Surveillance system of bluetongue in Italy

A. Giovannini[(1)], C. Paladini[(1)], P. Calistri[(1)], A. Conte[(1)], P. Colangeli[(1)], U. Santucci[(2)], D. Nannini[(1)] & V. Caporale[(1)]

(1) Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale', Via Campo Boario, 64100 Teramo, Italy
(2) Ministero della Salute, Direzione Generale della Sanità Pubblica Veterinaria, Alimenti e Nutrizione, Piazzale Marconi, 00144 Rome, Italy

Summary

The authors provided details of the bluetongue surveillance and the Internet-based information systems that were implemented in Italy. The systems were structured with the aim of gathering and spreading information and data to support decision-making, management of control activities and provide an early warning system. Information and data generated by the surveillance system enabled the detailed analysis of bluetongue epidemiology, vector distribution and vector population dynamics. This information and data also allowed the analysis of risk factors associated with vector spread and animal movements, which resulted in and increased the flexibility and the efficiency of the enforcement of control measures.

Keywords

Bluetongue – Epidemiological surveillance – Information system – Information technology – Italy.

During August 2000, Italy experienced the largest bluetongue (BT) epidemic in Europe (2). At the time, control of BT was covered by European Union (EU) Directive 92/119/EEC (12), together with some other Office International des Épizooties (OIE) List A diseases (such as foot and mouth disease, rinderpest, sheep pox, swine vesicular disease etc.), and EU Directive 92/35/EEC (11) had already defined specific measures against African horse sickness.

Directive 92/119/EEC outlined direct control measures and the demarcation of a 3-km radius protection zone and a 10-km radius surveillance zone, around infected farms. Direct control measures included the slaughter of all susceptible animals on farms and the possible extension of such measures to neighbouring farms suspected of being exposed. In November 2000, the EU, after reviewing the provisions of Directive 92/35/EEC (11), issued EU Directive 2000/75/EC (13) defining specific rules for the control and eradication of BT. In particular, Directive 2000/75/EC established the following:

a) a 100-km radius protection zone around the outbreaks or any farm on which virus circulation was confirmed
b) establishment of a 50-km radius surveillance zone around the protection zone
c) slaughter of all animals deemed necessary to prevent the spread of the epidemic and, the destruction of the carcasses of those animals
d) implementation of serological and entomological surveillance programmes in the protection and surveillance zones
e) prohibition of animal movement from protection and surveillance zones.

To complement these measures, the Directive foresaw the possibility of performing vaccination in the protection zone. Within the context of its general principles, Directive 2000/75/EC allows for the regulation of specific aspects by Commission Decisions (13). If relevant information on the spread of infection and risk factors were considered, this Directive allowed some flexibility in planning and enforcing control measures. Therefore, in Italy, a control strategy was adopted, combining direct and indirect control measures with an intense surveillance programme. The aim of the control measures was to reduce virus circulation in susceptible animal populations. The objective of the surveillance system to collect and analyse the

information needed to:

a) classify the territory in relation to the presence/absence of virus circulation
b) evaluate risk factors associated with the spread of vectors and animal movements
c) establish an early warning system.

The authors describe the BT surveillance programme and the Internet-based information system implemented in Italy.

Analysis of the systems

Surveillance system

The system was based upon regular:

a) recording of all suspected and confirmed clinical cases of BT
b) recording of results of periodical testing of sentinel animals
c) reporting on monitoring of the spread of vectors and their seasonal dynamics
d) recording of all diagnostic results
e) recording progress of vaccination campaigns.

The system also records results of specific ad hoc monitoring, such as the evaluation of the immune status of vaccinated populations, risks posed by transhumant animals (18) and verification if BT is present when testing results were inconclusive. The following laboratory tests were conducted exclusively at National Reference Centre for Exotic Diseases (CESME: *Centro Studi Malattie Esotiche*) in Teramo: virus isolation, serotyping of viral isolates, entomological identification of insects, polymerase chain reaction (PCR) testing of blood, tissues and insects, and virus neutralisation (VN) test confirmation of positive competitive enzyme-linked immunosorbent assays (c-ELISA) from local *Istituti Zooprofilattici Sperimentali* (IZS) laboratories. The reason why samples were sent to the laboratory was recorded in the information system and included: trace-back of animals from protection and surveillance zones, follow-up testing of a previously positive farm, confirmation of suspected clinical cases, testing of sentinel animals, surveys of infected or adjoining areas, surveys of vaccinated animals and evaluation of vaccine-related problems. Data was obtained from local Veterinary Services and from laboratories that supplied the data for the national information system. Information generated was circulated over the Internet and provided a common source to facilitate decision-making processes and the management of activities at central, regional and local level and also enabled verification of the consistency and efficiency of control activities in relation to national objectives.

Clinical surveillance

When clinical signs that were suspected as being BT were observed, a clinical examination on all susceptible animals present on the farm was performed and samples were collected for laboratory testing. During farm visits, the following information was collected and recorded: national farm identification code, postal address and geographic co-ordinates, date of onset of symptoms, number of susceptible animals present on the farm by age (<6 months of age, >6 months of age), number of diseased animals and number of dead, slaughtered or destroyed animals. Specimens sent to the laboratory were accompanied by the following information: national farm identification code, individual identification code of animal sampled, type of test requested (virological and/or serological) and the reason for sampling. Weekly follow-up clinical visits were performed on the farm to monitor the evolution of disease and to update the information system. Clinical visits were discontinued when either the suspicion of BT was ruled out or when there was no further evidence of virus circulation. When the presence of BT was confirmed, the clinical visits were extended to all ovine flocks within a radius of 20 km of a confirmed case with clinical disease or 4 km of a confirmed case with subclinical infection. During the clinical visits, the following data were collected and submitted: national farm identification code, geographic co-ordinates, altitude of the farm, date of and reason for the visit, total number of animals, number of animals examined and presence or absence of clinical signs of BT.

Serological surveillance

In the summer of 2001, in order to detect or exclude the presence of BT, a serological surveillance system based on sentinel animals was implemented in the protection and surveillance zones, and in areas at risk of infection (Fig. 1). In October 2001, the system was extended nationwide (Fig. 2). Italy was divided into grids of square units of either 400 km^2 or 1 600 km^2 according to the occurrence or risk of introducing infection, respectively. To detect a 5% infection rate with a 95% confidence level in each 400 km^2 unit, a sample of 58 bovine animals was selected from 5 to 8 farms. To detect a 2% infection rate with a 95% confidence level in each unit of 1 600 km^2, a sample of 148 bovine animals was selected from 8 to 12 farms (Fig. 3). If cattle were not present in the area, sheep were selected as sentinel animals. Sentinels were bled regularly with variable frequency, depending on the season and infection rate in the area. Blood samples were

collected at least once every 30 days in the protection and surveillance zones and, from May-December, samples were collected every fortnight. In infection-free zones, sentinels were examined every 30 days from May to December and every 60 days from January to April. Blood samples were tested for BT using the c-ELISA by the local IZS laboratory and positive results were confirmed by the VN test at the CESME.

