

## Updates on Cystic Echinococcosis (CE) in Italy

G. Garippa

Dipartimento di Biologia Animale, Sezione Parassitologia e Malattie Parassitarie, Università di Sassari, Sassari, Italy.

**Abstract.** An update on Cystic Echinococcosis (CE) diffusion in Italy during 2003-2005 is reported. CE seems to have a sporadic diffusion in the northern part of the country where this disease plays a minor role (prevalence < 1%). Recent investigations have shown the occurrence of CE cases in humans from the mountains between Reggio Emilia and Modena, with an average year incidence between 9.4 and 5.6/100,000. In Abruzzo prevalences in sheep and cattle are 20.2% and 15.3%, with a fertility of 4.6% and 1.3%, respectively. In the same region, G1 and G3 strains were identified and a prevalence of 31% in dogs was found with CaELISA. In Campania, CE prevalence was 14.8% in cattle, with no viable cysts recovered, and 10.5% in water buffaloes, with a fertility of 1.4%. Biotechnologies allowed to find G1 and G3 strains in water buffaloes. In Sicily, CE was found in 67.1% of cattle, with a fertility of 4%, and in 57.6% of sheep, with 9.2% of viable cysts. Biomolecular investigations have found G1 strain in sheep and cattle. In dogs, a prevalence of 5.6% for *Echinococcus granulosus* was reported. In Sardinia CE prevalence was 75.3% in sheep and 41.5% in cattle, with a fertility of 10.3% and 2.6%, respectively. CE was found also in 9.4% of pigs, with fertility of 6.5%. The G1 strain was recovered in sheep and cattle while the G7 in pigs.

**Key words:** Cystic Echinococcosis, *Echinococcus granulosus*, epidemiology, strains, Italy.

Actually in the genus *Echinococcus* five species are considered: *E. granulosus*, *E. multilocularis*, *E. oligarthrus*, *E. vogeli* and the recently described *E. shiquicus* (Thompson and McManus, 2002; Xiao *et al.*, 2005). In the last 15 years biotechnologies have light up inside *E. granulosus* 10 different strains and genetic variants, named G1 (Sheep strain), G2 (Tasmanian sheep strain), G3 (Buffalo strain), G4 (Horse strain), G5 (Cattle strain), G6 (Camel strain), G7/G9 (Pig strain), G8 (Cervid Strain), the lion strain and the recently discovered G10 or Fennoscandinavian Cervid Strain. These genetic variants differ in host specificity, pathogenicity, transmission dynamics, epidemiology and chemotherapeutic sensivity. For some of these strains (G4 and G5) these differences are so evident that for various researchers they could be elevated to species status: *E. equinus* and *E. ortleppi* (Jenkins *et al.*, 2005). *E. granulosus* is worldwide widespread and the Mediterranean region is considered an hyperendemic area. In this region, Cystic Echinococcosis (CE) is considered one of the most diffused parasitosis in production animals and also plays an important social role, being the first parasitary zoonosis in the Mediterranean Basin (Eckert *et al.*, 2001). CE is usually a problem where small ruminants are bred with traditional (extensive) methods and in which the lifecycle of the parasite could be completed with sheepdogs, implicating also other animals and man. Molecular techniques have confirmed that sheep-dog-man is the main way of transmission of the parasite, with the G1 homogeneous diffusion. Socio-economic conditions, familiar butcherries and the high number of stray dogs and sheepdogs are some of the most important factors that allow the high diffusion of CE.

In this work a complete *scenario* of CE diffusion in Italy is presented, based on recent investigations. In this country, sporadic, endemic and hyper endemic areas could be identified. CE seems to have a sporadic diffu-

sion in the northern part of the peninsula: Valle d'Aosta, Piemonte, Liguria, Lombardia, Trentino Alto Adige, Friuli Venezia Giulia and Emilia Romagna regions (Garippa *et al.*, 2004). Recently in Piemonte Rossi (pers. comm.), has found prevalences for CE of 27.9% and 23.5% in sheep coming from the valleys of Turin and Cuneo provinces, respectively. Unexpected prevalences were found with the CA-ELISA in dogs and wolves (24.6% and 26.2%) in Pesio, Turin and Stura areas. In Emilia Romagna, CE in cattle was estimated to be 0.41%-0.54% and a cluster of infection (1.4%) was identified in the north-west area of the province of Reggio Emilia (Guazzetti *et al.*, 2006). It is interesting to underline that the same area was illegally pastured by several sheep flocks and as that practice could constitute a risk factor for CE in cattle. Recent investigations have shown a CE risk area for humans in the mountains between Reggio Emilia and Modena, with an average year incidence between 9.4/100.000 and 5.6/100,000 (Battelli *et al.*, 2004). In Abruzzo (central Italy) from 1981 to 1994 CE prevalences were reported by Garippa *et al.* (2004): sheep and goats 17.8%-50.8%; cattle 2.3-3.5%; pigs 0.3-0.6; horses 1-3.8%; dogs 4%. Recent data evidenced in sheep and cattle prevalences respectively of 20.2% and 15.3% with a fertility of 4.6% in sheep and of 1.3% in cattle. The molecular characterization revealed genotype G1 (ovine strain) in sheep and G3 (buffalo strain) in cattle. CA-ELISA showed a prevalence of 31% in dogs (Giangaspero *et al.*, 2006). In Arezzo Province CE was recovered in 47% butchered sheep (Bio and Fagiolo, 2004). About CE diffusion in wild animals, Guberti *et al.* (2004) has described a prevalence of 15% in wolves coming from all the Apennines area, while investigations on fallow deer near Ferrara (Boscone della Mesola) didn't show any positives to *E. granulosus* cysts (Battelli, pers comm.). In Apulia, recent investigations in the abattoirs of Foggia, have shown CE in 5.7% of cattle, 5% of sheep

