Supplementary Tables

A. Worldwide reports on prevalence of *T. multiceps* in dogs

Country/region	Dog origin	No. tested	No. positives (%)	Identified stage	Identification method	Reference
Afrtica **Algeria** Constantine, Batna	Stray	127	15 (11.8)	Adult	Morphology	Bentounsi et al., 2009
Kenya Turkana, Maasai Mara, Isiolo and Meru	Stray	1621	55 (3.4)	Eggs	PCR	Mulinge et al. 2020
South Africa Cape Province and Orange Free State	Stray	502	19 (3.8)	Adult	Morphology	Verster, 1979
Zambia Lusaka and Eastern	Stray	38*	3 (7.8)	Eggs	PCR and sequencing	Nonaka et al., 2011
Tunisia Jendouba, Béjà	Stray	314	15 (4.8)	Adult	Morphology	Lahmar et al., 2008
Raoued, Soukra	Stray	271	9 (3.3)	Adult	Morphology	Lahmar et al., 2017
Americas Uruguay	Herding	303	10 (0.3)	Adult	Morphology	Cabrera et al., 1996
Australia Melbourne	Stray Urban dogs Stray Rural dogs	174 59	None	Adult	Morphology	Pullar, 1946
Asia **Jordon** Irbid, Mafraq, Amman, Zarqa, Karak, Aqaba	Stray	340	13 (3.8)	Adult	Morphology	El-Shehabi et al., 1999
China Heilongjiang	Herding	178	4 (2.3)	Adult	Morphology	Wang et al., 2006
Qinghai	Herding	277	2 (0.9)	Egg	PCR	Guo et al., 2014
Hunan	Herding	438	64 (14.6)	Adult	Morphology	Dai et al. (2009)
Iran Khuzestan	Stray	23	1 (4.3)	Adult	Morphology	Farahnak et al., 1998
Mazandaran	Stray	30	3 (10.0)	Adult	Morphology	Gholami et al.,

						1999
Tehran	Housed	140	20 (14.4)	Adult	Morphology	Mirzayans et al., 1972
Kashan	Stray	70	3 (4.3)	Adult	Morphology	Arbabi et al., 2004
Isfahan	Stray	105	30 (28.5)	Adult	Morphology	Hejazi et al., 2004
Azarbaijan, Kordestan, Kermanshah	Stray	83	4 (4.8)	Adult	Morphology	Dalimi et al. 2006
Mashhad, Khorasan	Stray	100	2 (2.0)	Adult	Morphology	Razmi et al., 2006
Semnan	Stray	50	5 (10.0)	Adult	Morphology	Eslami et al., 2010
Ilam	Stray	65	12 (18.5)	Adult	Morphology	Abdi et al., 2013
Chaharmahal, Bakhtiari	Stray	14	3 (21.4)	Adult	Morphology	Nabavi et al., 2014
Lorestan	Stray	80	20 (25.0)	Adult	Morphology	Parsa et al., 2014
Tabriz	Stray	40	9 (22.5)	Adult	Morphology	Yagoob et al., 2014
Mashhad	Stray	90	11 (12.2)!	Adult	Morphology	Emamapour et al., 2015
Bojnurd	Stray	32	8 (25.0)	Adult	Morphology	Arzmani et al., 2016
Zabol	Stray	30	2 (6.7)	Adult	Morphology	Geraili et al., 2016
Mazandaran	Stray	42	2 (4.8)	Adult	Morphology	Amouei et al., 2018
Khuzestan	Stray	167	5 (3.0)	Eggs	PCR	Beiromvand et al., 2018
India Bihar	Stray	36	2 (5.6)	Adult	Morphology	Kumar and Sahai, 1972
Europe **Russia** Altali	NS	72	0.85%	Adult	Morphology	Luneva, 2014
Azerbaijan	Stray	156	NS	Adult	Morphology	Ibrahimova et al., 2015
Russia	NS	794	124 (15.6)	Adult	Morphology	Moskvina and Ermolenko, 2016
Spain Aragon	Stray	42	2 (4.7)	Adult	Morphology	Arriolabengoa et al., 1992
Italy	Herding	648	10 (1.5)	Eggs	PCR	Morandi et al., 2020
Turkey Ankara	Stray	33	4 (12.1)	Adult	Morphology	Zeybek et al., 1992

Kayseri	Stray	50	2 (4.0)	Adult	Morphology	Şahin et al., 1993
Konya	Stray	60	13 (21.7)	Adult	Morphology	Aydenizöz, 1997
Kars	Stray	42	3 (7.1)	Adult	Morphology	Umur and Özkan, 1998
UK Snowdonia	Herding	485	17 (3.5)	Adult	Morphology	Edwards et al., 1979
Different	Herding	289	10 (3.5)	Adult	Morphology	Cook and Clarkson, 1971
Dyfed	Herding	396	40 (10.1)	Adult	Morphology	Williams, 1976a
Dyfed	Hunting	522	41 (7.5)	Adult	Morphology	Williams, 1976b
Wales	Hunting	164	2 (0.6)	Adult	Morphology	Stallbaumer, 1987
Wales Powys	Herding	882	15 (1.7)	Adult	Morphology	Jones and Walters, 1992a
Wales Powys	Herding	875	4 (0.5)	Adult	Morphology	Jones and Walters, 1992b

B. Worldwide reports on prevalence of *Taenia multiceps* in red fox (*Vulpes vulpes*), kit fox (*Vulpes mecrotis*), grey fox (*Pesudalopex culpaeus*) and sand fox (*Vulpes ferrilata)*

Country/region	Fox species	No. tested	No. positives (%)	Identified stage	Identification method	Reference
Azerbaijan	NS	112	NS	Adult	Morphology	Ibrahimova et al., 2015
Bulgaria north-western	Red fox	243	2 (0.8)	Adult	Morphology	Jančev and Ridjakov (1978)
Blagoevgrad, Burgas, Varna, Vidin, Kyustendil, Lovech, Montana, Pernik, Silistra, Sofia, Sofia region, Targovishte and Yambol	Red fox	53	4 (7.5)	Adult	Morphology	Radev et al., 2013
China Qinghai	Red fox	27	None	Adult	PCR	Li et al., 2013
	Sand fox	9	2 (22.2)	Adult	PCR	
Czechoslovakia	Red fox	41	4 (10)	Adult	Morphology	Kozman and Schanzl, 1962
Germany Berlin	Red fox	60	3 (5)	Adult	Morphology	Saar, 1957
Arnsberg, Detmold, Kassel	Red fox	397	13 (3.3)	Adult	Morphology	**Ballek et al., 1992**
Iran Kashan	NS	22	4 (18.2)	Adult	Morphology	Arbabi et al., 2004
Italy Modenese Apennines	Red fox	23	1 (4.4)	Adult	Morphology	Soldati et al., 1976
Sardinia Island	Red fox	63	4 (6.3)	Adult	Morphology	Varcasia et al., 2015
Poland Lublin voivodships	Red fox	68	2 (2.9)	Adult	Morphology	Furmaga and Wysocki, 1951
Peru Central Indes		20	4 (20.0)	Adult	Morphology	Moro et al., 1998

	Grey fox					
Romania Transylvania	Red fox	561	26 (4.6)	Adult	Morphology	Barabási et al., 2010
Switzerland	Red fox	809	3 (0.4)	Adult	Morphology	Wandeler and Hörning, 1972
Turkey Kars	Red Fox	20	2 (10.0)	Adult	Morphology	Gicik et al., 2009
USA New Mexico	Kit fox	53	1 (1.9)	Adult	Morphology	Ubelaker et al., 2014
Wales Carmarthen, Pembroke	Red fox	149	1 (0.7)	Adult	Morphology	Williams, 1976
Mid Wales	Red fox	280	5 (1.8)	Adult	Morphology	Hackett and Walters, 1980