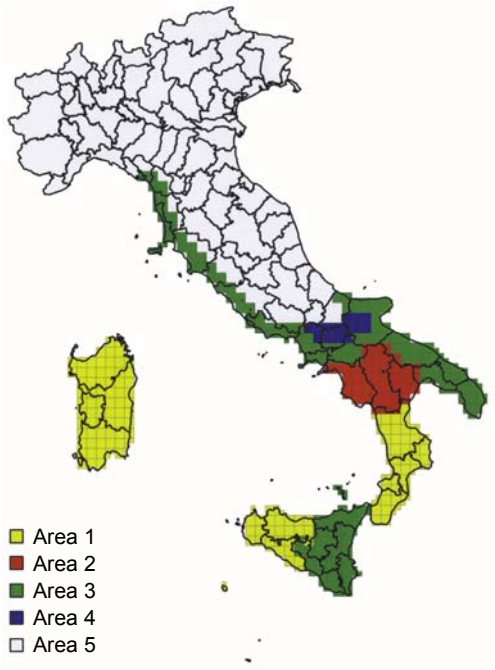

Figure 1
Five subdivisions of Italy, according to five different risk levels, May 2001

Figure 2
Subdivision of Italy into two areas, September 2001
Area A: squares of 400 km^2
Area B: squares of 1 600 km^2

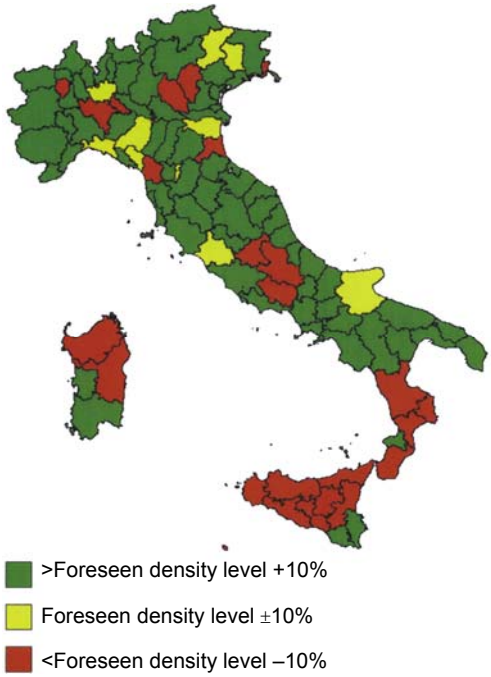

Figure 3
Density of sentinel animals per km^2
Each province was classified on the basis of the number of sentinel animals per km^2 as predicted by the serological surveillance plan

Entomological surveillance

From August 2000 until October 2001, an entomological surveillance programme was implemented in the protection and surveillance zones to map the distribution of vectors, with particular reference to *Culicoides imicola*. Blacklight traps were moved around the study areas to define the distribution of *C. imicola*. Permanent blacklight traps were operated from June to October 2001 in selected sites in various parts of the country to evaluate the effect of soil type on *C. imicola* presence. Since October 2001, entomological surveillance was extended nationwide (Fig. 2). Blacklight traps, were positioned in fixed locations in all provinces (Fig. 4) and operated weekly to monitor *Culicoides* population dynamics (17). Blacklight traps were also operated on a temporary basis in cases of suspected or confirmed virus circulation and whenever a more specific understanding of vector distribution was required.

For each insect catch, the following data were collected: national farm identification code, geographic co-ordinates, altitude of the farm, animal species present, date of capture, minimum and maximum temperatures during the night of the capture. Captures were examined to determine the total number of insects, the total number of *Culicoides* and the total number of *C. imicola*.

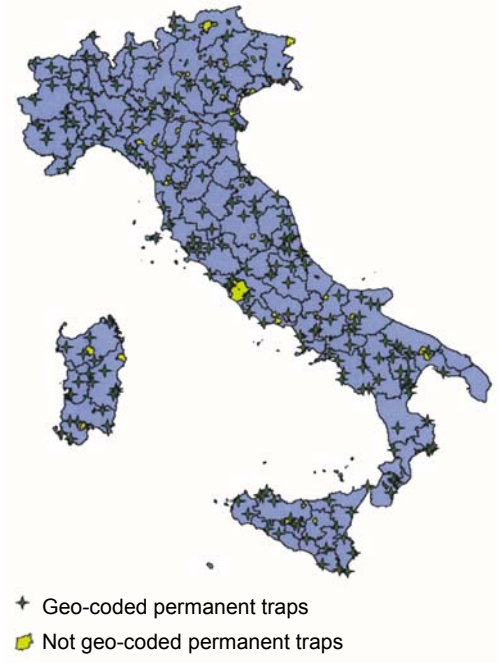

Figure 4
Geographical distribution of permanent traps in Italy, 30 July 2003

Ad hoc monitoring

Ad hoc monitoring was conducted to verify:

a) antibody prevalence in vaccinated populations
b) the risk linked to animal transhumance
c) the extent of virus circulation in certain zones where single seroconversions or unexpected positive results were found.

Antibody prevalence in vaccinated populations was evaluated by serological examination of 35 randomly selected vaccinated animals per grid cell. The risk linked to animal transhumance was evaluated through specific plans (18), which required entomological and virological examination of insects collected in both the departure and the arrival pastures and serological examination of non-vaccinated animals in transhumant flocks. The extent of BT virus (BTV) circulation in some zones, where single seroconversions or unexpected positive results were detected, was investigated by either PCR testing or serology, or by both PCR and serology of 58 randomly selected animals in the municipalities located within a 20 km radius around the suspect farm. In general, PCR was performed in vaccinated populations, while serology was used in unvaccinated ones. In either case, test results were recorded together with the national farm identification code, geographic co-ordinates of the farm, individual identification code for each animal, date and type of sample taken.

Progress of the vaccination campaign

Vaccination in infected and in at-risk zones commenced in the late autumn of 2001 (15). Since vaccination levels of susceptible populations in Italy were linked to approval of animal movement, progress of vaccination was recorded in the national BT information system. Data recorded were: Local Health Unit where vaccination was performed, total number of susceptible animals vaccinated, vaccine serotype/s used, vaccine batch number, national farm identification code, total number of susceptible animals on the farm, number of eligible animals, number of vaccinated animals by species and vaccination date.

Side-effects of vaccine

Possible undesirable side effects of the vaccine (deaths, abortions, stillbirths) were monitored by:

a) sampling animals in flocks where problems arose and testing dead animals and/or foetuses for the presence of vaccine virus
b) collecting information concerning type and incidence of disease observed, vaccine used, dates of vaccination, etc.

Samples were submitted to the laboratory for differential diagnosis and if BTV was isolated, the virus was identified (vaccine or field virus).

Information system

To ensure effective control of data and the link with surveillance activities, all laboratory test results were recorded in the local data bank of the IZS which was responsible for testing in the zone in which they were located. Data recorded in the local data banks, according to a pre-defined record layout, were transmitted weekly by e-mail from the local IZS to the National Information System (NIS) for BT at the CESME (Fig. 5). Clinical surveillance, which included suspected and confirmed outbreaks, municipal summaries of the clinical visits and vaccination data, were sent to the NIS each week by local Veterinary Services, either directly or through the regional services or through the local IZS. To facilitate data transmission, specific software was prepared by the CESME. Data were processed with the objective of providing a common base for all stakeholders that would provide the following:

a) an early warning system
b) a decision support tool to verify and plan activities by regional and national government bodies
c) a tool to manage routine activities.

