

Supplementary Materials

The emergence of bunched vowels from retroflex approximants in
endangered Dardic languages

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Phonemic inventories of Dardic and Nuristani languages

Kalasha (Dardic)

Table 1: Phonemic inventory of Kalasha (Cooper 2005, Heegård & Mørch 2004, Kochetov et al. 2020).

	Bilabial	Dental/Alveolar	Palatalized alveolar	Retroflex	Alveopalatal/Palatal	Velar	Glottal
Plosive	p p ^h b b ^{fi}	t _̱ t _̱ ^h d _̱ d _̱ ^{fi}		ṭ ṭ ^h ḍ ḍ ^{fi}		k k ^h g g ^{fi}	
Affricate		ts ts ^h dz		t͡ʂ t͡ʂ ^h d͡ʂ d͡ʂ ^{fi}	tɕ tɕ ^h dɕ dɕ ^{fi}		
Nasal	m	n		ɳ			
Tap or flap		r					
Fricative	(f)	s z		ʂ ʐ	ɕ ʑ	(x)	h
Approximant	w				j		
Lateral approximant		ɭ	ɭʲ				

i ĩ i˘ i˘̃
e ē e˘ e˘̃
a ã a˘ a˘̃

u ũ u˘ u˘̃
o õ o˘ o˘̃

Dameli (Dardic)

Table 2: Phonemic inventory of Dameli (Perder 2013).

	Bilabial	Dental	Postalveolar	Retroflex	Velar
Plosive	p p ^h b	t t ^h d		ʈ ʈ ^h ɖ	k k ^h g
Affricate		ts	tʃ	tʂ	
Fricative		s z	ʃ ʒ	ʂ ʐ	x ɣ
Nasal	m	n		ɳ	
Tap or flap		r		ɽ	
Approximant	ʋ	l	j	ɻ	

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a:

Kamviri (Nuristani)

Table 3: Phonemic inventory of Kamviri (Nelson 1986, Strand 2011a). Parentheses denote consonants which occur in loanwords.

	Bilabial	Dental	Postalveolar	Retroflex	Velar
Plosive	p b	t d		ʈ ɖ	k ɡ
Affricate		ts dz	tʃ dʒ	ʈʂ ɖʂ	
Fricative	(f) v	s (z)	ʃ (ʒ)	ʂ ʐ	(x) (ɣ)
Nasal	m	n		ɳ	ŋ
Tap or flap		r		ɽ	
Lateral		l			
Approximant			j	ɻ	

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Eastern Kataviri (Nuristani)

Table 4: Phonemic inventory of Eastern Kataviri (Nelson 1986, Strand 2011b). Parentheses denote consonants which occur in loanwords.

	Bilabial	Dental	Postalveolar	Retroflex	Velar	Glottal	Uvular
Plosive	p b	t d		ʈ ɖ	k ɡ		(q)
Affricate		ts	tʃ dʒ	ʈʂ ɖʂ			
Fricative	(f) v	s z	ʃ (ʒ)	ʂ ʐ	(x) (ɣ)	(h)	
Nasal	m	n		ɳ	ŋ		
Tap or flap		r		ɽ			
Lateral		l					
Approximant			j	ɻ			

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e ə o
a

Unlike Kalasha, which has no rhotic approximant phoneme apart from the rhotic vowels, the Nuristani languages it is in contact with have prevocalic and postvocalic retroflex approximants. While the postvocalic retroflex approximants are similar to the sequences that apparently gave rise to Kalasha rhotic vowels, by all accounts they appear as part of vowel-retroflex approximant sequences in these languages, and the retroflex approximants occur in non-postvocalic contexts such as Kataviri /ɽotr/ ‘night’ (Turner 1966 via Di Carlo 2016).

Typological survey

The following table shows the names of all the Indo-Iranian varieties (Indo-Aryan, Iranian, and Nuristani), their geospatial coordinates, and the presence vs. absence (1 = present; 0 = absent) of retroflex approximants (/ɭ ɭʲ/) and flaps (/ɽ ɽʰ/).

