Veterinary public health in Israel

A. SHIMSHONY *

Summary: The epizootiological and ecological conditions in Israel, as well as socio-economic and agricultural structures, have created a unique and hazardous veterinary public health (VPH) situation. The paper describes various VPH problems concerning zoonotic diseases, products of animal origin and rural ecology, and the attempts to solve them by the State Veterinary Services and Animal Health.


INTRODUCTION

The Israeli Veterinary Services and Animal Health (VSAH), within the Ministry of Agriculture, are confronted with a specific overall situation and with local problems in animal and public health. These dictate the adoption of measures which will be briefly described.

To facilitate the diagnosis, prevention and eradication of animal diseases, fifty-seven diseases have been declared notifiable in accordance with the Animal Diseases Ordinance; fifteen of these have been officially declared as common to animals and man.

This review deals with the main activities of VSAH within the area of veterinary public health, namely zoonotic diseases, inspection of animal products and rural ecology.

STRUCTURE OF THE VETERINARY SERVICES

The structure of VSAH is represented in Fig. 1; the total number of employees in 1990 was 207.

Veterinary Field Service

The Veterinary Field Service (VFS) comprises ten district veterinary offices. All obligatory tests and vaccinations in farm animals, as well as veterinary control measures, regarding notifiable animal diseases are carried out by VFS personnel. Among their functions is the supervision of compulsory registration, ear-tagging and

* Director, Veterinary Services and Animal Health, Ministry of Agriculture, P.O. Box 12, Beit-Dagan 50250, Israel.
FIG. 1
Structure of Veterinary Services and Animal Health
Brackets refer to the number of facilities
transport of cattle. In addition, they direct and coordinate the activities of municipal veterinarians. The director of VFS is deputy to the Director of VSAH.

**Kimron Veterinary Institute (KVI)**

The institute comprises five divisions including fifteen laboratories at the Beit-Dagan campus and two elsewhere. Five of the laboratories are national reference centres (for brucellosis, botulism, rabies, bovine mastitis and mycoplasmosis). A national reference laboratory for residues in animal products is currently under construction. KVI is the centre of all veterinary activities in the country regarding diagnosis, research and development, and control of veterinary vaccines. The director of KVI is deputy-director of VSAH.

**Poultry Health Service**

There are eight district laboratories, operated jointly by VSAH and the National Poultry Board (NPB). The Service is headed by the Chief Poultry Diseases Officer and eight laboratory directors who are State Veterinary Officers. They direct the activities of poultry disease practitioners and microbiologists, who are employed in the laboratories by NPB. This unit is responsible for diagnosis, prevention, law enforcement and therapy for poultry diseases. Diagnostic activities are assisted by KVI reference laboratories.

**Rabies detention kennels**

Until recently, VSAH maintained and operated three State detention stations where dogs and cats which have bitten persons are detained for ten days of observation, as prescribed by the Rabies Ordinance. There are also sixteen municipal stations. At the end of 1990, sole responsibility for this activity was transferred to local authorities, bringing the total number of rabies detention stations to nineteen. The paragraph on rabies (below) provides further details.

**Animal products inspection**

Two subunits divide these responsibilities, as follows:

1. Control by local authorities of municipal slaughterhouses, meat inspection, licensing and control of various establishments with animal and public health implications. VFS, through the District Veterinary Officers, coordinates and directs the activities of 108 veterinarians engaged by the municipal and local authorities throughout the country. They are assisted by the expertise and guidance of the department for control of animal products at its headquarters in Beit-Dagan.

2. Inspection of all certified exporting plants, including poultry slaughterhouses and processing plants of various animal products. The head of the unit, a State Veterinary Officer, assisted by two regional veterinary inspectors, directs veterinary control in twenty-three industrial poultry slaughterhouses and eighteen processing plants approved for export. Most of the inspection personnel, veterinarians and lay inspectors are employed by NPB, and some by local authorities.

**Control of import and export of animals and animal products**

The unit is responsible for veterinary inspection at Israel’s seaports and airport, as well as at two frontier posts. In addition, three State quarantine stations for
domestic animals and one quarantine station for wildlife (jointly operated with the Nature Reserves Authority) are maintained. The system is headed by the Chief Import-Export Officer.

**Mastitis laboratories**

Between 1979 and 1981, six district milk-hygiene laboratories were established, initially to facilitate introduction of the proposed "milk hygiene improvement scheme" (see below). They were later converted into five udder health laboratories maintained by the National Milk Board, in cooperation with VSAH. The system is assisted by the reference laboratory for mastitis at KVI.

**Other activities**

Other areas of activity, such as the provision of specialists for small ruminant diseases and for bee diseases, are organised as shown in Figure 1.

**DATA ON ZOONOTIC DISEASES**

**NOTIFIABLE DISEASES**

Fifteen notifiable diseases have been officially declared common to animals and man, and all diagnoses of these diseases are reported to the Medical Officer in the Ministry of Health, for further action. Medical Officers are likewise required to report human cases of brucellosis to the Veterinary Officer. There follows a summary of data on the prevalence of these zoonoses in animals and man, and of certain other non-notifiable zoonoses, together with the main control measures. Data on prevalence in man were supplied by the Ministry of Health (2). Selected data for animals and man in 1990 are shown in Table I.

**Anthrax**

The incidence of anthrax in animals in Israel is low, with a mean occurrence of one to two cases annually (approx. 80% in bovines and 20% in small ruminants).