C. Worldwide reports on prevalence of *Taenia multiceps* in the grey wolves (*Canis lupus*)

Country/region	No. tested	No. positives (%)	Identified stage	Identification method	Reference
Azerbaijan different	35	5 (14.3)	Adult	Morphology	Fataliyev, 2011
Canada North, West	191	3 (1.6)	Adult	PCR	Schurer et al., 2016
Croatia Gorski Kotar	400	2 (0.5)	Egg	PCR	Hermosilla et al., 2017
Estonia different regions	26	7 (27.0)	Adult	Morphology	Moks et al., 2006
Iran					
Central West	4	1 (25.0)	Adult	Morphology	Hashemi et al., 2014
Chaharmahal, Bakhtiari	4	1 (25)	Adult	Morphology	Nabavi et al., 2014
Kashan	10	4 (40.0)	Adult	Morphology	Arbabi et al., 2004
Italy					
different	89	8 (9)	Adult	Morphology	Guberti et al., 1993
Latvia	34	16 (47.1)	Adult	Morphology	Bagrade et al., 2009
Piedmont	42	32 (76.2)	Adult	Morphology	**De Macedo et al. 2020**
Serbia	102	4 (3.9)	Adult	Morphology	**Ćirović et al., 2015b**
Spain, Portugal	22	NS	Adult	Morphology	Torres et al., 1996
Spain Asturias, Galicia, Castilla	47	14 (29.8)	Adult	Morphology	Segovia et al., 2001*
Spain different	50	14 (28.0)	Adult	Morphology	Segovia et al., 2003*
Ukraine	NS	NS	Adult	Morphology	Kornyushin et al., 2011
USA					
Alaska	78	23 (29.0)	Adult	Morphology	Rausch and Williamson, 1959

*It seems that both reports used the same data

D. Worldwide reports on prevalence of *Taenia multiceps* in golden jackals (*Canis aureus*)

Country/region	No. tested	No. positives (%)	Identified stage	Identification method	Reference
Bangladesh	30	3 (10.0)	Adult	Morphology	Shaikh et al., 1982
Iran Mazandaran	16	2 (12.5)	Adult	Morphology	Amouei et al., 2018
*Mazandaran	45	2 (4.4)	Adult	Morphology	Gholami et al., 1999
Kashan	40	3 (7.5)	Adult	Morphology	Arbabi et al., 2004
***Serbia** different	447	7 (1.6)	Adult	Morphology	Ćirović et al., 2015a
***Bulgaria**	13	1 (7.7)	Adult	Morphology	Trifonov et al., 1970
Bulgaria North-West	11	1 (9.1)	Adult	Morphology	Kamenov et al., 2009
Azerbaijan	107	NS	Adult	Morphology	Ibrahimova et al., 2015
Azerbaijan different	98	8 (8.2)	Adult	Morphology	Fataliyev, 2011
India	NS	NS	NS	NS	Acharjyo, 2004
Kazakhstan	18	2 (11.1)	Adult	Morphology	Musabekov, 2008
Russia	NS	39.1%	Adult	Morphology	Atalay, 2010
Ukraine	NS	NS	Adult	Morphology	Kornyushin et al., 2011

E. Prevalence of *Taenia multiceps* cysts (*Coenurus cerebralis*) in sheep, goats and cattle worldwide.

Country	Region	Host	Study type	Age Range	No. tested	No. Positive (%)	Cyst location	Reference
Bangladesh	Variable	goats	Slaughterhouse	5 mo-> 18 mo	3036	192 (6.3)	Brain and abdominal muscles[3]	Islam et al., 1995
Brazil	Rio Grande do Sul	sheep	Postmortem	lambs	24	1 (4.2)	Brain	Almeida et al., 2018
Egypt	Dakahlia	sheep	Slaughterhouse	6-12 mo 1-2 yr >2 yr	151	11 (7.3)	Brain	Abu-Elwafa et al., 2009
	Cairo	sheep and goats	Slaughterhouse	NS	50	0	-	Desouky et al., 2011
	Sharkia		Postmortem		25	25 (100)	Left hemisphere (48%), right hemisphere (40%) and cerebellum (12%)[4]	
	Suez	sheep	Postmortem	< 1 yr - > 3 yr	60	11 (18.3)	Left cerebral hemisphere, Right cerebral hemisphere, Right side of the cerebellum[4]	Anwar et al., 2013
	El Menoufia	sheep	Slaughterhouse (Observation of clinical signs[a], postmortem[b])	NS	3668	420 (11.45)[a] 111 (3.03) [b]	one cyst in either hemisphere (95.49%), one cyst in each hemisphere (3.6%), disseminated in cerebrum, cerebellum and brain stem (0.9%)[4]	Amer et al., 2017
Ethiopia	Debre Berhan	sheep	Postmortem	4 to 96 mo	37 sick 183 healthy	37 (100) 5 (2.7)	Right cerebral hemisphere (57%), left cerebral hemisphere (43%), cerebellum (4%)[4]	Achenef et al., 1999
	Elfora, Hashim and Luna	sheep	Slaughterhouse	NS	738	(5) 0.7%	NS	Abdella 2006 Asmare et al., 2016[5]
		goats	Slaughterhouse	NS	738	(28) 3.8%		
	Debre Zeit	Sheep	Slaughterhouse	< 1.25 yr > 1.25 yr	648	22 (3.4)	Brain	Jibat et al., 2008
		goats		< 1 yr > 1 yr	974	68 (7)	Brain	
	Addis Ababa	sheep	Postmortem	NS	445	21(4.7)	cerebral hemisphere (94.4%), middle and hind cerebellar hemisphere (5.4%)[4]	Deressa et al., 2012

			Slaughterhouse	NS	10,760	693 (6.4)	NS	
	Oromia	Sheep	Slaughterhouse	NS	451	29 (6.4)	Brain	Regassa et al., 2013
		goats			674	14 (2.1)		
	Legahida	sheep	Slaughterhouse	<2 yr - >4 yr	111	23 (20.7)	Cerebrum (88.4%), cerebellum (10.5%), and median fissure (1.16%)[4]	Aliye and Deressa 2017
		Goats			301	29 (9.63)		
	Oromia	Sheep goats	Slaughterhouse	NS	162 512	14 (8.6) 31 (6.02)	right cerebral hemisphere, left cerebral hemisphere and cerebellum	Diba and Garoma 2021
Greek	Thessaly	sheep	Questionnaire	hoggets (up to 1 yr) and adult sheep (> 1yr)	74 flocks	57 cases in 15 flocks (20.27)	NS	Christodoulopoulos et al., 2008
Hungary	Budakeszi and Gyarmatpuszta	Sheep (Ovis musimon)	Postmortem	NS	17	1 (5.9)	Brain	Murai and Sugár, 1979
India	Tamil Nadu	sheep	Slaughterhouse	variable	122	15 (12.3)	Cerebrum (66.67%), cerebellum (26.67%) and on spinal cord (6.67 %)	Soundararajan et al., 2017
Iraq	Abogreb	sheep	Postmortem	<1 yr - >3 yr	1083	2.68%	NS	Alani and Belli 2010
		goats			414	0%	-	
	Thi-Qar	sheep	Observation of clinical signs, postmortem	NS	1610	212 (13.29)	right and left hemispheres and at the bottom of the brain	Gatie et al., 2018
	Nineveh	sheep	Butchers slaughtering	<1 yr - ≥3 yr	136	31 (22.8)	NS	Mohammed, 2020
	Baghdad, Wasit, and Nineveh	Sheep goat	Observation of clinical signs, blood-PCR	<1 yr - ≥3 yr	49 27	13 (26.53) 5 (18.52%)	-	Ajaj et al. 2021
Iran	Fars	sheep	Observation of clinical signs, postmortem	NS	406	5 (1.2)	Different locations in brain, the lumber region of the spinal cord in 1 case	Moghaddar 2007
	Urmia	sheep	Slaughterhouse	0.5 yr- >4 yr	402	75 (18.65)	left (54.63%) and right hemispheres (40.20%) and cerebellum (5.15%)[4]	Tavassoli et al., 2011