To this end, most information was made available online on the CESME website (izs.it/bluetongue/bluehome.html) and updated weekly (Figs 6 and 7). Only information concerning ad hoc monitoring and vaccine side-effects were not available online on a weekly basis, as this data required in-depth analysis.

The ad hoc monitoring reports were, however, made available on the website in the form of specific reports ('documents' at izs.it/bluetongue/documenti/bt_index.html or 'new', izs.it/bluetongue/vaccini.pdf). Information on the disease and on the relevant legislation was also available on the website (Fig. 6).

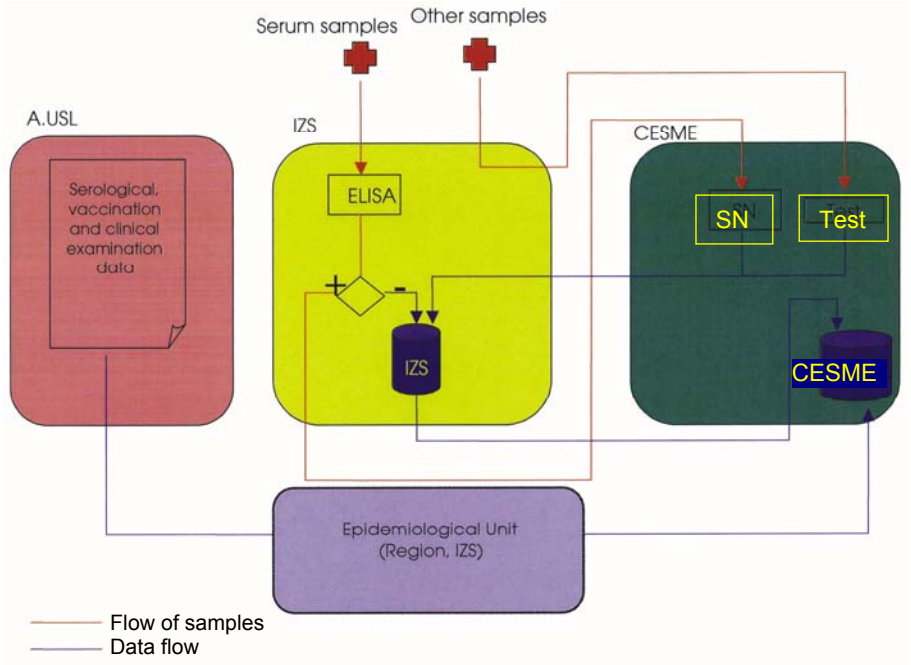

Figure 5
Flow chart of samples and data

Figure 6
Contents of the National Information System for bluetongue

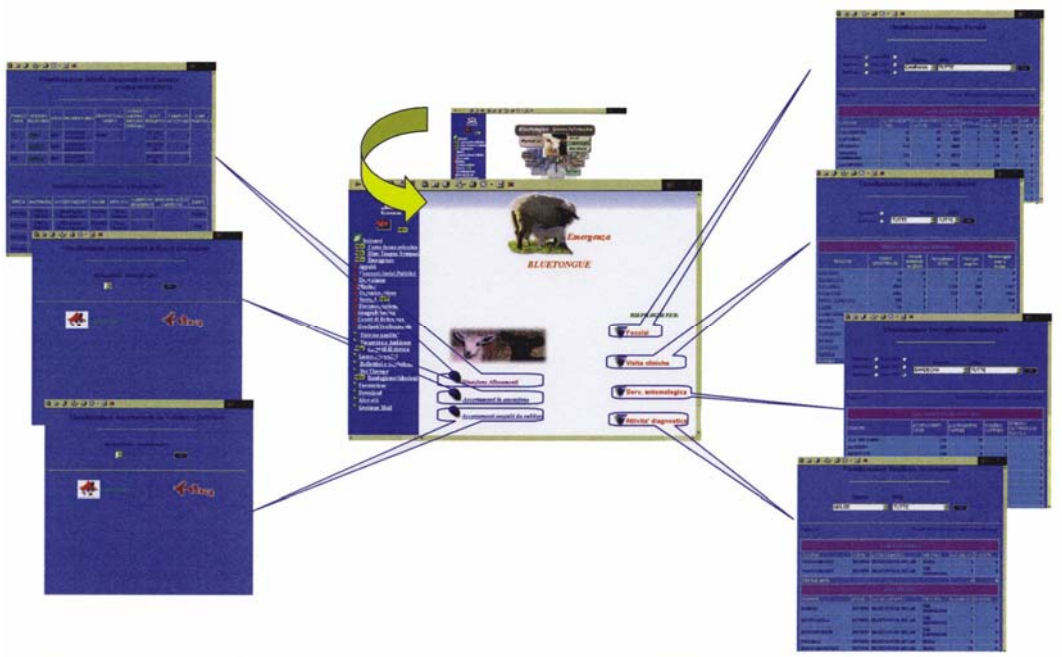

Figure 7
Web pages accessible by password from the National Information System for bluetongue: details of data available

Early warning system and decision-making support

The list of infected municipalities (derived from the notification of outbreaks or from serological surveillance) was available in the form of a table or map. Moreover, the table of infected municipalities was divided into the lists of newly infected municipalities and of municipalities that had re-gained free status (Figs 6 and 8). This category of information can be used both for early warning to highlight the trend of the epidemic and for management and decision support for applying animal movement restriction measures or vaccination. Maps showing the location of sentinel animals that had seroconverted were provided and the BTV serotype(s) implicated was indicated on the map. The *C. imicola* population dynamics in the main permanent traps in each region was also described in a series of graphs. These latter items of information were also provided in the form of Microsoft® PowerPoint® presentations of the evolution of the epidemic during the previous 100 days; this was updated every Monday (Figs 6 and 9). Finally, the monthly mean of the daily minimum and maximum temperatures nationwide were also available on the website (Fig. 10). These were derived from analyses of 10-year data provided by the Italian Military Air Force and collected at more than 100 weather stations uniformly distributed across Italy (Fig. 11).