All livestock on an infected farm is vaccinated annually with Sterne-strain spore vaccine during a ten-year period following an outbreak.

Between 1986 and 1990, no human case was reported. One case was reported in each of the two preceding years, 1983 and 1984.

**Brucellosis**

*Bovine brucellosis*

The dairy cattle of Israel, comprising at present approx. 105,000 milking cows in 1,647 farms, are free from infection with *Brucella abortus*. During the past five years (1986-1990), not a single positive case of *B. abortus* was detected in the course of VFS surveillance. Compulsory surveillance, sponsored by the State, is routinely performed by means of the mass milk ring test on tank milk two to four times a year. In the event of a positive reaction, the test is repeated on bulk milk from groups of cows, and the cows of a suspected group undergo individual blood-testing. A total
### Table I

**Occurrence of some zoonotic diseases in animals and man in Israel, 1990**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Animals (Reported outbreaks)</th>
<th>Man (Reported cases)</th>
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</thead>
<tbody>
<tr>
<td>Anthrax (+/+)</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Botulism (-/+</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Brucella abortus (+/+)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B. melitensis (+/+)</td>
<td>6 (1 bovine)</td>
<td>194</td>
</tr>
<tr>
<td>Echinococcosis (-/+</td>
<td>88 (bovines)</td>
<td>13</td>
</tr>
<tr>
<td>Erysipelothrix (+/-)</td>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>Leishmaniosis (+/+</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Leptospirosis (+/+</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Listeriosis (+/-</td>
<td>4</td>
<td>NA</td>
</tr>
<tr>
<td>Psittacosis (+/-</td>
<td>33 (avians)</td>
<td>NA</td>
</tr>
<tr>
<td>Q fever (+/+</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Rabies (+/+</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Salmonellosis (+/+</td>
<td>188 (mammals)</td>
<td>4,724</td>
</tr>
<tr>
<td>Spotted fever (-/+</td>
<td>NA</td>
<td>96</td>
</tr>
</tbody>
</table>

(a) Data for previous years are available in the OIE publication *World Animal Health*

(b) Outbreak = locality with at least one diagnosed case

(c) 0.15% of slaughtered cattle

(+/-) Notifiable in animals/notifiable in man

NA Not available

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of 2,000-3,000 blood samples are thus collected annually by the District Veterinary Officers and examined by KVI. During the past five years, five reactors were detected and slaughtered with full compensation, but were negative to bacteriological examination of viscera and organs by KVI. It can therefore be claimed that the national dairy herd is free from the disease, though farmers are reluctant to discontinue the mass vaccination of all dairy heifers, two to six months old, with *B. abortus* strain 19 vaccine. The risk of reinfection of dairy cattle from sheep, infected with *Brucella melitensis*, also encourages continuation of the present vaccination scheme.

In contrast to dairy cattle, the local "baladi" beef cattle which are maintained in small units with extensive management systems are found to be sporadically infected with *B. melitensis*. During the years 1986-1990, seven foci of infection in cattle were recorded, and the sixty-nine infected animals were slaughtered with compensation.

An exceptional case related to a dairy farm, comprising 765 animals, which was positive to the periodic ABR test in late 1988, and consequently found to be infected with *B. melitensis* biotype 3. The route of infection could not be established but circumstantial evidence implicated feeding with contaminated whey produced from sheep or goat’s milk (3). The herd was put under quarantine, and the test-and-slaughter policy was applied. This was completed during 1989, following the slaughter of 105 positive or suspected, and 70 unvaccinated animals. After two general tests with negative results, the herd was declared free. This incident highlighted the importance of S19 vaccination to protect cattle which may be exposed to *B. melitensis*, and the need to improve the supervision of pasteurisation procedures for whey in sheep cheese dairies. In 1990, another dairy farm, comprising 265 animals, was also found to be infected with *B. melitensis* biotype 1. In this case, no whey had been supplied to the bovines. The infection might have originated from nomadic sheep and goat flocks.
which contaminated the pasture. The herd will be declared free after two consecutive negative serological tests involving all animals on the farm.

**Ovine and caprine brucellosis**

The occurrence of *B. melitensis* in Israel has increased during recent years; thirty-five foci were reported during the years 1986-1990. The disease persists especially in primitive flocks kept under extensive management, and it is assumed that the prevalence of the disease in sheep and goats is much higher than the figures currently available suggest. Eradication of the disease by culling all infected flocks with full compensation was economically unsound, and at present individual whole flocks may be slaughtered, in most cases only at the farmer's initiative. However, in specific circumstances of exceptional risk to public health, for instance when an infected dairy flock is located within a densely populated or urban area, obligatory slaughter is carried out and compensated. Infected flocks that are not submitted for culling are branded and quarantined. It was found that sheep dogs could serve as a reservoir of the agent, and dogs found to be carriers are destroyed.

Since no official slaughter policy has been adopted, mass vaccination with the attenuated Rev 1 vaccine is carried out. Female lambs and kids, 2-6 months old, are vaccinated and marked.

