a1-M17 lineage appears to have come to Europe, via the ancestors of the present day Slavs, from the Indian sub-continent, before the spread of farming ~9000 years ago.

Genetic evidence does not support a large scale invasion of India from Europe during the prehistoric times, since no evidence of Hg R1*-M173, Hg I-M170 or of Hg N3-TAT has been found in India, although these Haplogroups are very frequent in Europe (Rosser et al. 2000, Sengupta et al. 2006).

The coalescence of Hg R1a1, the most frequent genetic marker in Indo-Aryan and Slavic populations, very likely occurred more than 100,000 years ago. Only if the most recent common ancestor of such a large percentage of Indo-Aryans and the Slavs lived more than 100,000 years ago, could the male population with this genetic marker grow to such high absolute numbers of 325 million men representing more than ~10 % of the world's total male population.

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Povzetek

Jezikovne in genetske sorodnosti med Indoarijci in Slovani izvirajo iz dobe pred kmetijstvom

Jezikoslovne primerjave indoarijskih jezikov, posebno vedskega sanskrta, s slovanskimi jeziki kažejo na izredno sorodnost osnovnih besed in tudi tistih, ki so v zvezi z udomačitvijo živali kot so ovce in govedo. Podobna sorodnost se vidi tudi v Y-kromosomskih genetskih primerjavah haploskupine (Hg) R1a1 (ali HG3 po izrazju Rosserjeve), med Indoarijci in Slovani, kjer je ta genetski marker najbolj pogost. Ta genetska sorodnost kaže na skupen izvor velikega odstotka prebivalstva, ki govori indoarijske in slovanske jezike. Z Alinei-jevo 'Lexical Self-Dating' metodo, uporabljajoč arheološke, genetske in jezikoslovne dokaze, se da sklepati, da so govorci teh dveh jezikovnih skupin imeli skupen izvor in so skupno udomačili ovce in govedo pred približno 10 tisoč leti. Toda predniki Indoarijcev in Slovanov so se razšli, še predno so udomačili žitarice in postali poljedelci. Nadalje, velika pogostost in razsežnost genetskih markerjev Hg I in Hg N3 v Evropi in odsotnost teh markerjev v Indiji dokazuje, da ni bilo kakšnega večjega preseljevanja ljudstev, vključno prednikov Slovanov, iz Evrope v Indijo v zadnjih 8 tisoč letih, čeprav je prišlo v Indijo v tem času veliko vojaških vpadov.

Nastanek Hg R1a1 ali M-17 mutacije v predniku velikega števila Slovanov in Indoarijcev, upoštevajoč arheološke, jezikovne, genetske dokaze in rast prebivalstva, se da postaviti v lovsko-nabiralno dobo. Skupni stiki prednikov teh ljudstev so se nadaljevali do udomačitve ovac in goveda, toda prenehali so pred poljedelstvom. Zato se da sklepati, da se je širjenje prebivalstva s to mutacijo iz indijskega pol-kontinenta že končalo v dobi pašništva. Ta mutacija mora biti stara najmanj 100 tisoč let, sodeč po veliki razširjenosti, raznolikosti in velikem številu potomcev v primerjavi z zgodovinskimi osebami, za katere se ve za čas rojstva in število potomcev. Starost mutacije ugotovljene na tej podlagi se precej razlikuje od tistih, ki se opirajo na hitrost mutacij posameznih haplotipov ki sestavljajo haploskupine, že objavljenih v literaturi.

APPENDIX

LINGUISTIC COMPARISONS

Transliteration and Pronunciation

Slovenian: Pronunciation: c is pronuciated as TS; č as CH; j as Y; š as SH; ž as ZH.

Russian: Transliteration of Cyrillic alphabet follows Slovenian orthography. Apostrophe at the end of a word marks a palatalized consonant. The letter <y> represents central [i] sound, [ɨ] in the IPA (http://en.wikipedia.org/wiki/Close_central_unrounded_vowel).

Sanskrit: Transliteration of Devanagari follows primarily *A Sanskrit-English Dictionary*" compiled by Sir Monier Monier-Williams and *Sanskrit for English Speaking People* by Acharya Ratnakar, where English is used as the base but: ć is pronounced as CH; ś as SH sometimes as S; dot under a letter denotes a cerebral letter.