	Language	Phylum	Latitude	Longitude	/ɭ/	/ɭʲ/	/ɽ/	/ɽʰ/
1	Aer	Indo-Aryan	25.254	69.029	0	0	1	0
2	Aleppo Domari	Indo-Aryan	36.20237	37.13577	0	0	0	0
3	Assamese (Standard)	Indo-Aryan	26.0876	91.2932	0	0	0	0
4	Awadhi	Indo-Aryan	27.5907	82.4663	0	0	1	1
5	Bagri	Indo-Aryan	28.6036	71.453	0	0	1	0
6	Bahelia	Indo-Aryan	22.08032	82.14089	0	0	1	1
7	Bangla (Standard)	Indo-Aryan	24	90	0	0	0	0
8	Bangru	Indo-Aryan	28.61431	77.21721	0	0	1	0
9	Barpetiya	Indo-Aryan	26.33019	91.00555	0	0	0	0
10	Bateri	Indo-Aryan	34.94633	72.88554	0	0	1	0
11	Bhili	Indo-Aryan	20.85	73.9592	0	0	0	0
12	Bhojpuri Sadani	Indo-Aryan	23.34	85.3	0	0	0	0
13	Bhojpuri (Southern)	Indo-Aryan	26.45846	84.81712	0	0	1	1
14	Bhuyan	Indo-Aryan	21.62756	85.58213	0	0	1	1
15	Bishnapuriya Manipuri	Indo-Aryan	24.62903	93.76665	0	0	0	0
16	Brokskat	Indo-Aryan	34.5308	76.6026	0	0	0	0

17	Bundeli	Indo-Aryan	24.74558	78.82999	0	0	0	0
18	Carua Goalpara	Indo-Aryan	25.53493	89.86263	0	0	0	0
19	Chakma	Indo-Aryan	23.00148	92.339	0	0	0	0
20	Chhattisgarhi	Indo-Aryan	21.24349	81.62508	0	0	1	1
21	Chitwan Tharu	Indo-Aryan	27.54647	84.43301	0	0	0	0
22	Dameli	Indo-Aryan	35.4613	71.71771	1	0	1	0
23	Dang Tharu	Indo-Aryan	27.8834	81.7761	0	0	0	0
24	Dangi (Bhils)	Indo-Aryan	20.78428	73.67278	0	0	0	0
25	Danuwar Rai	Indo-Aryan	27.56	85.03	0	0	0	0
26	Darai	Indo-Aryan	27.8623	84.1357	0	0	0	0
27	Desauriya Tharu	Indo-Aryan	28.10124	81.80566	0	0	0	0
28	Deukhuri Tharu	Indo-Aryan	27.87527	82.5026	0	0	0	0
29	Dhatki	Indo-Aryan	25.17918	69.56882	0	0	1	0
30	Dhivehi	Indo-Aryan	1.928498	73.54433	0	0	1	0
31	Dhundari	Indo-Aryan	26.473	76.198	0	0	1	0
32	Dogri	Indo-Aryan	32.5534	75.7111	0	0	1	0
33	Domaaki	Indo-Aryan	36.3258	74.7984	0	0	1	0
34	Jerusalem Domari	Indo-Aryan	31.7685	35.21268	0	0	0	0
35	Gade Lohar	Indo-Aryan	28.6656	77.18861	0	0	1	0
36	Garhwali	Indo-Aryan	30.5061	78.7201	0	0	0	0
37	Gawarbati	Indo-Aryan	35.1982	71.5428	0	0	1	0