	Kerman	goats	Slaughterhouse	NS	25739	2 (0.008)	The occipital lobe of the right hemisphere, cerebrum near the olfactory lobe, parietal lobe of the left cerebrum	Kheirandish et al., 2012
	Tehran, Alborz and Qom	sheep	food processing companies	NS	4500	114 (2.5)	NS	Rostami et al., 2013[b]
	Urmia	sheep	Observation of clinical signs, postmortem	5-8 mo	10 sheep herds	NS	cerebral hemispheres	Jalilzadeh-Amin et al. 2021
Italy	Sardinia	sheep	Slaughterhouse	6 mo - 10 yr	566	2 (0.35)	Temporal and aboral cortex	Scala et al., 2007
			Questionnaire, postmortem	3–36 mo*	54 farms	120 cases	Cortex (80.6%), Cerebellum (7.3%), Thalamus (5.7%), Basal nucleus (2%), Mesencephalon (1.7%), Medulla oblongata (1.3%), Obex (0.7%), Spinal cord (0.7%)	
	Sardinia	sheep	Postmortem	10–13 mo	68	27 (39.7)	Migratory lesions were found in 23 sheep (85.1%), cystic lesions in 3 sheep (11.2%) and both lesions were found in 1 sheep (3.7%).	Paltrinieri et al. 2010
	Sassari, Sardinia	Sheep Goats Cattle mouflon	Questionnaire, postmortem	6–36 mo	NS	86 4 1 1	brain (n = 102), spinal cord (n = 2) and the cerebellum (n = 14)[4].	Varcasia et al., 2016
	Sardinia	sheep	Observation of clinical signs and postmortem	>12 mo[a] 1-30 d[b]	600 ewes[a] 30 lambs[b]	26 cases (25 d- 6 yr)	cortex and in the midbrain	Pintus et al., 2018
Jordan	Irbid, Ramtha and Howarra	sheep	Slaughterhouse	<1 yr - ≥5 yr	451	12 (3)	NS	Abo-Shehada et al., 2002
			Questionnaire		95 flocks	42 cases	-	
Mozambique	Tete	goats	Slaughterhouse	NS	142	12 (8.5)	NS	Afonso et al., 2011
Oman	Salalah	goats	Observation of clinical signs and postmortem	adults	780	130 (16.6)	Right cerebral hemisphere (Parietal, Occipital and Frontal Lobe); Left cerebral hemisphere (Parietal, and Frontal Lobe) and Cerebral hemisphere median	El-Neweshy et al., 2019

							fissure, Cerebellum	
Syria	variable	sheep	Observation of clinical signs, postmortem	6mo-1 yr 1 yr-6 yr	5044	99 (1.9)	left cerebrum (47.5%), right cerebrum (32.3%), longitudinal fissure (10.1%), cerebellum (8.08%) and the olfactory bulbs (2.02 %)[4]	Al-Omar et al., 2016
Tanzania	Ngorongoro	sheep	Slaughterhouse	≤1 yr 1-2 yr ≥2 yr	90	41 (45.6)	Right hemisphere (56.1%), Left hemisphere (41.5%), Cerebellum (2.4%)	Miran, 2013 and Miran et al., 2015
		Goats			90	39 (43.3)	Right hemisphere (46.2%), Left hemisphere (46.2%), Cerebellum (7.7%)[4]	
	Arusha	Sheep	Questionnaire, Observation of clinical signs, postmortem	variable	474	5962 (23.6)[1] 561 (2.2)[2]	Brain (cerebrum, cerebellum and brain stem), or spinal cord in 30 cases from both	Hughes et al., 2019
		goats				4722 (25.8)[1] 423 (2.3)[2]		
Turkey	Kars	sheep	Slaughterhouse	1 yr - ≥3 yr	387	60 (15.5)	cerebral hemispheres (96.7%) and cerebellum (3.3%).	Gicik et al., 2007
	Konet	sheep	Slaughterhouse	6 mo- ≥4 yr	624	102 (16.4)	Right cerebrum (Parioto-occipital 12.76%, Frontal 14.18%, Temporal 16.31%), Left cerebrum (Parioto-occipital 17.02%, Frontal 14.89%, Temporal 14.89%), cerebellum (9.93%)[4]	Uslu and Guclu, 2007
	Erzurum	cattle	Slaughterhouse	Adult	1045	5 (0.47)	vermis cerebelli of cerebellum in 1 case, the occipital section of left cerebral hemisphere, the gyrus marginalis of left cerebral hemisphere, the right cerebral hemisphere between frontal and temporal sections and the right cerebral hemisphere between occipital and temporal sections, respectively in 4 cases.	Avcioglu et al., 2011
	Kirikkale	sheep	slaughterhouse	NS	100	12 (12)	cerebral hemispheres (right side	Gökpınar and

							frontal and occipital lobes are most infected (77.8%)) and the cerebellum (16.7%)	Yıldız, 2012
	Bingöl	Cattle	Observation of clinical signs and postmortem	NS	60	15 (25)	left frontal lobe	Gazioglu et al., 2017
		sheep			80	38 (47.5)	Right cerebellar hemisphere	
	Van	sheep	Slaughterhouse	0-1 yr to over 2 yr	241	156 (64.7)	left hemisphere (46.8%), right hemisphere (32.1%), both hemispheres (12.2%), cerebellum (5.1%) and occipital region (3.8%)[4]	Bİçek et al., 2019

Abbreviation; mo =month; yr = year; NS = not stated.

* Age of positive cases not examined

[1]Twelve-month period prevalence of farmer-reported neurological syndrome in sheep and goats.

[2]Point prevalence (household and individual) of farmer-reported neurological syndrome in sheep and goats.

[3] *Coenurus gaigeri* may be the correct species infecting the abdominal muscles

[4]organs are in order according to infection rate

[5]data on the reference Abdella 2006 was extracted from the review of Asmare et al., 2016.

F. Case reports on of *Taenia multiceps* cerebral coenurosis in various animals worldwide

Country	Region	Host	Cases no.*	Age Range	Cyst location	Reference
Brazil	Mato Grosso do Sul	sheep	1	18-mo female	The telencephalic portion of the right cranial lobe	Batista et al., 2010
	Universitário da Região da Campanha	sheep	1	ram	The base of the brain, in the region of the thalamus and third ventricle	Júnior et al. 2021
China	Qinghai Tibetan	yak	1	1.5-yr male	NS	Zhang et al., 2019
Egypt	South Valley	sheep	1	3.5 yr female	left lateral ventricle	Haridy et al., 2013
	South Valley	sheep	1	4 yr female	The perioptic nerve fat	Haridy et al., 2014
	Assiut	sheep	1	2.5 yr female	The subarachnoid space and protruding into the lateral ventricle	Hassanein and Elghaffar, 2016
Greece	Thessaloniki	sheep	2	18 mo female 2 yr female	left lateral ventricle, left cerebral hemisphere	Papaioannou et al., 2013
India	Hisar	cattle	1	5 yr female, pregnant with dystocia	Delivered dead fetus with Coenurous cerebralis cyst covering head.	Singh et al., 2011
	Jaipur	goat	1	12 mo female	right cerebral hemisphere and liver	Godara et al., 2011
	Rajasthan	goat	5	NS (2males +3females)	occipital region	Singh et al. 2016
	Makhdoom	goat	1	5 mo female	visceral cavity including heart, diaphragm, thoracic cavity, abdominal cavity and pelvic inlet	Gururaj et al., 2019
Israel	Ramon Crater west Negev	Nubian ibex	2	3–4 yr male Young female	Case 1: left frontal lobe, temporal and piriform lobes Case 2: the caudal fossa	Merbl et al., 2014
Iran	Shiraz	sheep	5	NS	in different locations in brain and the lumber region of the spinal cord	Moghaddar (2007a)
	Shahrekor	goat	1	18-mo, male	right cerebral hemisphere	Nourani and Kheirabadi 2009
	Urmia	sheep	3	1 yr ram 7 mo lambs (2)	cerebrum and cerebellum	Hobbenaghi et al., 2014
	Thessaloniki	sheep	1	2.5 mo lamb	brainstem parenchyma and cerebellum	Ioannidou et al., 2015
	Tehran	goat	1	2 yr female	occipital lobe of the right hemisphere and the superior colliculi	Dezfouli et al., 2019
	NS	sheep	1	6 mo	one cyst in each of the frontal and occipital lobes, two cysts in parietal and temporal lobes, three	Gholami et al. 2020