Hindi: Transliteration follows the Sanskrit.

m. means masculine; f. feminine; n. neuter; f.pl. feminine plural; v. verb

A) ELEMENTAL

Four elements

English	Russian	Slovenian	Sanskrit	Hindi
air in motion	veter m.	veter m.	vāta	vāt, vāyu f.
fire	ogon' m.	ogenj m.	agni, vahni	agni
ground, earth	zemlja f.	prst f., zemlja f., tla f.	pṛithvī f., tala	prthvī, sthal
water	voda f.	voda f.	uda n.	pānī

Astronomy and seasons

English	Russian	Slovenian	Sanskrit	Hindi
bright (be)	svet (*brightness*)	svetiti, svitati se	śvit (śvetate)	suspashṭ karnā
day	den'	dan m.	dina n.	din
darkness	t'ma	tema f.	tama	tamas
dawn	svetat' (*to dawn*)	svit m.	śvetanā	ushā kāl
light, brightness	svet, luč (*ray*)	luč f., svit	ruc f.	rashmī (*ray*)
month	mesjac m.	mesec m.	māsa m. or n.	mukh
moon	mesjac m.	mesec m.	mās m.	māsa
night	noč	noč f., tema f.	niśā f., tamā f.	tam
sky	nebo n.	nebo n.	nabha	nabha
spring	vesna	vesna	vasanta	vasānt
sun	solnce n.	sonce n., solnce n.	surya	surya
winter, cold	zima f.	zima f.	hima	śīt kāl

Weather and geography

English	Russian	Slovenian	Sanskrit	Hindi
cloud	oblako n.	megla f, oblak m.	megha	megh
dew, moisture	rosa f.	rosa f.	rasa	rasa
dryness	suš	suša f.	śushikā f.	sūkhapan
heat (to)	topit'	topiti	tap (tapati)	tapānā
heat	teplo(ta) n.	toplota f.	tāpa	tāpa
lake	ozero	jezero, jezer	sara n.	sarovar
mountain	gora f.	gora f.	giri m.	giri
open space	lug (*meadow*)	loka (*meadow*)	loka	ćarāgah
rain (to)	(idjot) dožd'	padati	pat (pātayati)	varsha padanā
river	reka	drava (*name of river*)	dravantī	dariya
sprinkle (to)	pryskat'	pršiti	pṛish (parshate)	chhirikanā
vapour	dym m.	dim m.	dhūma	vāshp
warm	teplo	topel m. topla f.	tapta	tapt
wet, moist	vlaga f.	voden	voda, ārdra	gīla

Primary actions

English	Russian	Slovenian	Sanskrit	Hindi
ask (to), beg	prosit'	prašati, prositi	prach (pṛiććhati)	puchhnā
abide(to) live, exist	byt, byvat'	bivati, biti	bhū (bhavati)	honā
bake (to)	peč'	peči	pać (paćyate)	pakānā
be (imperative)	bud'	bodi < biti	bodhi <bhū	ho
being, existence	bytije	bitje n.	bhūti f.	hastī
come forth (to)	prijti	priti	pre (praiti)	āgeānā
copulate, have sex	jebat' (vulgar)	jebati (vulgar)	yabh (yabhati)	sambhog karnā
copulation	jeblja(vulgar)	jebanje(vulgar)	yabhana n.	maithun
delight (to) gladden	byt prijatnym	prijati	prī (priyate)	priya honā
desire (to) long for	ljubit'	ljubiti	lubh (lubhati)	lobh honā
devour(to) consume	požyrat'	basati se, žreti	bhas (babhasati)	harapanā
die (to)	umirat'	mreti	mṛi (mriyate), (marati)	maranā
drink (to)	pit'	piti	pī (pīyate), pā (pibati)	pīnā
drink (causing to)	pojit'	pojiti v., pojenje n.	pāyana n.	pīlānā
dry (to)	sušit'	sušiti	śush (śushyati)	sūkhanā
eat (to)	jest', pojedat'	jesti, jedati	ad (atsyati, ādayati)	khanā
excrete (to)	srat' (vulgar)	srati	sṛi (sāryate)	utsarjit karnā
fall (to)	padat'	padati	pad (padyate)	patan honā
fear, be afraid	bojat'sja f.	bati se (bojim se)	bhī (bhayate)	bhaya honā

