

Cystic echinococcosis in the Campania region (southern Italy)

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Echinococcosis is cosmopolitan zoonosis caused by adult or larval stages of tapeworms belonging to the genus *Echinococcus* Rudolphi, 1801. Within the genus *Echinococcus* four species are presently recognised, namely *Echinococcus granulosus*, *E. multilocularis*, *E. oligarthrus* and *E. vogeli*, and taxonomic revision of the genus is probably needed (Thompson RCA, McManus DC, 2002, Trends Parasitol 18: 452-457). *E. granulosus*, the major species of medical and public health importance which causes cystic echinococcosis (hydatidosis), has a global distribution.

The range of intermediate host species (domestic ungulates) depends on the infecting strain of *E. granulosus*, regional or local differences in the availability of the various intermediate host species, and other factors. Laboratory and field observations have revealed considerable phenotypic variability among isolates of *E. granulosus* from different species of intermediate hosts (Thompson and McManus, 2002). In total, 10 distinct strains (genotypes) of *E. granulosus* have been described using DNA sequence data: G1 (common sheep strain), G2 (Tasmania sheep strain), G3 (buffalo strain), G4 (horse strain), G5 (cattle strain), G6 (camel strain), G7 (pig strain), G8 (cervid strain), G9 (human strain), and G10 (Fennoscandian cervid strain) (McManus DC, 2002, Trans R Soc Med Hyg 96: 151-157; Lavikainen A, Lehtinen MJ, Meri T, Hirleva-Koski V, Meri S, 2003, Parasitology 127: 207-215; Maravilla P, Andrew Thompson RC, Palacios-Ruiz JA, Estcourt A, Ramirez-Solis E, Mondragon-de-la-Pena C, Moreno-Moller M, Cardenas-Mejia A, Mata-Miranda P, Aguirre-Alcantara MT, Bonilla-Rodriguez C, Flisser A, 2004, Acta Trop 92: 231-236). Although the validity of the G9 genotype has been questioned (Snábel V, D'Amelio S, Mathiopoulos K, Turceková L, Dubinsky P, 2000, J Helminthol 74: 177-181) and it might correspond to the G7 genotype. The horse strain G4 and the cattle strain G5 have been also considered to represent distinct species, *E. equinus* and *E. ortleppi*, respectively (Thompson and McManus, 2002). Data regarding the presence and distribution of echinococcosis-hydatidosis in definitive and intermediate hosts are scant and fragmentary in Italy

(Garippa G, Battelli G, Cringoli G, Giangaspero A, Giannetto S, Manfredi MT, 2004, Parassitologia 46: 33-38). Scant are also the studies regarding the number and type of *E. granulosus* strains present in Italy; researches performed by the sequencing of the mitochondrial genes NADH dehydrogenase and CO1, showed the presence of the G1 strain in sheep and cattle and of the G1 and G7 strains in pigs from Sardinia (Garippa *et al.*, 2004; Varcasia A, Nieddu MS, Scala A, Garippa G, 2004, Parassitologia 46: 193). In addition, Busi *et al.* (Busi M, Snabel V, De Liberato C, D'Amelio S, 2004, Parassitologia 46: 164) recently reported the presence of the G1 strain in sheep and of the G1 and G2 strains in cattle from Sardinia, as well as the presence of the G1 and G3 strains in sheep from Latium region. It is noteworthy that the G3 buffalo strain, detected for the first time in India, seems to be prevalent in the hydatid cysts obtained from human infections (Busi *et al.*, 2004).

Literature reports only three surveys on animal echinococcosis-hydatidosis in the Campania region of southern Italy. In the first one, Damiano, 1964 (Acta Med Vet 10: 397-401) reported prevalence values of 7.1% in cattle slaughtered in the Caserta province. The second one (Capurso A, Rivellini P, Guarino C, 1968, Atti SISVET 22: 725-729) reported prevalence values of 1% in dogs from Naples province and of 2.4% in intermediate hosts (cattle, sheep, goats, pigs and horses) slaughtered in the same zone.

In a recent survey, Cringoli *et al.* (Cringoli G, Capuano F, Landolfi MC, Esposito A, Veneziano V, Rinaldi L, 1998, Atti Giornate Scientifiche Campanie: 238), as a result of a surveillance at 26 slaughterhouses in the Campania region, reported an average prevalence of cystic echinococcosis lower than 5% in cattle, sheep, goats and pigs. However, some zones were at high risk for cattle and sheep with prevalence values ranging between 16 and 21%.