During recent years, a test-and-slaughter policy was practised only in selected well-managed flocks, with rather encouraging results. This procedure is being continued whenever possible but, as mentioned before, the budget for compensation of slaughtered animals is limited. A detailed eradication scheme has been planned, which includes mass testing, identification of infected flocks, test-and-slaughter of positive animals in flocks with an infection rate lower than 10%, and slaughter of entire flocks when the infection rate is higher. In view of this general control and eradication scheme, a pilot operation was carried out in a selected area in northern Israel. The area included sheep and goat flocks kept under both extensive and intensive management conditions. Of thirty-five flocks with 5,555 animals, seven flocks (20%) were found infected, with 148 positive animals (2.6%). Only one flock was found to be infected at a rate higher than 10% (92/484 = 19%). This flock was slaughtered, along with 56 animals in the other infected flocks. The test-and-slaughter policy was applied in these flocks. Mean compensation per slaughtered animal was US$ 90. Judging from this pilot project, available data from other parts of the country, and differences in husbandry systems, it is estimated that at least 15,000 sheep and goats would have to be slaughtered during the first year of a general operation, with compensation to cover owners’ losses.

**Human brucellosis**

The incidence of reported cases of *B. melitensis* in man is increasing (18). The lowest reported national incidence, since 1950, was in 1970, when there were six cases, giving a national incidence rate of 0.2/100,000. Since then, there has been a gradual increase which became pronounced in 1984, with the highest incidence reported during 1988, when 487 cases (10.9 per 100,000) were reported. Malta fever occurs mainly as a food-borne disease, the chief source of infection being milk products such as unpasteurised soft cheese from sheep and goats, which is consumed mainly by certain ethnic groups. Fewer cases occurred in shepherds and their families, veterinarians and laboratory personnel, although in recent years six VSAH personnel have been infected. The peak months of human brucellosis are May, June and July.
An analysis of publications of the Ministry of Health (10) revealed that 35% of 774 cases of brucellosis, registered between the years 1974-1985, involved children. Clinically, the illness presented symptoms of pyrexia (77%), arthralgia and arthritis of the large joints (55%), splenomegaly (50%), lymphadenopathy (37%), hepatomegaly (27%), hepatitis (27%) and encephalitis (5%).

The department of bacteriology at KVI serves as a national reference centre for human brucellosis. In the years 1970-1979, this laboratory isolated *B. melitensis* from 80 cases in sheep and goats, and from 54 human cases, mostly of biotype 1 (5). In 1990, the centre identified 12 isolates in sheep and goats, 3 in cattle and 70 in man. The 70 human isolates were classified as follows: 53 biotype 1; 10 biotype 3; 1 vaccine strain Rev 1; 6 unclassified (M. Banai, personal communication).

**Economic aspects of B. melitensis infection**

Malta fever in humans in Israel was estimated (15) to have caused direct economic losses of US$ 380,000 in 1987, excluding long-term disability. The lowest estimate for 1988 is US$ 820,000; the hospitalisation rate and the days in hospital could be reduced during 1988, due to earlier diagnosis and treatment in clinics (Table II).

### TABLE II

**Malta fever in humans: reported cases, days of hospitalisation and estimated costs**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. cases</th>
<th>Days in hospital</th>
<th>Cost of hospitalisation (in US$)</th>
<th>Cost of medicine and tests (in US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>41</td>
<td>342</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>193</td>
<td>1,608</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>205</td>
<td>1,708</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>79</td>
<td>658</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td>220</td>
<td>1,833</td>
<td>231,250(c)</td>
<td>48,125</td>
</tr>
<tr>
<td>1988</td>
<td>512(a)</td>
<td>2,730(b)</td>
<td>457,500(d)</td>
<td>111,875</td>
</tr>
</tbody>
</table>

(a) Estimate based on data of first six months  
(b) Mean eight days per hospitalised patient, compared to 12.5 in previous years  
(c) Day of hospitalisation = US$ 126  
(d) Day of hospitalisation = US$ 167

The losses in one sheep flock of the mutton-Merino breed, infected with *B. melitensis*, were calculated as US$ 85,000 (= $ 358 per ewe), equivalent to the production value during two years.

**Cysticercosis bovum**

The disease became notifiable in 1981. The mean infection rate among slaughtered cattle of 0.38% (0.27-0.47%) has remained unchanged during the past ten years. In 1990, the infection rate was 0.26% (157 cases). Upon notification by the Veterinary Services, the public health authorities carry out epidemiological investigations, including examination of faeces from persons in the reported foci.
Erysipelas

Most cases in animals are reported in geese and turkeys, with a mean annual rate since 1986 of 8.9 cases. Rare cases have been reported in lambs (arthritis and septicemia) and pigs. The annual number of outbreaks in sheep during the five years 1986-1990 was 4, 4, 1, 2 and 2. A few cases of human erysipeloid have been diagnosed as an occupational disease (13), but the human disease is not notifiable.

Glanders

This disease was once common. However, it has not been reported since 1951, probably due to a decline in the number of equines combined with absence of imports from neighbouring countries. Strict measures are adopted to prevent its reintroduction by import.

Leishmaniosis (canine)

No cases in dogs have been reported since 1955, but the diagnosis of three cases of visceral leishmaniosis in humans during the five years 1986-1990 indicates that the infection is present.

Cutaneous leishmaniosis in humans, caused by *Leishmania tropica major* is endemic in certain areas, mainly in the Jericho valley — hence its common name “Rose of Jericho”. It is transmitted to man by *Phlebotomus* spp. from the alleged endemic natural host, the *Psammomys* mouse. The annual number of reported cases in the five years 1986-1990 was 70, 17, 115, 89 and 60 (preliminary data for 1990).