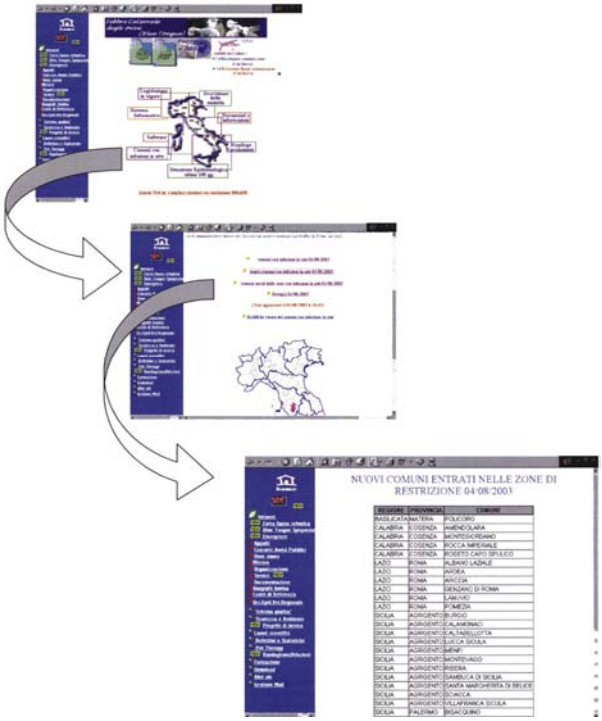

Figure 8
List of new infected municipalities, 4 August 2003

The number and location of all outbreaks by year or by seasonal epidemic was available both in tabular form (Figs 7 and 12) and as a dynamic map (Fig. 13). These data may be aggregated at municipality or

Local Health Unit level. The tables also provided data on the following:

a) number of outbreaks
b) total number of sheep/goat flocks
c) total number of animals in infected flocks
d) number of diseased, dead, slaughtered and destroyed animals in outbreaks.

Dynamic maps were also available showing the percentage of the population that had been vaccinated by animal species or by serotype (Fig. 14).

Results of entomological surveillance were mapped by seasonal epidemic displaying the presence/absence of *C. imicola* by municipality (Fig. 13). Data on the serological and entomological surveillance

Figure 9
Maps showing the location of serologically positive animals, bluetongue serotypes identified and the presence or absence of *Culicoides imicola*

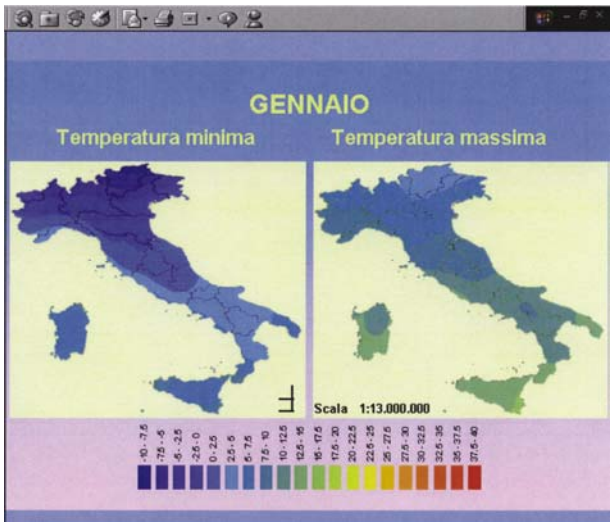

Figure 10
Mean value of minimum and maximum monthly temperatures for January 2003

Figure 11
Distribution of weather stations of the Italian Air Force Meteorological Service

performed during the previous 100 days were provided as Microsoft® PowerPoint® presentations (Figs 6 and 9). Other data useful to the decision-making process and available in the website concerned clinical visits (Fig. 7), subdivided by reason for the visit (animals introduced from protection/surveillance zone; surveillance in protection/surveillance zone; visits to and around suspected outbreak; monitoring of risk zones) and aggregated by the municipality or Local Health Unit. This information provided support for the management of daily activities of local Veterinary Services, such as entomological surveillance, vaccination and health status of each area.

Other management support data were also available, such as: detailed data on each holding investigated by the surveillance system nationwide, results of all diagnostic, serological, virological and entomological activities performed in a specific holding (Figs 7 and 15). In the case of an infected holding, the date of onset of clinical signs, dates of clinical visits and total number of animals, in addition to the number of diseased, dead, slaughtered, and destroyed animals, were available.

Ancillary information

Ancillary information (Fig. 6) includes the following:

a) EU legislation (directives and decisions) and all the national regulations on BT
b) software to record and despatch outbreak data, clinical visits, vaccination management and serology
c) forms and procedures for data input, including record layouts for data transmission to the NIS
d) a detailed description of the epidemiology, symptoms, pathology, laboratory diagnosis, prophylaxis and control of BT, in addition to a gallery of pictures and a comprehensive bibliography.

Rules for access to information

Access was regulated by password according to the type of user (Fig. 16). In general, official veterinarians and laboratories could access all data concerning their territory, while the Ministry of Health and the CESME had access to all information. A public section was also available and included a compendium of the information described above.

Discussion

The strict enforcement of Directive 2000/75/EC (13) caused very serious problems to the animal production sector of at least one third of Italy. After the first month of the epidemic, Decision 2001/138/EC (4) instituted protection and surveillance zones according to the criteria established by Directive 2000/75/EC (13) and movement restrictions were enforced in one-third of Italy. The movement of susceptible animals was prohibited from the regions of Sicily, Sardinia and southern Italy into infection-free regions. Consequently, it became virtually impossible to either fatten or cull cattle as the production system was organised to perform this type of activity in the Po Valley which was in the free zone. Moreover,