The present paper reports the results of an abattoir-based survey aimed to enlarge the knowledge on cystic echinococcosis in the Campania region of southern Italy.

Starting in October 2003, cattle and water buffaloes were examined for cystic echinococcosis at 2 slaughterhouses located in the Caserta province (north of the Campania region). Each animal was inspected in order to detect and collect hydatid cysts. The number of animals slaughtered each day was recorded, as well as the age, sex and origin of each animal. Parasitized organs were examined in

order to evaluate the number of cysts, their sizes, their form (unilocular, pseudo-multilocular, or iperlaminated). Fertility was assessed by determining protoscolex viability by microscopic examination, observing protoscolices and their flame cells movements; degenerative modifications (calcification, caseation) were also determined.

Out of a total of 108 cattle examined, 16 (14.8%) were found to be infected, aged between 1 and 12 years, all were females. Out of a total of 494 water buffaloes examined, 43 (8.7%) were found to be infected. They aged between 2 and 19 years and were 42 females and 1 male. The average number of cysts per cattle was 15.7 (minimum 1, maximum 74). Six animals had hydatid cysts only in the liver (with an average of 9.7 cysts/liver), 1 only in the lungs (with an average of 2.0 cysts/lungs), and 9 cattle had cysts both in the liver and in the lungs. Fertile cysts were not found. The frequency, form and type of hydatid cysts recovered from different organs of cattle, are reported in Table 1.

With respect to water buffaloes, the average number of cysts per animal was 5.7 (ranging from 1 to 45 cysts/animal). Ten animals had hydatid cysts only in the liver (with an average of 8.0 cysts/liver), 20 only in the lungs (with an average of 1.7 cysts/lungs), and 13 buffaloes had cysts both in the liver and in the lungs. Fertile cysts were found in 7 (16.3%) out of the 43 positive buffaloes. The frequency, form and type of hydatid cysts recovered from different organs of water buffaloes, are reported in Table 2.

In order to display the presence and distribution of cystic echinococcosis in animals from the Campania region, provenience data of positive animals were utilized, combining the data from present survey with the data from the survey performed in 1998 (Cringoli *et al.*, 1998) and a distribution map (Fig. 1) was drawn using a Geographical Informa-

tion System (GIS) (software Arc-View 3.2 GIS, ESRI, Redlands, CA, USA). This map uses the municipality as the geographic unit of reference and display the municipalities with animals (buffaloes, cattle, sheep, goats and pigs) parasitized by cystic echinococcosis. This map show that all the five provinces of the Campania region had municipalities with animals positive for cystic echinococcosis.

Cystic echinococcosis is known to be one of the most important parasitosis in livestock in the Mediterranean region and it is the most important parasitic zoonosis in this area (Garippa *et al.*, 2004). The findings of this survey are important to better know the distribution of cystic echinococcosis in the Campania region of southern Italy, mostly for the data reported for water buffaloes. In fact, until now, surveys aimed to evaluate the presence and distribution of bubaline cystic echinococcosis have been performed neither in Italy, nor in the whole Mediterranean region. In a recently published review of the epidemiological situation on echinococcosis in the Mediterranean region by the Mediterranean Zoonoses Control Centre, WHO (Seimenis A, 2003, *Acta Trop* 85:191-195), the Author reports incidence and/or prevalence values of echinococcosis/hydatidosis in humans, cattle, sheep, goats, camels, and dogs; there are no data on the water buffaloes. The prevalence values reported for buffaloes (8.7%) are noteworthy; they are higher than the average values previously reported in cattle, sheep, goats and pigs by Cringoli *et al.* (1998). Noteworthy is also the presence of fertile cysts in the 16.3% of positive buffaloes; this let to believe that the *E. granulosus* buffalo strain G3 – that seems to be prevalent in human infections too – is present in water buffaloes bred in Italy. The prevalence values reported for cattle in the present paper (14.8%) are double than the average values

Table 1. Frequency, form and type of hydatid cysts recovered from different organs of cattle.