Leptospirosis

Since 1976, there has been a significant increase in the incidence of leptospirosis in cattle, mostly caused by *Leptospira hardjo*, with a peak of forty outbreaks in 1979 (8, 12). Most cases in cattle are subclinical or very mild, though mastitis and abortions have been observed in a few cases; vaccination of susceptible cattle in infected herds with an inactivated *L. hardjo* vaccine has been carried out since 1979, involving 6,000-14,000 bovines annually. Since 1986, 12-22 foci have been recorded annually (mean = 17), all in unvaccinated cattle.

More than 300 clinical leptospirosis cases in humans, many of them on dairy farms, have been diagnosed and reported by the Ministry of Health during the ten years 1973-1982, with only fifteen cases during the five years 1986-1990.

Listeriosis

Listeriosis is not very common. Until 1986, three to six outbreaks were recorded annually, mostly in sheep (60%) and cattle (35%). A sharp rise in the incidence of listeriosis in sheep commenced in 1987 (nineteen localities), followed by eleven in 1988, seven in 1989 and four in 1990. Listeriosis has been officially declared a zoonotic disease, and diagnosed cases are reported to the public health authorities. Since the disease in man is not reportable, no data are available on human cases; however, eighteen human cases, fourteen of which were fatal, were diagnosed at the Sheba Medical Centre between 1964 and 1972 (11).
Psittacosis and ornithosis (chlamydiosis)

Cases have been diagnosed mainly in imported parrots and cage birds. In one case, 160 cage birds in an urban pet-bird shop had to be destroyed. The importation of parrots was temporarily discontinued in 1984 to enable the implementation of modified veterinary import requirements. Consequently, imported parrots are now required to have been treated, before importation, with a specific long-acting antibiotic. The occurrence in humans is not officially recorded, but at least eight family outbreaks were diagnosed in hospitals in Israel during 1986 and 1987. Clinical manifestations in thirty-seven patients with positive culture and/or positive serology included mainly pneumonia or upper respiratory tract infection (7).

Q fever

Cases of Q fever are reported in animals in Israel every year. The mean number of outbreaks during the ten-year period 1973-1982 was 5.6 (range 1-11), characterised by abortions in ruminants, of which 85-90% were sheep (12). In 40-50% of the outbreaks in sheep, numerous abortions during late pregnancy were observed. In other cases, and in all outbreaks reported in cattle or goats, only sporadic or single abortions have been observed. The incidence of Q fever in sheep is reported to have increased since 1984, reaching an annual peak of thirty-four outbreaks in 1988 and 1989. It declined to thirteen in 1990, probably due to vaccination of many flocks with a bivalent chlamydia/Q fever inactivated vaccine.

In most cases, there was no evidence of contact infection of humans. The annual number of human cases, as reported by the public health authorities, was 150-200 until 1984, but has considerably decreased since: 31, 10, 15, 6 and 9 cases in the five years 1986-1990.

Rabies

The evolution of rabies in vectors since the establishment of Israel in 1948 is presented in Table III, demonstrating a sharp decrease of the incidence in dogs.

<table>
<thead>
<tr>
<th>Years</th>
<th>No. of years</th>
<th>Domestic animals</th>
<th>Wildlife</th>
<th>Fauna (%)</th>
<th>Human cases</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dogs</td>
<td>Cats</td>
<td>Foxes</td>
<td>Jackals</td>
</tr>
<tr>
<td>1948-1957</td>
<td>10</td>
<td>72.0</td>
<td>3.9</td>
<td>0.1</td>
<td>9.9</td>
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<tr>
<td>1958-1966</td>
<td>9</td>
<td>19.4</td>
<td>0.9</td>
<td>0.3</td>
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<tr>
<td>1967-1978</td>
<td>12</td>
<td>8.6</td>
<td>0.3</td>
<td>1.3</td>
<td>0.3</td>
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<tr>
<td>1979-1990</td>
<td>12</td>
<td>6.2</td>
<td>0.25</td>
<td>12.6</td>
<td>1.25</td>
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</tbody>
</table>

Since 1979, rabies has become sylvatic, with most cases observed in foxes and other wildlife. It is compulsory for pet dogs to be vaccinated annually with a killed vaccine. Farm animals, including horses, are vaccinated with the same vaccine upon the owner’s request in areas with high prevalence. Rabies cases occur in most parts of Israel. After an absence of almost thirty years, the disease has recently reappeared
in southern Israel, including the Negev desert. According to the regulations, dogs, cats and monkeys involved in biting must be kept for ten days in rabies-observation kennels. The rabies reference laboratory at KVI examines 700-1,000 animal brains annually for rabies. The data concerning rabies diagnoses in animals during the past ten years are presented in Table IV.

<table>
<thead>
<tr>
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<tbody>
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<td>Canines</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
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<td>2</td>
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<td>Equines</td>
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<td>(3)</td>
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<td>(7)</td>
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<td>(3)</td>
<td>(10)</td>
<td>(9)</td>
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<td>Total</td>
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<td>20</td>
<td>17</td>
<td>8</td>
<td>23</td>
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<td>23</td>
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<td>(17)</td>
<td>(17)</td>
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</tr>
</tbody>
</table>

( ) = in territories controlled by Israel

In 1990, the following activities were carried out: examination of 1,108 brains; vaccination of 99,153 dogs and cats, 32,875 cattle and 6,157 other animals; destruction of 21,843 stray dogs and 13,522 cats and other strays; detention of 2,109 biting dogs in government kennels and 2,804 in municipal kennels.

There has been no human case of rabies in Israel since 1960. The last case in the territories controlled by Israel was recorded in 1971.