38	Ghatoali	Indo-Aryan	24.37519	87.42831	0	0	1	1
39	Ghullia Goalpara	Indo-Aryan	26.031	89.96627	0	0	0	0
40	Gojari	Indo-Aryan	34.3768	73.1461	0	0	1	0
41	Grangali	Indo-Aryan	34.6485	70.7323	0	0	1	0
42	Gujarati (Standard)	Indo-Aryan	22.687	71.0962	0	0	1	0
43	Hadoti	Indo-Aryan	24.8546	75.8366	0	0	1	0
44	Hajong	Indo-Aryan	25.52436	91.70686	0	0	0	0
45	Halbi	Indo-Aryan	20.3081	81.3742	0	0	0	0
46	Hindi	Indo-Aryan	25.31891	82.98115	0	0	1	1
47	Hindko	Indo-Aryan	34.00044	71.54653	0	0	1	1
48	Indus Kohistani (Bhatise dialect)	Indo-Aryan	34.90849	72.8664	0	0	1	1
49	Indus Kohistani (Kinyawali dialect)	Indo-Aryan	35.7054	73.41552	0	0	1	1
50	Jangli	Indo-Aryan	31.44641	73.01173	0	0	1	1
51	Jaunsari	Indo-Aryan	30.5587	77.9084	0	0	1	0
52	Jharua Goalpara	Indo-Aryan	26.32117	90.44095	0	0	0	0
53	Kacchi	Indo-Aryan	23.83	69	0	0	1	0
54	Kalam Kohistani (Gawri)	Indo-Aryan	35.5303	72.5738	0	0	0	0
55	Kalasha (Bumburet dialect)	Indo-Aryan	35.6415	71.6657	0	0	0	0
56	Kalkoti	Indo-Aryan	35.3651	72.0533	0	0	0	0
57	Kanauji	Indo-Aryan	26.45035	80.31733	0	0	1	1
58	Kangri	Indo-Aryan	31.915	76.366	0	0	1	0

59	Kashmiri	Indo-Aryan	34.16683	74.33046	0	0	0	0
60	Kathoriya Tharu	Indo-Aryan	28.5867	80.8931	0	0	0	0
61	Khandeshi Ahirani	Indo-Aryan	20.96524	75.53569	0	0	0	0
62	Kharia Thar	Indo-Aryan	22.245	83.799	0	0	1	1
63	Khetrani	Indo-Aryan	30.4799	70.2828	0	0	1	1
64	Khowar	Indo-Aryan	36	72	0	0	0	0
65	Konkani	Indo-Aryan	15.41831	73.90778	0	0	0	0
66	Kumauni	Indo-Aryan	29.5622	80.0171	0	0	1	0
67	Kundal Shahi	Indo-Aryan	34.79582	74.19444	0	0	1	0
68	Kupia	Indo-Aryan	18.38702	82.52986	0	0	0	0
69	Kvari (Pahari)	Indo-Aryan	31.20071	78.06368	0	0	1	0
70	Lahndi (Awankari)	Indo-Aryan	33.76941	72.35813	0	0	1	0
71	Lamani	Indo-Aryan	16.5734	76.9717	0	0	0	0
72	Lawatiyya	Indo-Aryan	23.6322	58.4916	0	0	0	0
73	Lodhi (Midnapur)	Indo-Aryan	22.42553	87.31931	0	0	1	1
74	Magahi	Indo-Aryan	25.0915	85.3335	0	0	1	1
75	Mahl	Indo-Aryan	10.91367	72.67851	0	0	1	0
76	Maithili	Indo-Aryan	26.3817	86.2211	0	0	0	0
77	Malhoriya	Indo-Aryan	28.51034	81.10905	0	0	0	0
78	Malpahariya	Indo-Aryan	24.37519	87.42831	0	0	1	1
79	Malvi (Central)	Indo-Aryan	23.17636	75.78557	0	0	0	0

80	Malvi (Rajwadi)	Indo-Aryan	23.33144	75.03743	0	0	0	0
81	Malvi (Sondhwadi)	Indo-Aryan	23.42712	76.27289	0	0	0	0
82	Malvi (Umathwadi)	Indo-Aryan	24.00752	76.72822	0	0	0	0
83	Mandeali	Indo-Aryan	31.5425	77.0419	0	0	0	0
84	Mankiyali	Indo-Aryan	34.31748	73.15548	0	0	1	0
85	Marathi	Indo-Aryan	17.9344	76.6665	0	0	0	0
86	Marwari (Indian)	Indo-Aryan	27.002	75.0656	0	0	1	0
87	Marwari (Northern, Pakistan)	Indo-Aryan	28.41633	70.30312	0	0	1	0
88	Marwari (Southern, Pakistan)	Indo-Aryan	26.04137	68.9473	0	0	1	0
89	Mewari	Indo-Aryan	24.57	73.68	0	0	1	0
90	Mewati	Indo-Aryan	27.736	76.947	0	0	1	0
91	Morang Tharu	Indo-Aryan	26.63624	87.47743	0	0	0	0
92	Naibariya Kampur	Indo-Aryan	26.44575	91.4399	0	0	0	0
93	Nepali	Indo-Aryan	28	85	0	0	0	0
94	Odki	Indo-Aryan	27.53636	67.84754	0	0	1	0
95	Oriya (Standard)	Indo-Aryan	20.46662	85.88663	0	0	0	0
96	Pahari	Indo-Aryan	34.35909	73.49501	0	0	1	0
97	Pahariya	Indo-Aryan	22.89233	86.21702	0	0	1	1
98	Palasbaria Kampur	Indo-Aryan	26.12125	91.54089	0	0	0	0
99	Palula	Indo-Aryan	35.5096	71.8421	0	0	1	0
100	Pangwali	Indo-Aryan	32.9753	76.5569	0	0	1	0