					cysts in cerebral white matter, and one cyst in the cerebellum	
	Lorestan	sheep	5	6 mo- 1 yr	the ventricles of the brain	Mohammadi et al. 2021
Ireland	Dublin	sheep	1	5-mo female	cerebrocortical	Doherty 1989
Italy	Sassari	sheep	24	1-3 yr	rostro-tentorial position (frontal-parietal; parietal-temporal occipital; frontal-parietal-occipital lobes; hemisphere), caudo-tentorial position (left intraventricular; cerebellum; brainstem)	Zobba et al., 2014
	Sassari	Sheep goat	2 1	4 mo males	In sheep: left parietal lobe, close to the left side of the falx cerebri, on the right temporal lobe, on the right frontal lobe; left frontal lobe. In goat: cysts were located in the right parietal lobe, the left side of the cerebellum, and in the fourth ventricle.	Evangelisti et al. 2016
Japan	Hokkaido	cattle	1	1 yr female	Lateral ventricle	Yoshino and Momotani, 1988
Korea	Gangwon-do	goat	1	10 yr male	left cerebral hemisphere	Ahn et al. 2021
Russia	Moscow	bison bull	1	1.5 yr male	brain	Kosminkov et al., 2016
Saudi Arabia	Taif	sheep	1	20 mo female	The caudal portion of the cerebellum	Qassim et al., 2017
Turkey	Antalya	sheep	12	1–5 yr	Commonly localized in the parietal and frontal lobes of the brain and in the cerebellum. In two cases, cysts were on the lumbar aspect of the medulla spinalis	Ozmen et al. 2005
	Van	cattle	1	10-mo male	The caudal of the left cerebral hemisphere	Özkan et al., 2011
	Erzurum	cattle	3	6, 9, 11 mo males	vermis cerebelli of cerebellum, right cerebral hemisphere, occipital section of left cerebral hemisphere and the gyrus marginalis of left cerebral hemisphere.	Avcioglu et al. 2012
	Antalya	goat	1	2 yr, male	lumbar region of spinal cord	Oge et al., 2012
	Kars	cattle	4	7-16 mo	Cerebrum, parietal, frontal lobes and parietal-occipital lob	Gökçe et al., 2013
	Erzurum	cattle	1	2 yr bull	the ventral region of left cerebral hemisphere	Kirbas et al., 2017
	Siirt	goat	1	2 yr female	cerebral hemisphere	Celik et al., 2018

	Sanliurfa	sheep	15	6mo-4yr males and females	the right and left frontal cerebral lobes (21.21%), the right and left parietal lobes (18.18%), the right and left temporal lobes (6.06%), and occipital lobe (3.03%). Two cysts (6.06%) were detected in the cerebellar tissue.	Rahsan et al. 2018
Uruguay		cattle	2	2-3 yr females	Right or left hemisphere for each case	Buroni et al., 2017
Zimbabwe	Matopos	Hippotragus niger niger	2	9 mo, 14 mo females	frontal portion of the brain, in the vicinity of the olfactory bulbs	Grobler, 1981

Abbreviation; mo =month; yr = year; NS = not stated.

* All infected cases were suffering from clinical coenurosis.

G. Prevalence of *Taenia multiceps* non-cerebral coenuri in sheep, goats worldwide.

Country	Region	Host	Study type	Age Range	No. tested	No. Positive (%)	Cyst location	Reference
Bangladesh	NS	goats	Slaughterhouse	1-2.5 yr	430	31 (7.21%) Coenurus cerebralis and 5 (1.16%) mixed infection with C. tenuicollis.	diaphragm, subcutaneous tissues, the muscles of the abdomen, intercostal, thigh and neck muscles.	Alim et al. (2002)[1]
	Chittagong	goats	Slaughterhouse	NS	385	8 (2.1) *	Thigh muscles	Faruk et al., 2017
Emirates	Dubai	goats	Slaughterhouse	3-6 mo	17,223	30 (0.2) *	Between the muscles of the frontal and distal extremities; between the muscles of the back or attached to the diaphragm or to the abdominal wall. One coenurus was situated in the fat next to the kidneys.	Schuster et al., 2010
		goats	Slaughterhouse	3-6 mo	300	48 (16) *	between fasciae of the skeletal muscles, under the skin, diaphragm, and abdominal cavities.	Varcasia et al., 2012
		goats	Slaughterhouse	5-6 mo	19,046	57 (0.3)*	Legs, abdominal muscles, diaphragm, shoulder, Loin, rack, renal fat, heart, neck, and masseter.	Schuster et al., 2015
India	Murshibadabad	goats	Slaughterhouse	-	85698	207 (0.2)	muscles	Bandopadhyaya (1991)[1]
	Chattisgarh	goats	Case study	-	-	2	masseter	Gosh et al. (2005)[1]
	Assam	goat	Case study	-	-	5	orbita, muscles	Islam et al. (2006)[1]
	Bidar	goats	Case study	-	-	25	neck, shoulder, abd. muscles, leg	Shivapraksh and Thimma (2009)[1]
	Maharashtra	Cattle goat	Case study	NS	-	24	Gastrocnemius m., loin region attached to spinal canal and jugular furrow	Gabhane et al., 2009
	Jaipur	goat	Case study	12 mo	-	1	liver	Godara et al.

				female				(2011)[1]
	Bengal	goat	Case study	6 mo female	-	1	Fatty tissue below the attachment of fornix conjunctivae	Jana and Jana, 2012
	NS	kid	Case study	5 mo female	-	1	prescapular, medial thigh regions and lateral thorax regions	Velavan et al. 2012
	NS	goat	Case study	11 mo female	-	1	The left hind leg on the inner aspect of thigh and inguinal region	Madhu et al., 2014
	NS	sheep	Case study	2 yr male	-	1	quadriceps femoris muscle	Saritha et al. 2015
	NS	sheep	Case study	2 yr male	-	1	Palpebral Sub-Conjunctiva of the lower eyelid	Dar et al. 2016
	Orathanadu Thanjavur	goat	Case study	6 mo female	-	1	submandibular region, both sides of the neck and thoracic wall, last two intercostals space of the right side and behind the sternum	Saravanan, and Kumar, 2016
	Kamrup, Assam	goat	Case study	5-6 mo male 6mo-1.5 yr female	-	5 15	Multiple subcutaneous on the cheek, neck and abdomen	Islamet al., 2016
	NS	goat	Case study	3 yr female	-	1	Subcutaneous at neck and prescapular regions	Giri et al. 2017
	NS	goat	Case study	Adult	-	2	Retro-bulbar muscle	Sharma et al., 2017
	Tamil Nadu	goat	Observation of clinical signs	NS	93	12	Dorsal lumbar, right flank and prescapular areas	Venkatesan et al., 2018
	District Veterinary Complex	goat	Case study	3 mo	-	1	retrobulbar cyst	Shah et al. 2021
Iran	Shiraz	sheep	Case study	3 yr		1	subcutaneous tissue on jugular furrow and muscles of wither and internal aspect of the right thigh	Aslani,1999
	Shiraz	goat	-	-	52	4	neck, shoulder, loin	Moghaddar (2007b)[1]
	Shiraz	goat	Slaughterhouse	NS	310	8 (2.6)	The biceps femoris, triceps brachii muscles, the abdominal muscles	Oryan et al., 2010
	Kerman	goats	Slaughterhouse	NS	25739	23 (0.09)	Thigh, neck and shoulder muscles, followed by subcutaneous tissues, perineal fat and abdominal muscles	Kheirandish et al., 2012
Mozambique	Tete	goats	-	-	130	8	leg, neck, loin	Vink et al.