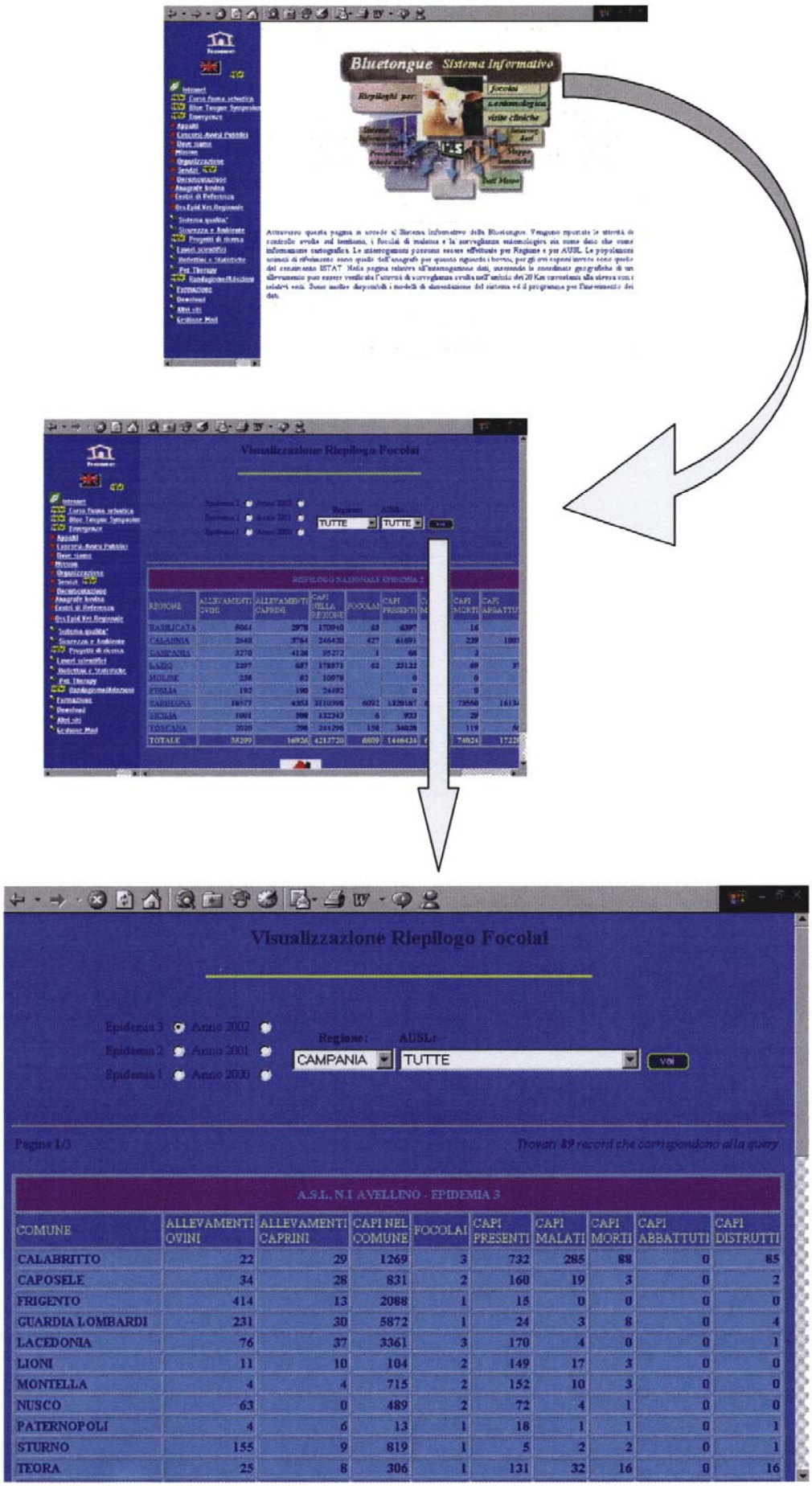

Figure 12
Number and location of all outbreaks by seasonal epidemic, year and municipality