and 0.02 of equids (Puccini, com pers, 2003), while the situation in dogs (5.73%) was not updated (Puccini *et al.*, 1975). In the period between 1996-2002, the following prevalences for CE were recorded in Basilicata: cattle 2.8%-3.8%, sheep 5%-28%, goats 4%-25%, pigs 0.05%-0.5%, horses 0.04%-0.1% (Quaranta, 2003). In the Campania region, prevalence for CE was 14.8% in cattle with no viable cysts recovered and 10.5% in water buffaloes, with a fertility of 1.4%. Biomolecular investigations allowed to find G1 and G3 strains in water buffaloes (Capuano *et al.*, 2006).

In Sicily, latest investigations found CE in 67.1% of cattle with a fertility of 4%. While in sheep prevalence was of 57.6%, with 9.2% of viable cysts (Giannetto *et al.*, 2004). These values were sensibly higher than those reported by Magliarditti and Niotta (1995) in cattle (11.13%) and by Poglayen *et al.* (2003) in sheep (15%), even if this last investigation reported fertility rates from 31% to 90% (Agrigento Province). Biomolecular investigations have found G1 strain in several isolates from sheep and cattle. In dogs, a prevalence of 5.6% for *E. granulosus* was reported in shepherd dogs in 2003-2005, lower than that reported by Giannetto *et al.* (1997) in Agrigento province (19%).

In Sardinia, CE prevalence was of 75.3% in ovine while the percentage of sheep with fertile cysts was 10.3%. Hydatid cysts were found in 41.5% of the cattle investigated, although, only 2.6% of the animals harboured fertile hydatids. CE was found in 9.4% of pigs examined during home inspection visits and viable cysts were found in 6.5% of sampled animals. Strain typing have shown as all sheep cattle and pigs isolates were identified as the *E. granulosus* G1 genotype, whereas 2 isolates in pigs were identified as G7 genotype. In cattle, the G1 strain of *E. granulosus* was found to be frequently infertile (2.6% fertile cysts) (Garippa *et al.*, 2004; Scala *et al.*, 2006; Varcasia *et al.*, 2006). CA-ELISAs performed with the commercial kit (Echinotest, Bommeli CH) found 3% positive while two ELISA which employed monoclonal antibodies (MAbs: EmA9 and EgC3) found 6% and 10% positive respectively on faecal samples of 300 dogs (Varcasia *et al.*, 2004).

The above said *scenario* for CE diffusion in Italy highlights as the knowledge of the epidemiology of this important zoonosis was increased, even if data from some regions lack. Anyway, according to the described prevalences, in the northern part of the country CE should be considered sporadic, even if recent reports by Rossi, have shown important prevalences in sheep and wolves. The incidence of CE in man in Emilia Romagna (5.6-9.4/100,000 inhabitants/year) results sensibly higher than that reported in 1989-1993 period and only a little bit lower than that reported in Sardinia (Gabriele *et al.*, 2004). The presence of CE in areas where sheep breeding is conducted with traditional methods lead the parasite to affect also other species (Emilia Romagna) and also to maintain constant prevalence during last years in central Italy (Abruzzo). The situation of the two major islands continue to be alarm-

ing even if the prevalences and fertility rates seem to be lower than in the past. In Sardinia, the low level of viability of the hydatids found in sheep seems to be related to the increased farm management practiced over the last 10 years. The lack of official data from the National Health System do not allow us to have a complete picture of the parasite diffusion and the possibility of individualize risk situation in non endemic or sporadic areas to promptly put into practice control measures. Anyway, in our country the sheep-dog cycle seems to be the most diffused way followed by the parasite for its diffusion. The epidemiological data (Guberti *et al.*, 2004) suggest that in Italy the wolf is still part of the classical dog-sheep cycle and thus a true wild cycle has not evolved, although the role of the wolf and its possible implications in the epidemiology of CE in north and central Italy have to be cleared. These data agreed with the biomolecular findings, in fact the G1 strain (and its nearest variants G2 and G3) seems to be the most diffused strain of the parasite, even if the pig strain (G7) was found in a hyper endemic area (Sardinia). Last investigations seem to exclude the presence in our country of G4 (*E. equinus*) after its recovering in the past years.