English	Russian	Slovenian	Sanskrit	Hindi
fearful, timid	bojazlivji	bojazen, bojazljiv	bhijasāna	bhīru
free (to set), release	rešit'	rešiti	rī (reshyati)	chhodanā
give (to)	dat'	dati, dajati	dā (dadāti, dāti), dāy (dāyati)	denā
go (to)	idti	iti	i (eti)	jānā
kill, hurt (to)	kolot' (*kill animals*)	klati	krath, klath (klathati)	mārānā
know (to)	znat', vedat'	znati, vedeti	jñā (jānāti), vid (vetti)	jānnā
knowledge	znanije	znanje n., veda f.	jñāna, veda	gyān
lead away (to)	otvest'	odvesti	udvah (udvahati)	le jānā
live (to)	žit'	živeti	jīv (jīvati)	jīnā
murder (to)	morit' (archaic)	moriti	mṛi (māryati)	mārnā
nibble (to), gnaw	kusat' (*bite*)	(po)kušati	kush (kushati)	kutarnā
open mouth (to)	zevat' (*yaw*n)	zijati, zehati (*yawn*)	jeh (jehate)	jābha:nā
pleased, fond of	rad (a)	rad, rada adj.	rata adj.	rat
pleasure, delight	radost' f.	radost f.	rati f.	rati f.
remove (to), separate	ubrat'	odvzeti, odvezati	udvas (udvasayati)	vichchhin honā
setting free	otvjaz (yvanije)	odveza f.	udvāsa m.	
report (to)	obvinit' (*accuse*)	ovaditi	āvid (āvidati)	āvedan karnā
revolve (to), turn	vertet'	vrteti	vṛit (vartate)	vartan karnā
run (to), hasten	bežat'	drveti	dru (dravati)	druti karnā
scream (to)	kričat'	rjuti, kričati	ru (rauti)	ronā
see (to)	videt'	opaziti,paziti	paś (paśyati)	dekanā
sit upon (to)	sidet'	sedeti	sad (sadati, sīdati)	baithnā
shine (to), glitter	bljestet'	blesteti, bleščati	bhlāś (bhlāśati)	ābhās honā
sleep (to)	spat'	spati	svap (svapiti)	sonā
speak (to)	govorit'	govoriti, praviti	bru (bravīti)	prakaḍ karnā
stand (to)	stojat'	stati	sthā (tishṭhati)	sthan lena
stand firm (to)	stojat' trvjordo	stalen (biti)	sthal (sthalati)	
state, condition	sostojanije	stanje n.	sthāna n.	
stop at a place (to)	vstat'	vasovati	vas (vasati)	vasnā
swim (to)	plavat'	plavati	plu (plavate)	tairnā
thirsty (to be)	žaždat'	žejati	jeh (jehati)	pyāsā honā
understand (to)	uvidet' (*to see*)	uvideti	vid (vedati), ave (avaiti)	jananā
violate (to), rob	grabit'	ropati	rup (rupyati) lup (lumpati)	chhīnanā
wake (to)	budit'	buditi	budh (budhyate)	jāgnā
waken (to)	probudit'	prebuditi	prabudh (prabodhayati)	jagānā
ward off (to), hide	vorovat'	varovati, varati	vṛi (varati)	āvaran karnā
yell (to)	kričat'	kričati	kruś (krośati)	chīnkhanā

Life and life sustaining substances

English	Russian	Slovenian	Sanskrit	Hindi
alive	živoj, -a, -o (m., f., n.)	živ, -a, -o (m., f., n.)	jīva m., n. jivā f.	jivā m.
animal	životnoje n.	žival f.	jīvī m.	jīvī m.
cover, membrane	koža (*skin*)	koža f.(*skin, hide*)	kośa m.	kosha
dwelling	ves (*little village*)	vas f.(*village*)	vasa m.	āvās
food	pišča f., jeda f.	živež m., jed f., piča f.	jīvatu (m., n.), adana, pitu m.	jivan
honey	mjod	med m.	madhu n.	madhu
home	dom	dom	dam, dama	dhām
living being	živyje	živina (f.pl.) (*cattle*)	jīvin	jīvī
meat	mjaso n.	meso n.	mās n. = māṅs	māns
raft	plot	splav m.	plava	lattha
seat	sidenje	sedež m.	sadas n.	āsan
skin, hide	sdirat' (*to skin, to flay*)	dreti (*to skin, to flay*)	dṛiti m., kritti f.	
tree	derevo n.	drevo n.	dru, taru m.	taru
wood	drova n.pl.	drva f.pl.	dāru	driksh