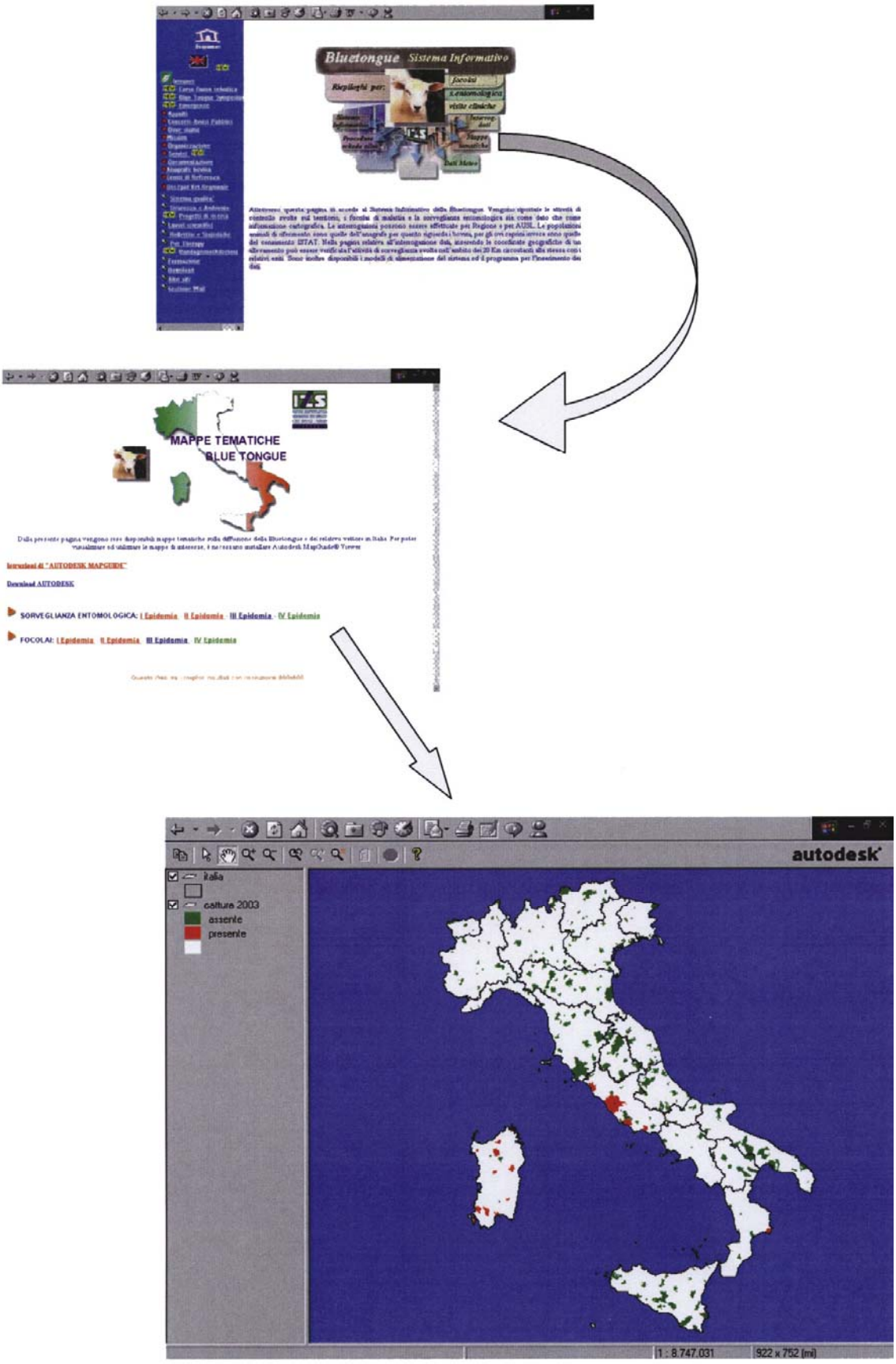

Figure 13
Results of entomological surveillance

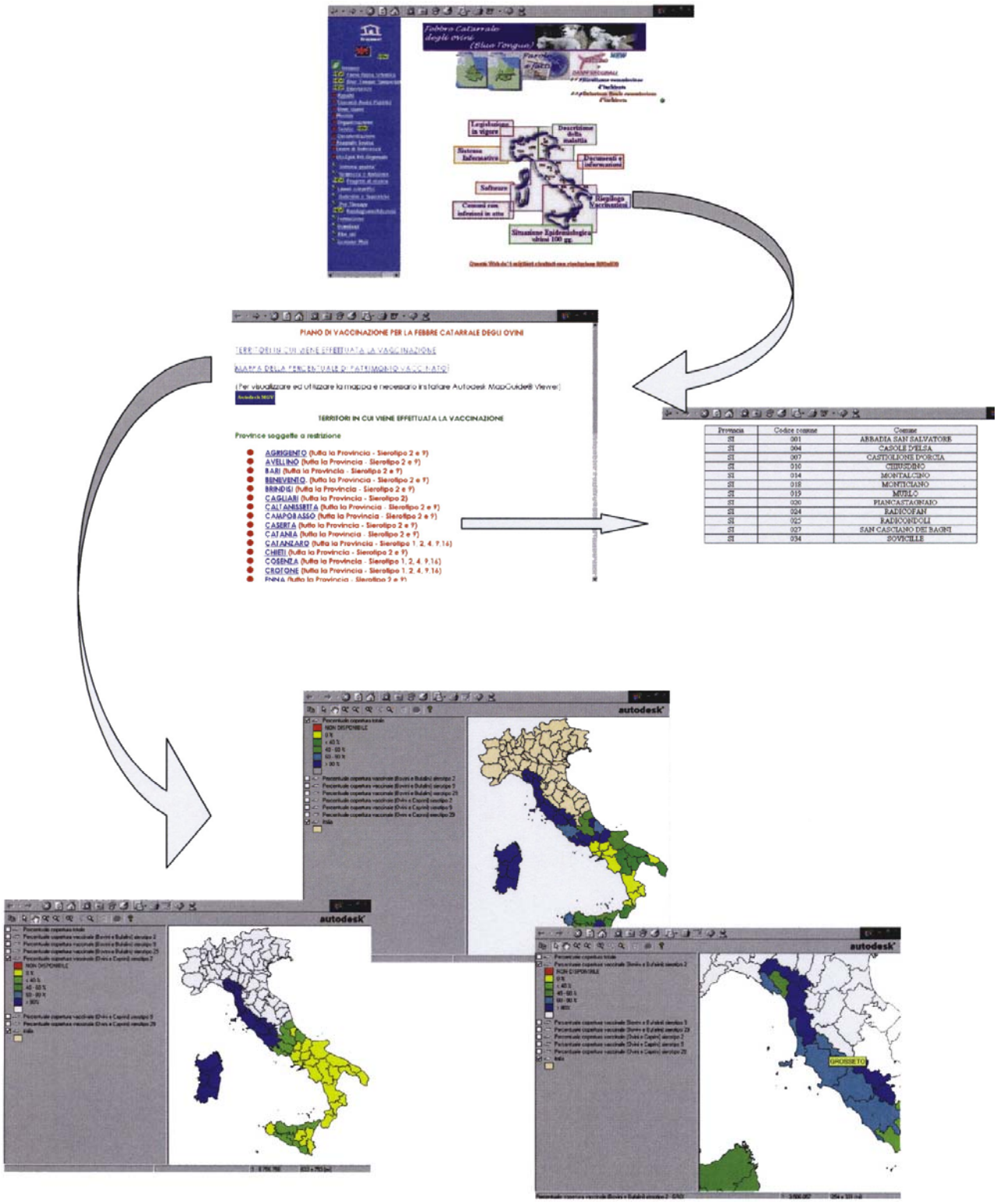

Figure 14
Example of the information made available by Government
Maps show the percentage of the vaccinated population by species and/or by serotype