								(1998)[1]
	Tete	goats	Slaughterhouse	NS	149	22 (14.8)	Muscle and subcutaneous tissue	Afonso et al., 2011
Oman	-	-	Case study	-	-	1	leg, neck, loin, diaphragm	El Sinnari et al. (1999)[1]
Pakistan	NS	goat	Case study	6 mo	-	1	Left lower eye lid	Raidurg et al., 2009
	NS	sheep	Case study		-	1	Retrobulbar region of left eye.	Naveen et al., 2016
	Faisalabad	goat	Case study	3-mo kid 2 yr old	-	2	Case 1: subcutaneous tissue and abdominal muscle Case 2: spreading throughout the body especially inside the muscles surrounding thigh and shoulder region.	Abbas et al., 2017
South West Africa	NS	Gemsbok	Case study	NS	-	1	Hindquarter m.	Verster and Bezuidenhout 1972
Sudan	Omdurman	goat	Case study	-	-	1	generalised	Hago & Abu-Samara (1980)[1]
***Turkey**	Antalya	goat	Case study	2yr male	-	1	Loin (under the lumbar spinal cord)	Oge et al. (2012)[1]
***United states**	California–Davis Veterinary Hospital	chinchilla	Case study	4 yr male	-	1	ventral right orbit	Holmberg et al., 2007

Abbreviation; mo =month; yr = year; NS = not stated.

*isolates mentioned as non-cerebral Taenia multiceps cysts (Coenurus)

[1] Reviewed by Schuster et al., 2015

H. Worldwide reports on prevalence of *Taenia Multiceps* coenuri in miscellaneous intermediate hosts

Cerebral coenuri						
Country	**Region**	**Host**	**Cases no.**	**Age Range**	**Cyst location**	**Reference**
China	Qinghai Tibetan	Yak	1	1.5-yr male	NS	Zhang et al., 2019
Greece	Thessaly	Cattle	3	9-15 mo	NS	Al-Riyami et al. 2016
India	Hisar	Cattle	1	5 yr female, pregnant with dystocia	Delivered dead fetus with Coenurous cerebralis cyst covering head.	Singh et al., 2011
Israel	Ramon Crater west Negev	Nubian ibex	2	3–4 yr male Young female	Case 1: left frontal lobe, temporal and piriform lobes Case 2: the caudal fossa	Merbl et al., 2014
Italy	Sardinia	Cattle	1	2 yr male	the right hemisphere	Varcasia et al., 2013
	Sardinia	Cattle	1	NS	NS	Varcasia et al., 2016
Japan	Hokkaido	Cattle	1	1 yr female	Lateral ventricle	Yoshino and Momotani, 1988
Russia	Moscow	bison bull	1	1.5 yr male	brain	Kosminkov et al., 2016
Turkey	Van	Cattle	1	10-mo male	The caudal of the left cerebral hemisphere	Özkan et al., 2011
	Erzurum	Cattle	5/1045 brains	Adult males	In one case, cysts found in the vermis cerebelli of cerebellum, in four cases, in the occipital section of left cerebral hemisphere, the gyrus marginalis of left cerebral hemisphere, the right cerebral hemisphere between frontal and temporal sections and the right cerebral hemisphere between occipital and temporal sections, respectively.	Avcioglu et al., 2011
	Erzurum	Cattle	3	6, 9, 11 mo males	vermis cerebelli of cerebellum, right cerebral hemisphere, occipital section of left cerebral hemisphere and the gyrus marginalis of left cerebral hemisphere.	Avcioglu et al. 2012
	Kars	Cattle	4	7-16 mo	Cerebrum, parietal, frontal lobes and parietal-occipital lob	Gökçe et al., 2013
	Erzurum	Cattle	1	2 yr bull	the ventral region of left cerebral hemisphere	Kirbas et al., 2017
	Bingöl	Cattle	15		the left frontal lobe in one necropsied calf	Gazioglu et al., 2017
Uruguay		Cattle	2	2-3 yr females	Right or left hemisphere for each case	Buroni et al., 2017
Zimbabwe	Matopos	Hippotra	2	9 mo, 14 mo females	frontal portion of the brain, in the vicinity of	Grobler, 1981

		gus niger niger			the olfactory bulbs	
Non-cerebral coenuri						
United states	California–Davis Veterinary Hospital	chinchilla	1	4 yr male	ventral right orbit	Holmberg et al., 2007

Abbreviation; mo =month; yr = year; NS = not stated.

I. Worldwide reports on molecular characterization of *Taenia multiceps* isolates. ND, not done; NS, not stated.

Country/region	Animal species	Parasitic stage	No. isolates	Gene marker	Sequencing	Remarks	Reference
China Gansu	Sheep, goat	Cerebral coenuri	16	cox1	Partial	10 haplotypes with low diversity among isolates which clustered into three genotypes.	Li et al., 2013b
China Qinghai	Dogs	Eggs	2	nad1 rrnS	Partial	LAMP assays (nad1) and multiplex PCR-sequence analysis (rrnS for Taenia species).	Feng et al., 2017
China Hunan, Sichuan	Goat, dog	Cerebral coenuri (18), non-cerebral coenuri (18), adult worms (18)	54	cox1, 12S rRNA, ITS1	Partial	35, 44 and 35 haplotypes for cox1, 12S rRNA and ITS1 respectively. phylogenetically, no existence of host segregation of geographic isolation among T. multiceps isolates	Tan et al., 2018
China Sichuan	Dogs	Eggs	12	nad5	Partial	The developed direct PCR (nad5) assay is sensitive to detect the DNA from as few as 10 T. multiceps eggs with no cross-reactions with other tapeworm	Wang et al., 2018
China Inner Mongolia	Sheep, goat	Cerebral coenuri	6	cox1, nad4, cytb	Partial	Two haplotypes were identified for each gene and the degrees of genetic variations were 1.18%, 0.61% and 0.52% for cox1, nad4 and cytb loci respectively	Zhang et al., 2018
China Qinghai Tibetan	Yak	Cerebral coenurus	1	cox1, nad1, 18S rRNA	Partial	High homology (> 97%) was detected with the reference sequences from different hosts. Phylogenetically, the yak isolate intermixed with T. multiceps isolates from definitive and intermediate hosts worldwide	Zhang et al., 2019
Egypt, Dakahlia	Sheep	Cerebral coenuri	3	cox1, nad1	Partial	Isolates were identical and were closely similar to those from Turkish and Iranian sheep.	Abbas and Elbeskawy, 2016
Egypt, El Menoufia	Sheep	Cerebral coenuri	48	ITS1 cox1, nad1	Partial	Extensive sequence diversity due to deletions/insertions in the microsatellite regions in ITS1 region. Low genetic diversity in the analyzed mitochondrial cox1 and nad1 gene sequences in which the isolates were clustered in 4 haplogroups.	Amer et al., 2017
Greece different	Cattle Goats Sheep	Cerebral coenuri	3 5 97	cox1, nad1	Partial	Direct sequencing of the revealed amplicons demonstrated 5 haplotypes each for both cox1 and nad1. Cattle isolates are genetically different from	Al-Riyami et al., 2016