VSAH cooperates closely with the Public Health Service, to which every incident of biting, as well as the results of the observations in the detention stations, are reported. Since 1978, the public health authorities have used human diploid tissue-culture vaccine for vaccination following exposure. The number of antirabies treatments in man during 1982-1989 was reported (2) to be an average of 1,016, with a minimum of 652 and a maximum (in 1989) of 1,765. A total of 316 (17.9%) persons treated in 1989 had direct contact with confirmed rabid animals.

The economic aspects of rabies and of related control activities in Israel have been evaluated recently (16). The total nation-wide expense in 1988 was estimated at US$5,225,000, of which 84% was the cost for local municipalities, responsible for control activities. The expenses of VSAH for rabies diagnosis and control during 1988 were estimated at US$ 273,000. Losses to livestock were approx. US$ 11,000 and
vaccinations of livestock approx. US$ 190,000. The annual cost of post-exposure treatment of humans, carried out by the Ministry of Health, was approx. US$ 316,000.

Rift Valley fever

Rift Valley fever was declared notifiable in 1978 following reports of a major outbreak in Egypt, but it has never been recorded in Israel. To prevent its introduction, strict measures were taken during the years 1978-1981, including mass vaccination of all ruminants with a killed vaccine. This vaccination has been discontinued, but stringent control measures along the frontiers and surveillance activities are still in effect.

Salmonellosis

Most cases in mammals have involved cattle (75%) and sheep (20%); sporadic cases have been recorded in dogs. The annual mean number of outbreaks in mammals is 220 and in poultry 350. The most prevalent types in 1989, as summarised by the national reference laboratory (1), were as follows:

- in bovines: *Salmonella dublin* (19.1%) and *S. typhimurium* (18.9%)
- in chickens: *S. infantis* (15.5%), *S. enteritidis* (12.1%) and *S. hadar* (10.6%)
- in turkeys: *S. emek* (15.9%) and *S. saint-paul* (13.7%).

There was a marked increase in the prevalence of *S. enteritidis* in chickens, which increased from less than 1% in 1987 to 7.5% in 1988 and 12.1% in 1989. However, phage-type 4 was found only in imported birds and their progeny, and eleven infected flocks were destroyed. The annual prevalence of *S. typhimurium* decreased in turkeys (7.6%, 5.3%, 4.7% and 1.9% from 1986-1989), and in chickens (12.0%, 12.1% and 7.4% from 1987-1989).

In 1989, 46 serovars were identified within 524 strains isolated from *human food*, the most prevalent being *S. infantis* (18.9%), followed by serovar 9,12:1,v (8.6%) and *S. bredeney* (8.2%). Only six strains of *S. enteritidis* were recovered from food, of which four were from chicken, one from turkey and one from Berber sheep. Of the 524 *Salmonella* strains isolated from human food, 242 were of chicken origin (46.2%), 98 of turkey (18.7%) and 80 of beef (15.3%).

The annual number of salmonellosis cases in *humans*, as reported by the Department of Epidemiology in the Ministry of Health, has gradually increased from 3,053 in 1986 to 4,724 in 1990. The three main types, out of 75 different types isolated from humans in 1989, were *S. infantis* (13.5%), *S. goettingen* var monophasic (11.0%) and *S. typhimurium* (8.2%). The annual prevalence of *S. typhimurium*, which decreased in turkeys, decreased in humans as well: 22.0%, 11.1%, 11.8% and 8.2% from 1986-1989. The prevalence of *S. enteritidis* in humans gradually decreased from 9% in 1970 to 2.1% in 1987, while being practically absent from animals and animal products during the same period (0.2% in 1987). In 1988, the figures increased to 4.1% of all human isolates and 3.6% of all other sources. The increase continued in 1989, reaching 9.1% of all human isolates. Strikingly, not a single isolate of *S. enteritidis* was identified in 1988 in the 176 positive chicken-products samples, and only 4 of 242 in 1989. Typing of salmonellas from all sources is carried out by the National Salmonella Centre, Ministry of Health, Jerusalem (1).
Trichinellosis

Trichinellosis has never been diagnosed in local pigs in Israel. The disease was declared notifiable in 1982, when the high prevalence of the disease in a neighbouring country became apparent, and infected people from that country were being admitted to Israeli hospitals. Surveillance is carried out in pig slaughterhouses, so far without a positive finding.

According to a specific regulation, published in 1977, entire carcasses of hunted wild boars are compulsorily inspected by accredited veterinarians at specialised stations. More than 1,200 such animals have been inspected during the last nine years, all with negative results. However, in May 1992, the first case of trichinellosis was diagnosed in a wild boar, shot adjacent to the Lebanese frontier (A. Marcovics, personal communication).

Tuberculosis

Bovine tuberculosis (TB) was eradicated from Israel in 1973, following the termination of a three-phase eradication scheme, which commenced in 1950. Since 1973, all dairy and beef herds have been tuberculin tested once in five years while “accredited export herds” are tested every three years. A bovine found suspected or positive following the initial test with single, bovine tuberculin, is retested with the comparative bovine-avian tuberculin test. Following a repeated suspected reaction, the animal is slaughtered with compensation. The total number of animals thus slaughtered between 1985 and 1989 was 114, all found negative upon post-mortem examination.

Another measure to safeguard the freedom of the bovine population from TB is meat inspection at slaughterhouses, which the law requires be carried out by accredited municipal veterinarians. Despite the absence of the disease, VSAH intends to continue the described testing scheme, which is carried out by District Veterinary Officers.