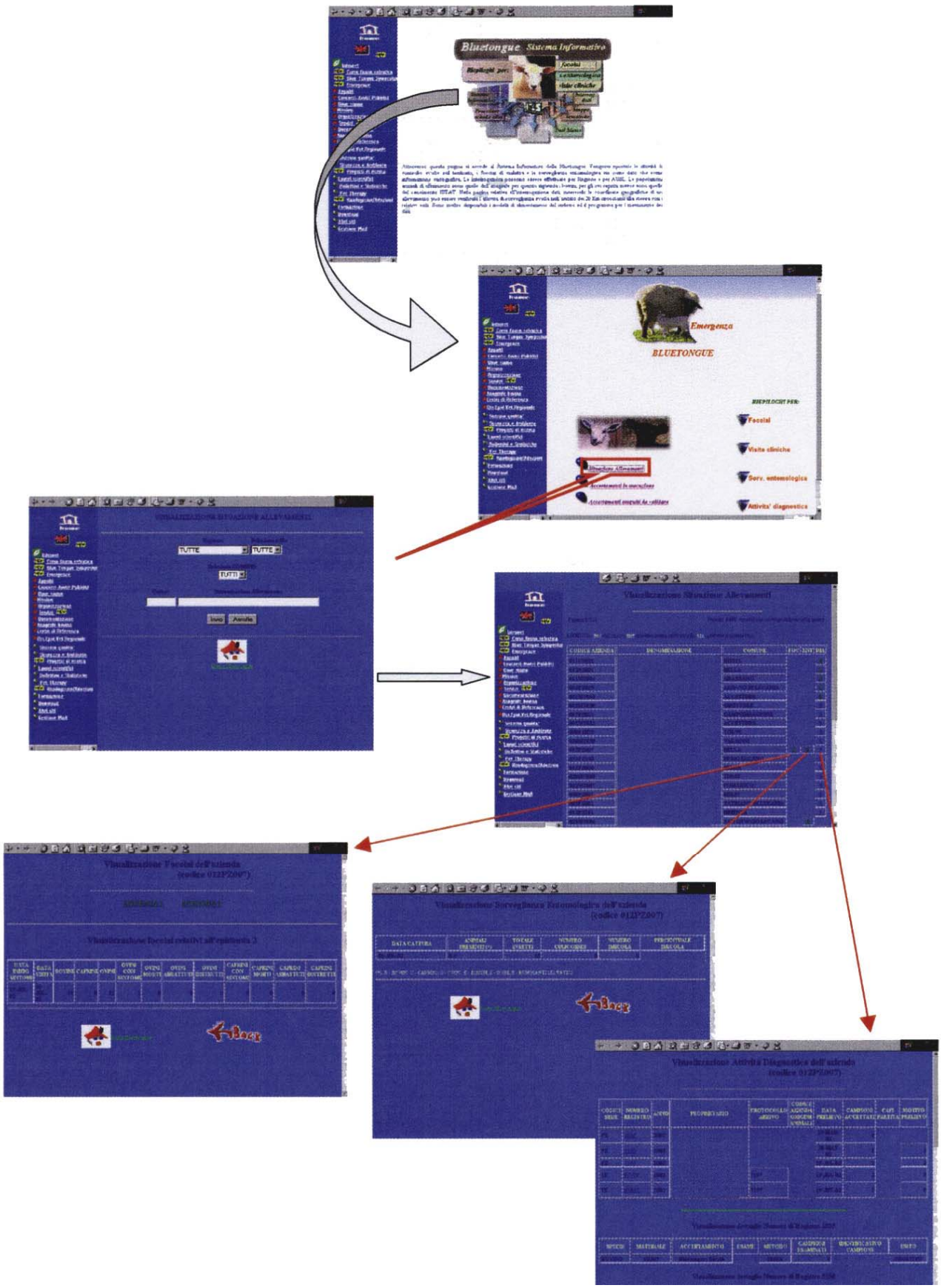

Figure 15
Detailed data on each holding investigated by the surveillance system

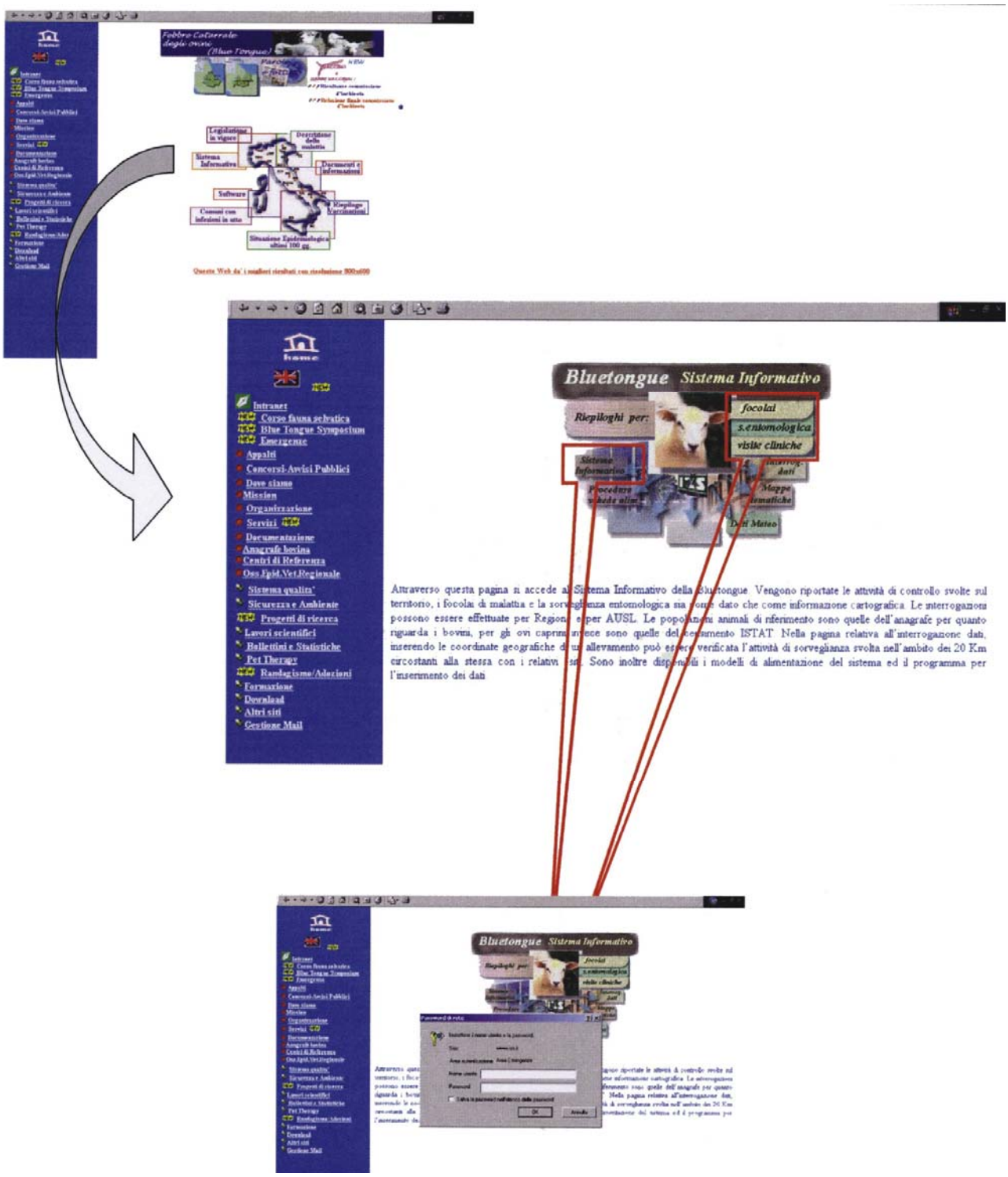

Figure 16
Sections of the information system accessible by password only

animal transhumance from the winter pastures in Apulia (surveillance zone) to the summer pastures in Abruzzo and Molise (free zones) was also blocked. The very nature and ecology of the BTV means that it cannot be eliminated from infected areas rapidly. The animal movement limitations imposed on BT susceptible species, on two-thirds of the Italian territory, was to result in either a complete reorganisation of the structure of the Italian bovine and ovine animal production sector or closing it down. A reorganisation of this magnitude appeared unlikely given not only the lack of both economic and human resources and the chronic shortage of adequate infrastructures, but the most important factor was the short time available. Things had been made much more difficult by the refusal of the EU

to allow the Italian government to compensate farmers for indirect losses due to the impossibility to access markets because of the animal movement restrictions. The problem was aggravated by the spread of the disease up the northern Tyrrhenian coast (Latium and Tuscany) (18). If these restrictions on animal movements had been enforced indefinitely or until BTV had been eradicated, which was very unlikely, the result would probably have been an irreversible decline of the agricultural sector with significant attendant social problems.

Since the commencement of the outbreak, authorities in Italy selected a strategy based on risk assessment and management with the objective of slowing, as far as possible, spread of infection and to develop a plan to alleviate the inconvenience caused by movement restrictions. After the first months of the epidemic, a number of factors highlighted the necessity for an in-depth understanding of the epidemiology of BT infection in Italy. Some of the elements that have characterised the seriousness of BT in Italy are the severity of the epidemic pattern in Sardinia, its spread to southern Italy (2), the lack of knowledge of vector biology and the lack of knowledge of BT epidemiology in countries like Italy that are located at the northern border of BT distribution. It has been well established that the circulation of BT is associated with a specific geographical area rather than on individual farms and, consequently, animal movement restrictions and trace-back activities were not applied to individual farms but to all the farms located in an infected zone. Therefore, management of control activities required regular oversight and co-ordination by Veterinary Services at the local, regional and central levels; efficiency of communication was of paramount importance. Information channels also had to be accessible to veterinary authorities in infection-free zones as they required punctual information on the distribution of infection in order to be able to evaluate the risks related to the introduction of animals from other regions and to implement the relevant safeguards.

Italy was the first country in the world in which BT caused a wide-scale epidemic in a previously infection-free susceptible population. The rapid implementation of a system that was able to support an organisation as complex as that needed to control BT in Italy, required the collection of massive quantities of data which required very intensive field activity. Response to the epidemic included, among other things, the periodical testing (in most cases fortnightly) of more than 30 000 sentinel animals (1) and the placing of about 250 permanent insect traps nationwide. Information and data produced by this surveillance system constitute the information base of the early warning system for BT in Italy. The information system was implemented online in an Internet environment. The advantages of this Internet system were that it was widely accessible by all parties concerned, that information was disseminated immediately and nationwide and that the privacy of sensitive data was controlled by a password system.