101	Parkari	Indo-Aryan	24.486	69.9423	0	0	1	0
102	Pashai (Darra-i-Nur)	Indo-Aryan	34.71131	70.16884	0	0	1	0
103	Punjabi (Lyallpuri, Western)	Indo-Aryan	31.43393	73.07899	0	0	1	0
104	Rajbanshi	Indo-Aryan	26.52195	88.03858	0	0	0	0
105	Rana Tharu	Indo-Aryan	28.6483	80.4419	0	0	0	0
106	Rathawi	Indo-Aryan	22.309	73.186	0	0	1	0
107	Romani (Mitrovica)	Indo-Aryan	38.11977	13.36417	0	0	0	0
108	Sambalpuri (Western Oriya)	Indo-Aryan	21.46524	83.97522	0	0	0	0
109	Sansiboli	Indo-Aryan	28.7364	72.6838	0	0	1	0
110	Saptariya Tharu	Indo-Aryan	26.60889	86.74079	0	0	0	0
111	Saurashtra (Northern Tirupati)	Indo-Aryan	13.63516	79.41328	0	0	0	0
112	Saurashtri (Southern)	Indo-Aryan	9.99	77.94	0	0	0	0
113	Sawi	Indo-Aryan	35.16729	71.4604	0	0	1	0
114	Shekhawati	Indo-Aryan	27.34	75.407	0	0	1	0
115	Shina (Gilgiti)	Indo-Aryan	34.6515	75.287	0	0	1	0
116	Shina (Gurezi)	Indo-Aryan	34.65198	74.73554	0	0	1	0
117	Shumashti	Indo-Aryan	34.4756	70.5696	0	0	1	0
118	Sindhi	Indo-Aryan	26	69	0	0	1	0
119	Sinhala	Indo-Aryan	8	81	0	0	0	0
120	Siraiiki	Indo-Aryan	29.5534	71.906	0	0	1	1
121	Sylheti	Indo-Aryan	24.83724	92.25347	0	0	1	1

122	Tharadri	Indo-Aryan	25.28633	69.24985	0	0	1	0
123	Torwali	Indo-Aryan	35.14066	72.57615	0	0	1	0
124	Urdu	Indo-Aryan	25	67	0	0	1	0
125	Ushojo	Indo-Aryan	35.12754	72.60976	0	0	1	0
126	Vaagriboli	Indo-Aryan	12.215	79.5335	0	0	1	0
127	Vagher (Okhamandal)	Indo-Aryan	22.46713	69.07239	0	0	1	1
128	Wadiyara	Indo-Aryan	26.0713	72.1312	0	0	1	0
129	Wagdi	Indo-Aryan	23.84147	73.71452	0	0	0	0
130	Zargari	Indo-Aryan	36.056	50.38167	0	0	0	0
131	Badakhshani	Iranian	36.95089	71.14553	0	0	0	0
132	Bakhtiari	Iranian	31.96296	49.28748	0	0	0	0
133	Balochi (Eastern)	Iranian	28	62	0	0	1	0
134	Bandari	Iranian	27.18164	56.26589	0	0	0	0
135	Chali Tati	Iranian	35.89783	49.77159	0	0	0	0
136	Danesfani Tati	Iranian	35.81241	49.74392	0	0	0	0
137	Dari	Iranian	31.0405	67.3593	0	0	0	0
138	Dezfuli	Iranian	32.38308	48.42036	0	0	0	0
139	Ebrahim-Abadi Tati	Iranian	35.81853	49.87443	0	0	0	0
140	Esfarvarini Tati	Iranian	35.93595	49.74928	0	0	0	0
141	Eshtehardi Tati	Iranian	35.72442	50.36567	0	0	0	0
142	Gilaki	Iranian	37.1344	49.8359	0	0	0	0