| Organs | No. of cysts | Form of cyst | | | Type of cyst | | | |
|--------|--------------|--------------|--------------------|---------------|--------------|------------|---------|-------------------|
| | | Unilocular | Pseudomultilocular | Iperlaminated | Fertile | Acephalous | Sterile | Calcified/caseous |
| Liver | 176 | 119 | 56 | 1 | 0 | 51 | 13 | 112 |
| Lungs | 64 | 58 | 3 | 3 | 0 | 35 | 0 | 29 |
| Total | 240 | 177 | 59 | 4 | 0 | 86 | 13 | 141 |

Table 2. Frequency, form and type of hydatid cysts recovered from different organs of water buffaloes.

| Organs | No. of cysts | Form of cyst | | | Type of cyst | | | |
|--------|--------------|--------------|--------------------|---------------|--------------|------------|---------|-------------------|
| | | Unilocular | Pseudomultilocular | Iperlaminated | Fertile | Acephalous | Sterile | Calcified/caseous |
| Liver | 142 | 107 | 21 | 14 | 29 | 27 | 5 | 81 |
| Lungs | 111 | 81 | 11 | 19 | 30 | 14 | 6 | 61 |
| Total | 253 | 188 | 32 | 33 | 59 | 41 | 11 | 142 |

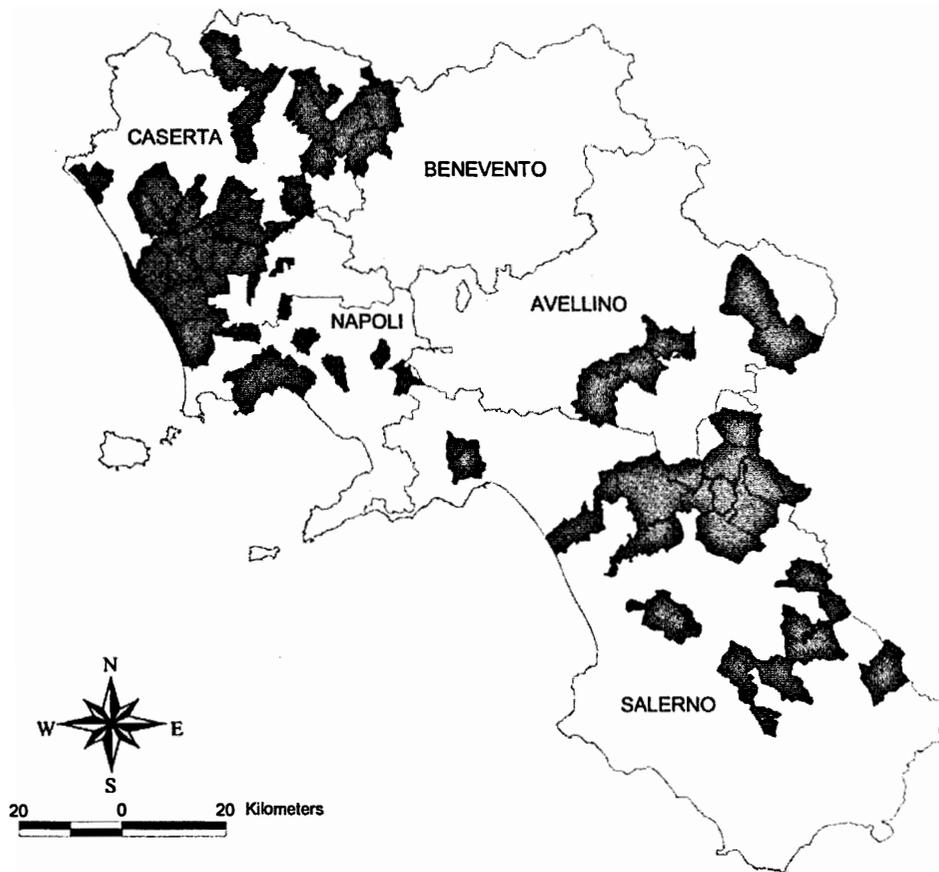


Fig. 1. Campania region: Municipalities with animals (buffaloes, cattle, sheep, goats and pigs) parasitized by cystic echinococcosis.

reported from the same province (Damiano, 1964) and they are in line with the values reported by Garippa *et al.* (2004) in southern Italy (13.3%). Further researches are necessary to explain the absence of fertile cysts in the cattle.

In conclusion, the findings of the present survey

showed that cystic echinococcosis is widespread in the Campania region of southern Italy; they represent an important starting point for further studies aimed to the molecular characterization of *E. granulosus* strain(s) in buffaloes from Italy, evaluating also its/their zoonotic potential.