It should be pointed out that avian TB has not been recorded in Israel.

In August 1990, TB was suspected and confirmed in a dairy farm on the Golan Heights. Subsequently, three infected contact farms were detected. All positive, suspected and exposed animals in the affected farms were slaughtered. As of 31 December 1990, these totalled 386 bovines, for which compensation was paid as prescribed by law.

In 1990, approx. 64,000 tuberculin tests were carried out, compared with approx. 38,000 in 1989. An extensive testing programme is being pursued. In addition, examinations are underway in wildlife in the Golan Heights and other regions to identify the origin of the outbreak. Animals tested include badgers, hyrax, gazelles and boars. The source of infection has not yet been identified.

NON-NOTIFIABLE DISEASES

Following are data on selected zoonotic diseases, which are not notifiable under the Animal Diseases Ordinance.
Echinococcosis (hydatid disease)

The infection rate in slaughtered bovines, as reported from slaughterhouses in 1990, was 151 per 100,000. The infection rate in sheep in 1989 was 258 per 100,000.

Since 1981, human hydatid disease has been declared notifiable by the Ministry of Health. Since 1980, 10-23 human cases have been identified annually, the mean being 16.5, which is an infection rate of 0.36 per 100,000.

In 1990, echinococcosis was found in 19 (11.7%) of 163 wild boars presented by hunters for veterinary inspection. This rate is seventy-seven times higher than in slaughtered bovines, and it requires further investigation.

Botulism

Over the past decade, one to seven outbreaks of botulism, types C or D, have been recorded annually in farm animals (cattle, horses and sheep). Since 1978, when a major outbreak caused heavy losses in dairy cattle and small ruminants fed with contaminated recycled poultry manure (4), annual vaccination of cattle with a bivalent C/D vaccine is practised voluntarily in most cattle farms.

The department of bacteriology at KVI serves as a national reference centre for botulism in man. During the years 1983-1990, this laboratory examined samples from twenty-three human suspect cases, and identified the botulinum toxin type E in two cases, the origin of which was found to be privately imported fish. The toxin was identified in samples of the suspect fish (17). One patient died.

Contagious ecthyma (orf)

This viral dermal infection is very common in sheep and goats in Israel, as elsewhere. Related vesicular dermatitis cases in the rural human population are not uncommon. Some typical cases have been described in detail (6).

Spotted fever

The incidence of rickettsial spotted fever in humans has decreased since 1982. This is probably due to increased awareness among dog owners, who treat their pets with recommended and approved insecticides against the transmitting ixodid ticks, and to intensified public health education activities.

The prevalence of IgG antibodies to \textit{R. conorii} in dogs is a useful criterion for the possible occurrence of spotted-fever disease in man (9).

CONTROL OF ANIMAL PRODUCTS

Regarding animal products, the major responsibilities of the Veterinary Services involve control at the time of slaughter, meat inspection in the abattoirs and also in the municipalities into which the meat is transported, the control and licensing of poultry and meat products processed for export, the control of imported frozen meat and its cold storage and, in conjunction with other governmental and local agencies, supervision of licensed trades and industries associated with animals and animal products.
Abattoirs

In accordance with the regulations, the slaughter of animals may take place only in an abattoir, under the supervision of a municipal veterinary officer, accredited by the Director of Veterinary Services. The veterinarian is responsible for inspection before and after slaughter. In 1967 the Israeli government decided to close thirty-five abattoirs and to centralise the slaughter of all animals in seven regional modernised establishments. This goal was not attained, however, as only twenty local slaughterhouses closed and only three of the regional abattoirs satisfied hygienic requirements. The government therefore decided in 1981 to reverse its 1967 decision and legalise the operation of all abattoirs present at that time, provided that their hygienic standards improved. At present sixteen abattoirs are in operation for cattle, sheep and goats and three for pigs.

Since 1977, official identity cards for each bovine slaughtered have been returned to VSAH from the abattoirs, together with post-mortem findings and details of condemnations, and these are processed by computer. This system provides an up-to-date review of condemned entire carcasses and parts thereof and of the reasons for condemnation. The major findings in 1990 were mastitis (3.8%), liver abscesses (3.1%) and nephritis (2.6%). Cysticercosis (0.26%) and hydatidosis (0.15%) were the leading zoonoses reported.

Emergency slaughter

In accordance with regulations, emergency slaughter on a farm must take place in the presence of a veterinarian who is required to issue a certificate and send the carcass and viscera for inspection at a designated abattoir. Due to the relatively high level of rejection in such cases, farmers are occasionally tempted to market these animals without veterinary inspection. Obviously, such illegal activity carries risks for the control of animal diseases and public health. VSAH has tightened the control of emergency slaughter, and illegal slaughter is vigorously prosecuted. However, measures against illegal slaughter would be successful only if controlled slaughter was more attractive economically. Such a system was instituted in 1982 when VSAH initiated an agreement on a compulsory national insurance scheme for farmers, covering their losses from carcasses unfit for human consumption; the premium is paid jointly by farmers (60%) and government (40%). At this stage, the scheme is limited to cattle of the Israeli-Holstein breed (approximately 70% of slaughtered cattle in Israel) over the age of six months. Owners receive 70% of the meat value of condemned carcasses. The insurance system is part of the Insurance Fund for Natural Risks in Agriculture Ltd, a government-operated company. VSAH is represented on the Board of Directors of the Fund.