143	Hamdan (Jewish dialect)	Iranian	34.29327	48.794	0	0	0	0
144	Hawrami	Iranian	35.26251	46.06212	0	0	0	0
145	Ishkashimi	Iranian	36.67	71.55	0	0	0	0
146	Jawshaqani	Iranian	33.59086	51.21255	0	0	0	0
147	Juhuri	Iranian	42.06255	48.29084	0	0	0	0
148	Keshmi	Iranian	26.81261	55.89464	0	0	0	0
149	Khalkhal	Iranian	37.42828	48.17929	0	0	0	0
150	Khufi	Iranian	37.89054	72.2098	0	0	0	0
151	Koroshi	Iranian	29.441	53.008	0	0	0	0
152	Kumzari	Iranian	26.1602	56.4202	1	0	0	0
153	Kurdish (Sanandaji)	Iranian	35.3194	46.99287	0	0	0	0
154	Kurdish (Sorani)	Iranian	35.55894	45.4348	0	0	0	0
155	Kurdish (Kurmanji)	Iranian	38.15308	42.95949	0	0	0	0
156	Kurdish (Mukri)	Iranian	36.76764	45.72447	0	0	0	0
157	Luri (Southern)	Iranian	31.95969	50.5124	0	0	0	0
158	Madagalashti	Iranian	35.66369	71.91755	0	0	0	0
159	Mazandarani	Iranian	36.241	52.3009	0	0	0	0
160	Meimei	Iranian	33.44715	51.17156	0	0	0	0
161	Munji	Iranian	35.9321	70.9404	0	0	0	0
162	Ormuri	Iranian	32.6819	69.3444	0	0	1	0
163	Parachi	Iranian	36.0432	70.8805	0	0	1	0

164	Pashto (Central)	Iranian	31.9153	69.4529	0	0	1	0
165	Persian (Tehran)	Iranian	35.69983	51.39258	0	0	0	0
166	Rushani	Iranian	37.90267	72.16774	0	0	0	0
167	Sabzevari	Iranian	36.21604	57.66756	0	0	0	0
168	Sagz-abadi (Tati)	Iranian	35.76913	49.93851	0	0	0	0
169	Sanglichi	Iranian	36.45	71.3	0	0	0	0
170	Sarikoli	Iranian	37.905	75.1449	0	0	0	0
171	Shabaki	Iranian	36.375	43.144	0	0	0	0
172	Shughni	Iranian	37.5018	71.7925	0	0	0	0
173	Sivandi	Iranian	30.08	52.92	0	0	0	0
174	Tajiki	Iranian	38.8213	68.5549	0	0	0	0
175	Takestani Tati	Iranian	36.07179	49.70045	0	0	0	0
176	Taleshi	Iranian	38.23987	48.30021	0	0	0	0
177	Talysh (Northern)	Iranian	39.04314	48.60333	0	0	0	0
178	Wakhi	Iranian	36.30526	74.82358	0	0	0	0
179	Wanetsi	Iranian	30.0501	67.8327	0	0	1	0
180	Xiaraji (Tati)	Iranian	35.85087	49.71945	0	0	0	0
181	Xoznini (Tati)	Iranian	35.86135	49.75665	0	0	0	0
182	Yagnobi	Iranian	39.1486	69.2422	0	0	0	0
183	Yazghulami	Iranian	38.2801	71.565	0	0	0	0
184	Yidgha	Iranian	36.014	71.5077	0	0	1	0

185	Zazaki	Iranian	37.75341	39.31956	0	0	0	0
186	Ashkun	Nuristani	34.84277	70.37453	1	0	1	0
187	Kamviri	Nuristani	35.68102	71.63731	1	0	1	0
188	Kataviri (Eastern)	Nuristani	35.6837	71.63895	1	0	0	0
189	Kataviri (Western)	Nuristani	35.4145	70.9826	1	1	1	0
190	Mumviri	Nuristani	35.68108	71.64034	1	0	1	0
191	Prasun	Nuristani	35.1731	70.8004	0	0	0	0
192	Waigali	Nuristani	35.0358	70.9761	1	0	1	0

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