						Turkish cattle isolates.	
Greece, India, Iran, Sudan, Somalia, Oman, Bangladesh, Ethiopia, Yemen	Sheep, goat	Cerebral (26), non-cerebral (26) coenuri	52	nad1, cox1, 12S rRNA	Partial	See comment in the Supplementary text	Christodoulopoulos et al., 2016
India Makhdoom	Goat	non-cerebral coenuri	56	cox1, nad1	Partial	Cerebral and non-cerebral isolates of T. multiceps from goats in the same area had close proximity.	Gururaj et al., 2019
Iran Shiraz	Goat	non-cerebral coenuri	4	cox1, nad1	Partial	Partial nucleotide sequences of all isolates were 100% identical. The cerebral and non-cerebral coenuri are similar morphologically and genetically comprising a monophyletic group and a distinct clade within a single species.	Oryan et al., 2010
Iran, Tehran, Qom	Sheep	Cerebral coenuri	102	cox1, 12S rRNA	Partial	Cox 1 is less variable than 12S rRNA, where 7 and 25 representative haplotypes were identified for the 2 genes, respectively	Rostami et al., 2013a
Iran, Tehran, Alborz, Qom	Sheep	Cerebral coenuri	NS	cox1, 12S rRNA	Partial	Significant association was found between the 12S rRNA sequence variabilities (but not cox1) and difference in rostellar hook lengths	Rostami et al., 2013b
Iran Fars	Goats (experimentally infected)	Non-cerebral coenuri	12	cox1, nad1	Partial	See comment in the Supplementary text	Akbari et al., 2015
Iran Fars	Sheep, goats	Cerebral (5), non-cerebral (20) coenuri	25	ENO, cox1, nad1	Partial	ENO, cox1, nad1 partial nucleoide sequences are identical in the examined cerebral and non-cerebral coenuri suggesting that T. gaigeri are not a distinct species from T. multiceps.	Amrabadi et al., 2015
Iran	Sheep, goat	Cerebral (5), non-cerebral (5) coenuri	10	cox1, nad1	Partial	See comment in the Supplementary text	Oryan et al., 2015a
Iran	Sheep, goat*	parasite originated from the CSF	2	cox1	partial	Isolates were 100 % identical and shared 98-100 % with nucleotide sequences of the other T. multiceps isolates existing in the GenBank.	Oryan et al., 2015b
Iran	Experimentally	Non-	46	cox1, nad1	Partial	See comment in the Supplementary text	Amrabadi et

	infected dogs and goats	cerebral coenuri and adult worms					al., 2019
Italy Sardinia	Sheep dogs	Cerebral coenuri adult worms	37 3	cox1, nad1	Partial	Three different haplotypes for nad1 and 4 for cox1 with higher genetic variablily in nad1 sequences than cox1. 3 genetic variants were proposed; Tm1, Tm2 and Tm3	Varcasia et al., 2006
Italy Sardinia	Cattle	Cerebral coenuri	2	cox1, nad1	Partial	Isolates were closely related (100 % homology) to Sardinian sheep strain of T. multiceps and clustered with the Tm2 T. multiceps variant previously reported from sheep in the same area	Varcasia et al., 2013
Italy Sardinia	red foxes	adults	4	cox1, nad1	Partial	Isolates displayed 100 % nucleotide identity to T. multiceps Tm1 strain	Varcasia et al., 2015
Italy, Sassari	Sheep (41), goats (4), cattle (1), Mouflon (1)	Cerebral coenuri	52	cox1	Partial	the cox1 sequences identified 11 polymorphic sites were identified with high haplotype diversity (10 haplotypes), of them 3 related to Tm1-Tm3 variants previously reported from Sardinia. Tm1 variant pointed to the possible existence of a common lineage for T. multiceps.	Varcasia et al., 2016
Pakistan, Faisalabad	Sheep (4) Goat (8)	Cerebral and non-cerebral coenuri	12	cox1	Partial	A high haplotype and a low nucleotide diversity with three haplotypes from the 12 isolates were observed. This study suggests the existence of unique haplotypes of C. cerebralis in Pakistan.	Alvi et al. 2020
Saudi Arabia Taif	sheep	non-cerebral coenuri	2	cox1	Partial	Taif isolate 1, showed a higher alignment identity (99%) with coenurus cyst isolates found in brains of sheep in Egypt. Taif isolate 2, showed 98% identity with coenurus isolates from different hosts of China	Al Malki, and Hussien, 2021
Turkey Erzurum	Cattle	Cerebral coenuri	3	cox1, nad1	Partial	Isolates from cattle clustered in a separate entity other than that of sheep isolates retrieved from Genbank, and the nucleotide differences were 0.6-2.9% and 0.2-2.6% for nad1 and cox1, respectively.	Avcioglu et al., 2011
Turkey Mardin	Sheep	Cerebral coenuri	20	cox1	Partial	Three different variants were detected.	Sonmez et al., 2016
Turkey Bingöl	Sheep Calf	Cerebral coenuri	4 1	cox1	Partial	--	Gazioglu et al., 2017

UK, Wales	Sheep	Cerebral ceonuri	2	ITS2 -rDNA	ND	PCR-RFLP profiling of different taeniid cestode species. Using 4 endonucleases, the technique could be used for differentiating *T. multiceps* from *Taenia serialis*	Gasser and Chilton 1995
UK, Wales	Sheep	Cerebral coenurus	1	cox1, nad1	Partial	Interspecific nucleotide variation in NADH was greater than in cox1. T. multiceps, T. seialis, T. saginata and T. asiatica are genetically more similar and differ from T. hydatigena, T. pisiformis and T. taeniformis.	Gasser et al. 1999
United Arab Emirates,	Goats	non-cerebral coenuri	9	cox1, nad1	Partial	All cox1 sequences were identical to those isolated from extra-cerebral coenuri of Iranian native goats, and genetically different from cerebral coenuri isolates worldwide as well as cattle isolates. The existence of different strains or genotypes is proposed	Varcasia et al., 2012

Abbreviations

cox1: mitochondrial cytochrome c oxidase subunit 1 gene

nad1, nad5: mitochondrial NADH dehydrogenase subunit 1, 5 genes

ITS: internal transcribed spacer

12S rRNA (rrnS): small-subunit ribosomal RNA gene

cytb: Cytochrome b

ENO; enolase gene

* young sheep and goat with neurological signs

$ a cyst of 3.5 cm in diameter was retrieved from the mesentery of small intestine of sheep.

J. T. multiceps isolates used for the molecular analyses conducted in the present study

Haplotype	Accession number	Detected stage	Host species	Country
Hap01	KX547628	Cerebral	Goat	China
	KX547645	Adult	Dog	China
	KX547653	Adult	Dog	China
	KT217591	Cerebral	sheep	Turkey
	KX547651	Adult	Dog	China
	KT217593	Cerebral	sheep	Turkey
	KT217588	Cerebral	sheep	Turkey
	KX547631	Cerebral	goat	China
	KX522559	Non-cerebral	goat	China
	KX522549	Non-cerebral	goat	China
	KT217584	Cerebral	sheep	Turkey
	KX547654	Non-cerebral	goat	China
	KX522548	Non-cerebral	goat	China
	KX522561	Non-cerebral	goat	China
	KX547649	Adult	dog	China
	KX547647	Adult	dog	China
	KX547643	Adult	dog	China
	KX547654	Adult	dog	China
	KT217579	Cerebral	sheep	Turkey
	KX547635	Cerebral	goat	China
	KX522558	Non-cerebral	goat	China
	KX522550	Non-cerebral	goat	China
	KT217595	Cerebral	sheep	Turkey
	KX547627	Cerebral	goat	China
	KT217583	Cerebral	sheep	Turkey
	KT217577	Cerebral	sheep	Turkey
	KX522553	Non-cerebral	goat	China
	KX547623	Cerebral	goat	China
	KX547650	Adult	dog	China
	KT217587	Cerebral	sheep	Turkey

	KX522555	Non-cerebral	goat	China
	KX522557	Non-cerebral	goat	China
	KX547622	Cerebral	goat	China
	KX522554	Non-cerebral	goat	China
	KX547625	Cerebral	goat	China
	KX522546	Non-cerebral	goat	China
	KX522556	Adult	dog	China
	KX522560	Non-cerebral	goat	China
	KX547624	Cerebral	goat	China
	JQ710576	Cerebral	Sheep	Iran
	JQ710576	Cerebral	Sheep	Iran
	JQ710576	Cerebral	Sheep	Iran
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	JQ710576	Cerebral	Sheep	Iran
	JQ710576	Cerebral	Sheep	Iran
	KX522556	Non-cerebral	goat	China
	KT217596	Cerebral	Sheep	Turkey
	KR604808	Cerebral	Sheep	Greece