#### Acknowledgements

This paper was carried out with the valuable assistance of G. Battelli, G. Cringoli, S. Giannetto, A. Giangaspero, M.T. Manfredi and A. Varcasia with funds by MIUR PRIN 2003 Prot. 2003070410\_001.

#### References

- Battelli G, Ostanello F, Baldelli R, Di Francesco A, Grilli R, Vizioli M (2004). Human echinococcosis in the Emilia-Romagna Region (northern Italy) in the years 1997-2002: an updating. *Parassitologia* 46: 415-416.
- Bio C, Fagiolo A (2004). Incidence of Hydatidosis in sheep slaughterhouse in the province of Arezzo, Italy. *Parassitologia* 46: 28.
- Capuano F, Rinaldi L, Maurelli MP, Perugini AG, Veneziano V, Garippa G, Genchi C, Musella V, Cringoli C (2006). Cystic echinococcosis in water buffaloes: epidemiological survey and molecular evidence of ovine (G1) and buffalo (G3) strains. *Vet Parasitol* 137: 262-268.
- Eckert J, Gemmel MA, Meslin FX, Pawlowski ZS (2001). Manual on Echinococcosis in Humans and Animals: a Public Health Problem of Global Concern. WHO/OIE, Paris.
- Gabriele F, Bortoletti G, Conchedda M (2004). Human cystic echinococcosis in Sardinia during the 20th century. *Parassitologia* 46: 383-385.
- Garippa G, Varcasia A, Scala A (2004). Cystic echinococcosis in Italy from the 1950s to present. *Parassitologia* 46: 387-391.
- Giangaspero A, Paoletti B, Gatti A, Iorio R, Traversa D, Capelli G, Manfredi MT, Varcasia A, Garippa G (2006). The epidemiological scenario on echinococcosis in Abruzzo region. *Parassitologia*, in press.
- Giannetto S, Virga A, Buriola E (1997). Ricerche sui cestodi intestinali in cani da pastore della Sicilia occidentale. *Atti Soc Ital Sci Vet* 51: 311-312.
- Giannetto S, Poglayen G, Brianti E, Sorgi C, Gaglio G, Canu S, Virga A (2004). An epidemiological updating on cystic

- echinococcosis in cattle and sheep in Sicily, Italy. *Parassitologia* 46: 423-424.
- Guazzetti S, Micagni G, Ostanello F, Battelli G (2006). Bovine echinococcosis in the province of Reggio Emilia (Italy): an example of integrated analysis of passive surveillance data. *Parassitologia*, in press.
- Guberti V, Bolognini M, Lanfranchi P, Battelli G (2004). *Echinococcus granulosus* in the wolf in Italy. *Parassitologia* 46: 425-427.
- Jenkins DJ, Romig T, Thompson RCA (2005). Emergence/re-emergence of *Echinococcus* spp. a global update. *Int J Parasitol* 35: 1205-1219.
- Magliarditti D, Niutta PP (1995). L'idatidosi negli animali da macello nel territorio dell'USL 42 (ME) nel triennio 1991-93. *Atti Ass Siciliana Sanità Veterinaria* 2: 165-167.
- Nobile L, Virga A, Camelli A, Fioravanti ML (1993). Indagine sulla presenza di elminti intestinali in Cani della Sicilia occidentale. *Atti SISVet* 47: 1427-1430.
- Poglayen G, Brianti E, Russo A, Gaglio G, Sorgi C, Giannetto S (2003). Old dreams, new vision: Cystic echinococcosis in Sicily. *WAAVP* 19: 164.
- Puccini V, Lazari P, Sgherza F (1975). Nuovi controlli sulla frequenza dell'infestazione del cane da *Echinococcus granulosus* (Batsch, 1786). *Acta Med Vet* 21:73-81.
- Quaranta V (2004). Echinococcosi: presenza e diffusione della parassitosi in Basilicata. Convegno: Echinococcosi: una parassitosi da conoscere. Centro Sociale Camastra Alto Sauro, Anzi (PZ).
- Scala A, Garippa G, Varcasia A, Tranquillo VM, Genchi C (2006). Cystic echinococcosis in slaughtered sheep in Sardinia (Italy). *Vet Parasitol* 135: 33-38.
- Thompson RCA, McManus DP (2002). Towards a taxonomic revision of the genus *Echinococcus*. *Trends in Parasitol* 18: 452-457.
- Varcasia A, Canu S, Lightowler MW, Scala A, Garippa G (2006). Molecular characterization of *Echinococcus granulosus* strains in Sardinia. *Parasitol Res* 98: 273-277.
- Varcasia A, Garippa G, Scala A (2004). The diagnosis of *Echinococcus granulosus* in dogs. *Parassitologia* 46: 409-412.
- Xiao N, Qui J, Nakao M, Li T, Yang W, Chen X, Schantz P, Craig PS, Ito A (2005). *Echinococcus shiquicus* n sp, a teniid cestode from Tibetan fox and plateau pika in China. *Int J Parasitol* 35: 693-701.