Data and information generated by the surveillance system have contributed to the knowledge on BT epidemiology by providing a better understanding of the distribution and dynamics of its vectors (3, 17), the ability to monitor the spread of infection (2, 15), and the possibility to evaluate the risk factors linked to the spread of vectors and to animal movements. This knowledge has probably contributed to the flexibility that now characterises the EU Directives on BT. The information generated by the Italian surveillance system probably contributed to the amendments to the original European Union decision 2001/138/EC (4). The following are EU decisions that were developed:

a) Decision 2001/783/EC of 11 September 2001 (5) recognised the validity of two OIE standards (*Terrestrial animal health code*) (19), namely: Article. 2.1.9.8. for animal movements from infected zones and Article 2.1.9.3. for the definition of seasonally free areas; furthermore, the same Decision reduced the radius of the zone from which slaughter animals cannot be sent to free zones from 100 to 20 km, provided a surveillance system was in place

b) commencing in January 2002, three Decisions, namely: 2002/35/EC (6), 2002/189/EC (7), 2002/543/EC (8), excluded from the surveillance zone some Italian provinces in which the surveillance system had documented the absence of virus circulation

c) Decision 2003/14/EC (9) taken in January 2003 that allowed the shipment of slaughter animals from infected to free areas, provided that the province of origin had a vaccination coverage of susceptible populations of at least 80% and a risk assessment had been performed

d) Decision 2003/218/EC (10) taken in March 2003 that introduced the concept of 'risk' and subdivided the territories into areas of higher and lower epidemiological risks. Furthermore, the decision allows the shipment of live animals from the 'lower risk areas' where viral circulation has not been detected to the entire territory of the EU and the movement of slaughter animals from 'lower risk areas', even with active infection, and from 'higher risk areas', where viral circulation has not been detected, to free areas in the national territory. The latter was

allowed only if the animals had been vaccinated at least more than 30 days previously, belonged to a herd in which all the animals were vaccinated and transport occurred during daylight hours only. According to the decision 2003/218/EC, the Member State, can demarcate 'epidemiologically relevant areas of origin' autonomously; in other words, on the basis of surveillance results, it can modify the radius of the protection zone to more than or less than 20 km and it can modify the risk level of a zone from low risk to high risk. It has also been possible, through a series of risk assessments to define the national BT control strategy (14), the risk linked to animal movement from restriction zones, in relation to presence or absence of documented viral circulation and to the level of vaccination in susceptible populations (16), and the sensitivity of the serological surveillance system (1).

Finally, the online information system has grown progressively with the evolution of the epidemic. The system was tailored to the evolution of knowledge on BT, control measures and legislation. The initial design of the central core of the website followed top-down logic. Progressive modifications, most of them generated in emergency situations, have led to a loss of the original design of the information system, increasing data complexity and sometimes making it difficult to retrieve specific information. For this reason, the system has been completely re-designed and the prototype is currently undergoing its validation phase.

References

1. Calistri P., Giovannini A., Conte A. & Caporale V. (2004). – Use of a Montecarlo simulation model for the re-planning of bluetongue surveillance in Italy. *In* Bluetongue, Part I (N.J. MacLachlan & J.E. Pearson, eds). Proc. Third International Symposium, Taormina, 26-29 October 2003. *Vet. Ital.*, **40** (3), 360-364.
2. Calistri P., Giovannini A., Conte A., Nannini D., Santucci U., Patta C., Rolesu S. & Caporale V. (2004). – Bluetongue in Italy: Part I. *In* Bluetongue (N.J. MacLachlan & J.E. Pearson, eds). Proc. Third International Symposium, Taormina, 26-29 October 2003. *Vet. Ital.*, **40** (3), 243-251.
3. Conte A., Giovannini A., Savini L., Goffredo M., Calistri P., Meiswinkel R. (2003). – The effect of climate on the presence of *Culicoides imicola* in Italy. *J. Vet. Med. B*, **50**: 139-147.
4. European Commission (2001). – Commission Decision of 9 February 2001 establishing protection and surveillance zones in the Community in relation with bluetongue (2001/138/EC). *Off. J.*, **L 050**, 17-19.
5. European Commission (2001). – Commission Decision of 9 November 2001 on protection and surveillance zones in relation to bluetongue, and on rules applicable to movements of animals in and from those zones (2001/783/EC). *Off. J.*, **L 293**, 42-46.
6. European Commission (2002). – Commission Decision of 16 January 2002 amending Decision 2001/783/EC as regards the protection and surveillance zones in relation to bluetongue in Italy (2002/35/EC). *Off. J.*, **L 015**, 31.
7. European Commission (2002). – Commission Decision of 5 March 2002 amending Decision 2001/783/EC as regards the protection and surveillance zones in relation to bluetongue in Italy (2002/189/EC). *Off. J.*, **L 063**, 26.
8. European Commission (2002). – Commission Decision of 4 July 2002 amending Decision 2001/783/EC as regards the protection and surveillance zones in relation to bluetongue in Italy (2002/543/EC). *Off. J.*, **L 176**, 45.
9. European Commission (2003). – Commission Decision of 10 January 2003 amending Decision 2001/783/EC as regards the bluetongue protection and surveillance zones and conditions for movements of animals for immediate slaughter (2003/14/EC). *Off. J.*, **L 007**, 87-89.
10. European Commission (2003). – Commission Decision of 27 March 2003 on protection and surveillance zones in relation to bluetongue, and on rules applicable to movements of animals in and from those zones and repealing Decision 2001/783/EC (2003/218/EC). *Off. J.*, **L 082**, 35-39.
11. European Council (1992). – Council Directive 92/35/EEC of 29 April 1992 laying down control rules and measures to combat African horse sickness. *Off. J.*, **L 157**, 19-27.
12. European Council (1992). – Council Directive 92/119/EEC of 17 December 1992 introducing general Community measures for the control of certain animal diseases and specific measures relating to swine vesicular disease. *Off. J.*, **L 062**, 69-85.
13. European Council (2000). – Council Directive 2000/75/EC of 20 November 2000 laying down specific provisions for the control and eradication of bluetongue. *Off. J.*, **L 327**, 74-83.
14. Giovannini A., MacDiarmid S., Calistri P., Conte A., Savini L., Nannini D. & Weber S. (2003). – The use of risk assessment to decide the control strategy for bluetongue in Italian ruminant populations. *J. Risk Anal.*, **24** (6), 1737-1753.
15. Giovannini A., Calistri P., Nannini D., Paladini C., Santucci U., Patta C. & Caporale V. (2004). – Bluetongue in Italy: Part II. *In* Bluetongue, Part I (N.J. MacLachlan & J.E. Pearson, eds). Proc. Third International Symposium, Taormina, 26-29 October 2003. *Vet. Ital.*, **40** (3), 252-259.
16. Giovannini A., Conte A., Calistri P., Di Francesco C. & Caporale V. (2004). – Risk analysis on the

introduction into free territories of vaccinated animals from restricted zones. *In* Bluetongue, Part II (N.J. MacLachlan & J.E. Pearson, eds). Proc. Third International Symposium, Taormina, 26-29 October 2003. *Vet. Ital.*, **40** (4), 697-702.

17. Goffredo M., Conte A.M., Cocciolito R. & Meiswinkel R. (2003). – The distribution and abundance of *Culicoides imicola* in Italy. *Vet. Ital.*, **39** (47), 22-32.
18. Nannini D., Calistri P., Giovannini A., Di Ventura M., Cafiero M.A., Ferrari G., Santucci U. & Caporale V. (2004). – Health management of large transhumant animal populations and risk of bluetongue spread to disease-free areas. *In* Bluetongue, Part II (N.J. MacLachlan & J.E. Pearson, eds). Proc. Third International Symposium, Taormina, 26-29 October 2003. *Vet. Ital.*, **40** (4), 707-712.
19. Office International des Épizooties (OIE) (2003). – Terrestrial animal health code, 12th Ed. OIE, Paris (oie.int/eng/normes/MCode/A_summry.htm accessed on 3 May 2004).