	KX522562	Non-cerebral	goat	China
	KX547630	Cerebral	goat	China
	KX547646	Adult	Dog	China
	KX547629	Cerebral	goat	China
	KX522557	Adult	Dog	China
	KX522547	Non-cerebral	goat	China
	KT217580	Cerebral	Sheep	Turkey
	KX522562	Adult	Dog	China
	KX522551	Non-cerebral	goat	China
	KX522552	Non-cerebral	goat	China
	KT217592	Cerebral	Sheep	Turkey
	KT217582	Cerebral	Sheep	Turkey
	KX522563	Non-cerebral	goat	China
	KX505150	Non-cerebral	sheep	Somalia
	KX522559	Adult	Dog	China
	KX505150	Cerebral	Sheep	Greece
	KX505150	Cerebral	Sheep	Greece
	KX505150	Cerebral	Sheep	Greece
	KX505150	Cerebral	Sheep	Greece
	KX505150	Cerebral	Sheep	Greece
	KT217590	Cerebral	Sheep	Turkey
	KX547638	Cerebral	goat	China
Hap02	KX547636	Cerebral	goat	China
Hap03	KT258025	Cerebral	goat	Mongolia
Hap03	KT258025	Cerebral	goat	Mongolia
Hap03	KT258025	Cerebral	goat	Mongolia
Hap03	KT258025	Cerebral	goat	Mongolia
Hap03	KT258025	Cerebral	goat	Mongolia
Hap04	KX547648	Adult	dog	China

Hap05	KX547637	Cerebral	goat	Iran
Hap06	JQ710580	Cerebral	sheep	Iran
	JQ710580	Cerebral	sheep	Iran
	JQ710579	Cerebral	sheep	Iran
Hap07	KX547655	Adult	dog	China
Hap08	KX547642	Adult	dog	China
	KX547644	Adult	dog	China
Hap09	KX547634	Cerebral	goat	China
Hap10	KX547657	Adult	dog	China
Hap11	JQ710581	Cerebral	sheep	Iran
Hap12	KX547652	Adult	dog	China
Hap13	KX547632	Cerebral	goat	China
Hap14	KR604809	Cerebral	goat	Greece
Hap15	KT217581	Cerebral	sheep	Turkey
Hap16	KX547656	Adult	dog	China
Hap17	JX507233	Non-cerebral	goat	China
Hap18	JX507226	Cerebral	goat	China
	JX507225	Cerebral	goat	China

	JX507232	Non-cerebral	goat	China
	JX507234	Non-cerebral	goat	China
	JX507229	Cerebral	goat	China
	JX507224	Cerebral	goat	China
Hap19	JQ710586	Cerebral	sheep	Iran
	JQ710584	Cerebral	sheep	Iran
	JQ710582	Cerebral	sheep	Iran
	JQ710582	Cerebral	sheep	Iran
	JQ710582	Cerebral	sheep	Iran
	JQ710582	Cerebral	sheep	Iran
	JQ710583	Cerebral	sheep	Iran
Hap20	KX505154	Non-cerebral	goat	Undefined
Hap21	JX507235	Non-cerebral	goat	China
Hap22	KX505153	Non-cerebral	goat	Undefined
	KX505153	Non-cerebral	goat	Undefined
Hap23	JQ710585	Cerebral	sheep	Iran
Hap24	KX505152	Non-cerebral	goat	Undefined
	KX505152	Non-cerebral	goat	Undefined
	KX505152	Non-cerebral	goat	Undefined
	KX505152	Non-cerebral	goat	Undefined
	KX505152	Non-cerebral	goat	Undefined
	KX505152	Non-cerebral	goat	Undefined
	KX505152	Non-cerebral	goat	Undefined
	KX505152	Non-cerebral	sheep	Undefined
Hap25	JX507227	Cerebral	goat	China

Hap26	JX507238	Non-cerebral	goat	China
	HM101469	Non-cerebral	goat	Iran
	KP663641	Non-cerebral	goat	Iran
	KX547639	Cerebral	goat	China
	JX507237	Non-cerebral	goat	China
	KU358935	Cerebral	goat	India
	JX507228	Cerebral	goat	China
	JQ710577	Cerebral	sheep	Iran
	JQ710577	Cerebral	sheep	Iran
	JQ710577	Cerebral	sheep	Iran
	JQ710577	Cerebral	sheep	Iran
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	KX547640	Adult	dog	China
	KP663642	Non-cerebral	goat	Iran
	KX505151	Non-cerebral	sheep	Iran
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	KP325489	Cerebral	goat	Iran
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	KX547641	Adult	dog	China
	KX547626	Cerebral	goat	China
Hap27	JX507223	Cerebral	goat	China
Hap28	AB792725	Adult	dog	Mongolia
Hap29	MZ346598	Non-cerebral	sheep	Saudi Arabia
Hap30	KX505155	Non-cerebral	sheep	Unidentified

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	LC271702	Cerebral	sheep	Egypt
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	LC271709	Cerebral	sheep	Egypt
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	LC271713	Cerebral	sheep	Egypt
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	LC271694	Cerebral	sheep	Egypt
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	KX505159	Cerebral	sheep	Greece
	LC271740	Cerebral	sheep	Egypt
	LC271710	Cerebral	sheep	Egypt
	LC271725	Cerebral	sheep	Egypt
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	LC271698	Cerebral	sheep	Egypt
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	LC271701	Cerebral	sheep	Egypt
	LC271739	Cerebral	sheep	Egypt
	LC271705	Cerebral	sheep	Egypt
	LC271716	Cerebral	sheep	Egypt
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	LC271712	Cerebral	sheep	Egypt
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	LC271720	Cerebral	sheep	Egypt
Hap33	KT217594	Cerebral	sheep	Turkey
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Hap35	JX535576	Cerebral	goat	China
	MK189452	Cerebral	yak	China
	JX535572	Cerebral	sheep	China
	JX535568	Cerebral	sheep	China
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	KT217578	Cerebral	sheep	Turkey
	KT217586	Cerebral	sheep	Turkey
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	LC271715	Cerebral	sheep	Egypt
	LC271711	Cerebral	sheep	Egypt
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	KX505158	Cerebral	sheep	Greece
	KR604811	Cerebral	sheep	Greece
	DQ309768	Cerebral	cattle	Italy
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	LC271719	Cerebral	sheep	Egypt
	DQ309767	Adult	fox	Italy
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	LC271737	Cerebral	sheep	Egypt
	KX505156	Cerebral	goat	Greece

	KX505156	Cerebral	goat	Greece
	KR604810	Cerebral	goat	Greece
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	JX535567	Cerebral	sheep	China
	EF393620	Cerebral	sheep	Turkey
	LC271736	Cerebral	sheep	Egypt
	KU641265	Cerebral	cattle	Italy
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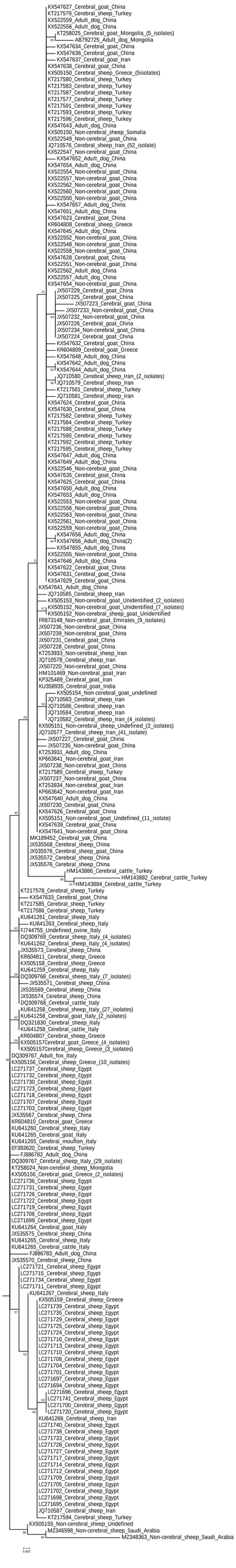
Hap50	HM143886	Cerebral	cattle	Turkey
Hap51	MZ348363	Non-cerebral	sheep	Saudi Arabia