While the number of cattle slaughtered in Israel has remained static, there has been a steady increase in emergency slaughters (1,113, 999 and 871 in the last three years, compared with less than 450 before 1982).

Of 1,290 total condemnations of bovine carcasses in 1990, about 27.4% were due to diseases of the digestive tract, including foreign body reticulitis and endocarditis, 16.0% to diseases of the genital tract and abortion, 14.2% to udder diseases and 11.5% to metabolic disorders. Compensation payments totalled US$ 856,600.
Inspection of imported frozen beef

Over 60% of the beef consumed in Israel is imported frozen. Latin America (Argentina, Brazil, Uruguay) is the main source of frozen beef along with some European and other countries. To minimise the risk of importing foot and mouth disease (FMD) virus, all meat imported from endemic countries is deboned. Cattle intended for the Israeli market must originate in FMD-free areas and undergo ante- and post-mortem examinations. An Israeli veterinarian is based in Latin America for the purpose of certifying and surveying those slaughterhouses which export to Israel.

In 1980, the permissible levels of residues (hormones, hormone-like agents, insecticides, antibiotics) in meat were standardised. Upon arrival in Israel, meat samples are examined for organoleptic properties and various residues. Once admitted at the port of entry, the beef is no longer the direct responsibility of the Ministry of Agriculture. During its transport and storage in the country, supervision is undertaken by the municipal veterinary authorities. In order to ensure continuous veterinary control on imported meat, from port to storage, distribution to various localities and final marketing, a central fund was established in 1982 by collecting a "reinspection tax" from importers of meat and offal. The fund, which is controlled by an inter-ministerial body and headed by a VSAH veterinarian, finances the veterinary control of five central and many smaller cold-storage premises, and also transport and marketing throughout the country.

Since the recognition of bovine spongiform encephalopathy (BSE) in Europe, measures to prevent its introduction have been adopted. Generally, these conform to EC decisions. However, the importation of specific target organs, such as brain, thymus, tonsils, intestines and spleen, is banned altogether if they derive from an animal fed with bone meal or meat meal.

Slaughter of poultry

Industrial slaughter plants

During the past decade, there has been a sharp increase in the number of broilers and turkeys processed in industrial plants. Along with a net increase in the amount of poultry consumed, the prosperity of these plants has resulted from their increased share in the slaughter of poultry at the expense of municipal poultry slaughterhouses. In the early 1970s, 40% of broilers and 50% of turkeys were slaughtered in industrial plants. Since 1982 these proportions have increased gradually, reaching 76% and 96% (respectively) in 1989; the latter figures represent approx. 62 million broilers and nearly 4.8 million turkeys. However, a revision in the government subsidies policy in 1990 has given some advantage to smaller, municipal or privately owned slaughterhouses.

Regulations for poultry slaughterhouses were issued in 1960. For poultry products intended for export, however, processing plants must conform to the more stringent requirements laid down in "Regulations for control on export of animals and animal products (poultry products), 1976". These regulations require full-time veterinary inspection and examination of each bird on the line in slaughterhouses, and official inspection in processing establishments. All carcasses and products must be suitably marked and accompanied by appropriate certification. Meat is also checked for chemical and biological residues, as specified in the regulations. No provision is made for different levels of inspection in the same plant. Consequently, industrial plants
approved for export must conform to export requirements for all of their products, including those intended for the domestic market, which form the largest share of production. Israel’s 23 industrial poultry slaughter plants, 18 of which are certified for export, employ 21 veterinarians and 49 meat inspectors. A further 12 veterinarians are employed in the 21 processing plants certified for export. All of these are supervised by the controller, a senior VSAH veterinary officer for poultry slaughter plants, aided by two regional veterinary officers.

The level of rejection of whole carcasses varies in different plants but the national average in 1990 was 2.41% for broilers, 1.0% for turkeys and 4.13% for geese. Of the nine main disease groups, the major grounds for rejection of broilers were colibacillosis (14% of total condemnations), emaciation and various conditions (10%) and septicaemia (10%). Concerning turkeys, the main causes for rejections were septicaemia (27%), emaciation and various conditions (22%) and colibacillosis (6%).

Municipal poultry slaughterhouses

These are operated by thirty local authorities, and most of them are not yet provided with constant in-plant veterinary supervision. Thirteen local-authority plants have full-time veterinary supervision and are licensed accordingly; other small plants are following suit. It should be mentioned that 80% of laying hens are processed in municipal plants.

Fish

Inspection of fish (including imported fish) for human consumption is carried out by the Ministry of Health. VSAH is involved only when veterinary certification is required for export purposes; two fish-processing plants are at present certified for export and consequently are under constant veterinary supervision by official veterinary inspectors.

KVI maintains a special laboratory for examining fishery products. This laboratory extends its services to the Ministry of Health and is incorporated in the department of bacteriology (Fig. 1).

Veterinary supervision in the local authorities

Local authorities employ veterinarians in the enforcement of three laws, which are the responsibility of VSAH:

– the Animal Disease Ordinance requiring slaughter supervision and meat inspection
– the Rabies Ordinance requiring detention of biting animals, destruction of stray animals and vaccination of dogs
– the Law of Trades Licensing regarding trades and industries which may be involved with animal diseases or contamination of water sources.

During the past decade, veterinary supervision, which at first existed only in 33 municipalities, employing 61 veterinarians, expanded to 165 municipalities (117 local councils and 48 regional councils) employing a total of 108 veterinarians.