Wild Animals and Prey

English	Russian	Slovenian	Sanskrit	Hindi
bear	medved'	medved m.	madhvad (honey eater)	bhālū
bird	ptica, ptaha	ptič m. ptica f.	patat m.	pakshi
deer, wild beast	zver' m.	mrha?, mrhač (*bear*)	mṛiga	mrig
flock	staja (*of birds*)	jata	yūtha	yūth
hunter	ohotnik	ujeda (*bird of prey*)	vyādha	vyādh
louse	voš'	uš f.	yūkā	yūkā
mouse	myš'	miš, miška f.	mūsh m. f., mūshika	mūshak
otter	vydra f.	vidra f.	udra	jalamarjara
wolf	volk m.	volk m.	vṛika	bheṛiā

B) PASTORAL

English	Russian	Slovenian	Sanskrit	Hindi
beef	govjadina f.	goveje meso	gomānsa n.	gomāns
cattle	skot m.	govo, govedo n.	gāva	gāyen
cow	korova f.	krava f.	go, gaus, gava	gāu, gāya.
grass	trava f.	trava f.	triṇa n.	triṇ
herd	stado n.	paša f.	pāśava n.	pashu
herdsman	pastuh	pastir, pašnikar m.	gopa, paśupāla	pashupālak
lamb	jagnjonok m.	bac m., jagnje n.	vatsa	bachchaṛa
master, owner	gospodin,	gospod, gospodar	pati, gopati	pati, gopati

English	Russian	Slovenian	Sanskrit	Hindi
milk (thickened)	syr (*cheese*)	sir m. (*cheese*)	kshīra n.	kshir
mutton	baranina f.	ovčje meso n.	avimānsa n.	gośta
pasture	pastbišče n.	pašnik m.	paśavya n.	pashuchar
ram	baran m.	oven m.	avi	mesh
sheep	ovca f.	ovca f.	avikā	bheṛ
shepherd	ovčar m.	ovnar, ovčar m.	avipāla	charavāhā
wool	šerst' f. / runo n.	volna f., runo n.	urṇā	ūn
yoke	jarmo n. / igo n.	igo n., jug m., jarem m.	yuga	yoktra

C) FARMING

Farmer

English	Russian	Slovenian	Sanskrit	Hindi
farmer	krestjanin m.	kmet m.	krishaka, kshetrī m.	krishaka
plough man	pakhar'm.	orač, oratar, oravec	krishaka, sairika	halvāhā
reaper	žnjec m.	žanjec m, žanjica f.	lavaka, ćhedaka	lavanā
sower	sejatel' m.	sejač, sejavec m.	vaptā m., vijavaptā m.	bīj bonevālā
winnower	vejatel' m.	vejač, vejavec m.	pāvaka	pāvak m.
thresher	molotil'ščik m.	mlatič m.	mardana m.	mardan m.

Field

English	Russian	Slovenian	Sanskrit	Hindi
field	pole n. niva f.	polje n., njiva f.	kshetra n., bhūmi f.	khad
field (ploughed)	pašnja f.	zorana zemlja f.	sītyakshetra n.	
furrow	borozda, pašnja f.	brazda f.	sītā f.	harāī
garden	sad m.	vrt m.	udyana, upavana n.	udyān
manure, dung	navoz m.	gnoj m., sranje n.	gomaya, sāra	gobar

Instruments

English	Russian	Slovenian	Sanskrit	Hindi
plough(wooden)	soha f.	drevo n.	hala n., sīra, gokīla	hal
plough (metal)	plug m.	plug m, oralo n.	lāṅgala n.	lāngala
flail	cep' m.	cep/cepec m.	kaṇḍanī f., musala	mūsal
harrow	borona f.	brana f.	koṭiśa	hengā m.
hoe	motyga f.	motika f.	khanitra, khātra n.	khanitra
mill	mel'nica f.	mlin m.	peshaṇa, ćatra n.	chak-ki
scythe	kosa f.	kosa f.	khaḍgīka, lavitra n.	hansiyā
sickle	serp m.	srp m.	lavitra n. dātra n.	dātrī
threshing-floor	gumno n.	gumno n.	khala m.	khaliyān m.