Supplementary Fig. S1. Maximum Likelihood phylogenetic tree constructed for cox1 partial nucleotide sequences of *T. multiceps* using the HKY model. The bootstrap analysis was conducted using 1000 replicates. Scale bar indicates the proportion of sites changing along each branch.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LC271729_Cerebral_sheep_Egypt
LC271725_Cerebral_sheep_Egypt
LC271724_Cerebral_sheep_Egypt
LC271716_Cerebral_sheep_Egypt
LC271713_Cerebral_sheep_Egypt
LC271710_Cerebral_sheep_Egypt
LC271708_Cerebral_sheep_Egypt
LC271704_Cerebral_sheep_Egypt
LC271701_Cerebral_sheep_Egypt
LC271697_Cerebral_sheep_Egypt
LC271694_Cerebral_sheep_Egypt
LC271696_Cerebral_sheep_Egypt
LC271741_Cerebral_sheep_Egypt
LC271700_Cerebral_sheep_Egypt
LC271720_Cerebral_sheep_Egypt
KU641266_Cerebral_sheep_Iran
LC271740_Cerebral_sheep_Egypt
LC271738_Cerebral_sheep_Egypt
LC271733_Cerebral_sheep_Egypt
LC271728_Cerebral_sheep_Egypt
LC271727_Cerebral_sheep_Egypt
LC271717_Cerebral_sheep_Egypt
LC271714_Cerebral_sheep_Egypt
LC271712_Cerebral_sheep_Egypt
LC271709_Cerebral_sheep_Egypt
LC271705_Cerebral_sheep_Egypt
LC271702_Cerebral_sheep_Egypt
LC271698_Cerebral_sheep_Egypt
LC271695_Cerebral_sheep_Egypt
JQ710587_Cerebral_sheep_Iran
KT217594_Cerebral_sheep_Turkey
KX505155_Non-cerebral_sheep_Undefined
MZ346598_Non-cerebral_sheep_Saudi_Arabia
MZ348363_Non-cerebral_sheep_Saudi_Arabia
0.002

Supplementary Text

Annex I: Preliminary Searching Form/Tool

Databases: PubMed, Scopus Science Direct and Google Scholar

Screening the literature based on title and abstract

Key words: *Taenia multiceps*, *Coenurus cerebralis*, *Coenurus gaigeri*, *Coenurus skrjabini*, dog, sheep, goat, cattle and wild animals in various combinations

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1. Does the title/abstract include any issues that are relevant to the **research question?** (Yes/No)
    - If they had found adult or laval stage positive samples.
    - Any further molecular analysis and experimental studies on isolates.
    - Case studies focusing on the diagnosis, pathology and treatment of clinical coenurosis.
    - Studies on molecular markers for diagnosis
2. Does the abstract describe a primary **research study?** (Yes/No)
    - All included are research papers
3. Is the **review question** in the species of interest addressed in the abstract? (Yes/No)
    - Host: all animals species
    - Parasite: *T. multiceps* and its larval stage; *C. cerebralis* and *C. gaigeri*

NB: Must answer "Yes" to all questions to be considered for further assessments.

Excluded articles after full text screening

- Reviews on T. multiceps and other taniid species.
- Studies which reported other taniid species along with negative results for *T. multiceps* and its larval stage; *C. cerebralis* and *C. gaigeri*
- Records investigated fecal samples and identified tandiis eggs without further PCR based speciation.
- Case studies focusing on treatment or management of cerebral and subcutaneous cysts without adequate descriptions of the cyst locations.

Annex II: Reports on cross-transmission experiments of the cerebral and non-cerebral T. multiceps coenuri

Christodoulopoulos *et al.* (2016) collected 26 cerebral coenuri from sheep and goats from Greece and another 26 non-cerebral coenuri from goats in some African and Asian countries. Measurements of the rostellar hooks of at least 1 protoscolecex from each coenurus were taken. About 30 ptotoscoleces from each of 6 coenuri were fed to 6 puppies as follows; 2 puupies infected with protoscoleces of 2 cerebral coenuri from sheep in Greece, a puppy with 1 cerebral coenurus from a goat in Greece, 2 puppies with 2 non-cerebral coenuri from goats in Ethiopia and Sudan, and a puppy with 1 non-cerebral coenurus from sheep in Somalia. Fifty-five days later, the puppies were euthanized; adult worms were collected and identified morphologically. They found no significant differences between the parasitic stages (adult worms and coenuri) of cerebral origin from sheep and goats, and the same for the parasitic stages of the non-cerebral origin, whereas the cerebral parasitic stages and the non-cerebral ones have distinct morphological differences, but not enough to typify 2 distinct taeniid species. Coenuri were molecularly examined amplifying nad1, cox1 and 12S rRNA genes. All isolates either cerebral or non-cerebral clustered with other *T. multiceps* isolates worldwide. Specifically, the non-cerebral isolates clustered with the cerebral ones from Greece in a clade (A) other than another 2 clades (B and C) including the other cerebral isolates from Greece. The phylogenetic analysis displayed no monophyletic groups based on geographical origin, organ location in the intermediate host (cerebral or non-cerebral), or species of intermediate host (sheep or goat). Authors suggested that clade A is a *T. multiceps* variant which has the affinity to produce cerebral and non-cerebral coenuri, whereas the other 2 clades produce only cerebral coenuri.

Amrabadi *et al.* (2019) fed 2 puppies protoscoleces (n=350) of 2 cerebral coenuri from sheep, and another 2 puppies with 2 non-cerebral coenuri from goats. Dogs were euthanized

after 4 months, and the adult worms were collected; the gravid proglottids were separated to harvest the eggs. Two separate groups of goat kids (6 kids/group) were infected with the harvested eggs (80,000-100,000 eggs/kid); the 1st group were infected with eggs from the non-cerebral coenuri infected dogs, whereas the 2nd group received eggs from the cerebral coenuri infected dogs. Five and 3 kids from the first and second groups displayed non cerebral coenuri which formed in lungs, heart, diaphragm and muscles; however, no cerebral or spinal coenuri were formed in all kids. Molecular examination of the coenuri (revealed from the experimentally infected goats) and the adult worms (from the experimentally infected dogs) amplifying cox1 and nad1 genes was conducted. The revealed nucleotide sequences were identical 100% in all isolates indicating that there is no host adapted variants of *T. multiceps* in sheep and goats. Additionally, intraspecific variations were detected between Iranian *T. multiceps* strains and other strains existing in GenBank database.

Akbari *et al.* (2015) fed protoscolices of cerebral (collected from sheep) and non-cerebral (collected from goats) *T. mullticeps* coenuri to 2 separate groups of dogs each of 2 puppies. Four months later, dogs were euthanized, and the adult worms in hundreds were collected and kept separately. Morphological features of the adult worms revealed from the two groups were the same; however minor differences in the protoscoleces sizes were noted. The harvested eggs from each group were orally inoculated into two groups of weaned goat kids (6 animals in each group). The infected goats were euthanized 4-12 months post infection. Noncerebral coenuri were found in 3 of the 6 goats of groups 1 (infected with the eggs from the cerebral cysts origin) and in 5 of the 6 goats of groups 2 (infected with the eggs from the noncerebral cysts origin). The revealed coenuri distributed in the muscles, heart, liver and lungs. The morphological features as well as the molecular characters (amplifying the cox1 and nad1 genes) of the revealed coenuri were identical.

Oryan *et al.* (2015a) fed 3 female dogs protosoleces (300-400/each) from cerebral ceonuri collected from sheep. Four months later, the harvested eggs for canine feces were fed to 3 lambs and 3 kids (80,000–100 000 eggs/animal). The developed coenuri were cerebral in lambs and non-cerebral (lung, muscles) in the kids. Degeneration of the larvae in renal cortex of lambs was evidenced. PCR amplifying cox1 and nad1 genes was conducted for the collected cysts from the naturally (n=10, 5 cerebral and 5 non-cerebral) and experimentally infected sheep and goats as well as the adult worms from experimentally infected dogs. The revealed nucleotide sequences were 100% identical and confirmed as *T. multiceps*.

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