Products for humans

English	Russian	Slovenian	Sanskrit	Hindi
bread	hleb m.	kruh m.(hleb-*loaf*)	pūpa, abhyusha	rotī
flour	brašno n. muka f.	moka f. (brašno-*food*)	śaktu, godhūmacūrna	āttā
sheaf	snop m.	snop m.	stamba m.	gattha pulindā

Food for animals

English	Russian	Slovenian	Sanskrit	Hindi
forage	korm m.	krma f.	gavādana n.	chārā
grass	trava f.	trava f.	trina n.	ghās
hay	seno n.	seno n.	śushkatriṇa n.	chārā

Agricultural activity verbs and gerunds

English	Russian	Slovenian	Sanskrit	Hindi
furrow (to)	borozdit', pahat'	brazditi	sītam kri, hal (halati)	hal chalānā
harrow (to)	boronit'	branati	koṭikshetrena bhūmim	kri chalānā
harrowing	-	branitva, branitev f.	krashṭanam	hengā chalanā
hoe (to)	motyžit', ryhlit'	okopati, rahljati	khanitreṇa khan (khanati)	khodanā
mill (to)	molot'	mleti	cūrṇ (cūrṇayati)	pīsnā
milling	pomol m.	mletva, mletev f.	cūrṇatva n.	pīsnā
plough (to)	pahat'	orati	halena krish (karshati)	hal chalānā
ploughing	pašnja f.	oratva, oratev f.	halanam	hal chalānā
reap (to)	žat'	žeti	lū (lunāti)	kātnā
reaping, harvest	žatva	žetva, žetev f.	lavanam	lavanā
seed (to)	seyat	dati seme, posejati	vījam dā	bījanā
sow (to)	seyat, zasevat'	sejati	vap (vapati), vapanam kri	bonā
sowing	posev m., sejanje n.	setev f., sejanje n.	vapanam	bonā
thresh (to)	molotit'	mlatiti	dhānyādi mrid	pīṭnā
threshing	molot'ba f.	mlatitva, mlatitev f.	mardanam	pīṭnā
winnow (to)	vejat'	vejati	śudh (śodhayati)	osāvā
winnowing	vejanie n.	vejanje n. vejatev f.	prasphoṭanam	osānā

Cultivated plants

English	Russian	Slovenian	Sanskrit	Hindi
cereals, grain	žito n.	žito n.	dhānya n., sītya n.	dhānyu
barley	jačmen' m.	ječmen m.	yava, yavaka	jav f.
beet	svjokla f.	pesa	pālanga	hukandar
cabbage	kapusta f.	zelje n., kapus m.	śākaprabheda, śāka	bandgobhī
carrot	morkov' f.	koren m.	garjara	gājar
cucumber	ogurec m.	kumara f.	karkaṭī	khīrā
flax	ljon m.	lan m.	atasī, umā, mālikā	san
hemp	konoplja f.	konoplja f.	śaṇa n., bhaṅgā	paṭuā
millet	proso n.	proso n.	aṇu, priyaṅgu	bājrī, juār f.
nut	oreh m.	oreh m.	driḍhaphalam	dhibrī
oats	ovjos m.	oves m.	oṭsangnaka	jaī f.
onion	luk m.	luk m., čebula f.	palāṇḍu, nīćabhojya	pyāj
pea	goroh m.	grah m.	kalāya, hareṇu	maṭar
rowen	otava f.	otava f.	x	
rye	rož' f., žito n.	rž f.	x	
spelt	polba f.	pira f.	x	
swede	brjukva f.	repa f.	x	
turnip	repa f.	repa f.	griññana	shalgam
wheat	pšenica f.	pšenica f.	godhūma	gehūn