Accreditation of local veterinarians was widened to include responsibility for the destruction or processing of animal carcasses, and trade in medicines, disinfectants
and insecticides for use in animals, as well as supervision of construction and maintenance of poultry farms. Local veterinarians must report monthly to the VSAH District Veterinary Officers about their activities in relation to the laws mentioned above. VSAH provides professional and legal advice, as required.

Other functions

Although not responsible for the control of milk quality, VSAH initiated and became active in the planning and operation of a system aimed at improving the bacteriological quality of raw milk. A committee chaired by VSAH suggested that producers be offered a rated price according to bacterial counts and this was adopted by the Ministry of Agriculture in 1978. The milk hygiene improvement scheme is operated by the Milk Marketing Board. A fund for the improvement of milk quality was set up and VSAH is represented in its directorate. Regional laboratories were built, initially carrying out milk quality testing and later modified to serve and instruct in the prevention and treatment of udder diseases. Bacterial counts are now performed in industrial dairies. Since 1980, when differential pricing commenced, milk quality has improved rapidly. The standards were upgraded at the end of 1983 (Table V), and in light of these results, again in 1990, leading to further significant improvements (Table VI).

### TABLE V

**Bacteriological standards and rated pricing of milk in Israel, 1983**

<table>
<thead>
<tr>
<th>Grade of milk</th>
<th>Bacterial count/ml</th>
<th>% of total marketed milk</th>
<th>Payment (% of full price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonus</td>
<td>&lt;100,000</td>
<td>12.5</td>
<td>102.0</td>
</tr>
<tr>
<td>A</td>
<td>100,000-500,000</td>
<td>33.4</td>
<td>100.0</td>
</tr>
<tr>
<td>B</td>
<td>500,000-1,000,000</td>
<td>29.3</td>
<td>98.0</td>
</tr>
<tr>
<td>C</td>
<td>1,000,000-3,000,000</td>
<td>18.6</td>
<td>97.0</td>
</tr>
<tr>
<td>D</td>
<td>&gt;3,000,000</td>
<td>6.2</td>
<td>94.0</td>
</tr>
</tbody>
</table>

### TABLE VI

**Bacteriological standards and rated pricing of milk in Israel, 1990**

<table>
<thead>
<tr>
<th>Grade of milk</th>
<th>Bacterial count/ml</th>
<th>% of total marketed milk</th>
<th>Payment (% of full price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonus</td>
<td>&lt;50,000</td>
<td>71</td>
<td>100.4-101.0</td>
</tr>
<tr>
<td>A</td>
<td>50,000-250,000</td>
<td>23</td>
<td>100.0</td>
</tr>
<tr>
<td>B</td>
<td>250,000-500,000</td>
<td></td>
<td>98.0</td>
</tr>
<tr>
<td>C</td>
<td>500,000-1,500,000</td>
<td>6</td>
<td>93.0</td>
</tr>
<tr>
<td>D</td>
<td>&gt;1,500,000</td>
<td></td>
<td>88.0</td>
</tr>
</tbody>
</table>
SPECIAL ACTIVITIES

Registration and movement control of cattle

A major achievement of VSAH during the recent decade has been the implementation of special regulations published in 1976 for the registration, ear-tagging and transport of cattle. These regulations modify the 1957 requirements for the ear-tagging of each bovine older than six months, by adding provisions for the official registration and the issuing of individual identity cards. Each card carries, in addition to basic details of the animal concerned, data pertaining to important tests and vaccinations which the animal has undergone (12).

Any movement of the animal for breeding or slaughter as well as any change of ownership must be authorised by a Veterinary Officer. The permit is entered on the identity card, which must accompany the animal throughout its life, and is returned to the Veterinary Services after the death or slaughter of the animal. In the case of slaughter, the returned certificate is accompanied with results of meat inspection, i.e. diagnoses and condemned organs.

If an animal or a herd is placed under quarantine, the identity card(s) is withdrawn and kept in the District Veterinary Office until the end of the quarantine period. This measure prevents unauthorised movement of animals. These regulations have enabled intensification of the control of animal movement, and the gathering of vital epidemiological and other data by processing the identity cards returned by owners of dead animals or from slaughterhouses and rendering plants.

Control of imported fodder

Grains

The existence and performance of the Israeli animal industries depend, to a very large extent, upon the constant supply of imported dry fodder, mainly grains from North America. Until recently, the purchase and supply of grain was a State responsibility. This highly centralised supply could expose the vulnerable industrialised dairy and poultry farms, throughout the country, to serious health hazards. The various imported feed ingredients could be contaminated by chemicals, mycotoxins or other toxic agents, in the producing countries or during long-distance transportation. In addition to direct health hazards to the animals, residues of toxic agents could reach the human population on a large scale through animal products, creating a serious public health problem.

To minimise these risks, KVI developed and established a unique bioassay control system (14). Representative samples of grains from each ship unloading its cargo in an Israeli harbour were fed to Muscovy ducklings, a species which is very sensitive to some mycotoxins and which also serves as a nonspecific bioassay test animal. A special installation for this purpose was built at KVI in Beit-Dagan. Any refusal of the birds to eat, or other behavioural, physiological or pathological deviation, was recorded and then followed by laboratory toxicological examinations according to a specified protocol. This arrangement operated from 1987 to the end of 1989, although not on a legal basis, since VSAH was not responsible for testing plant products. It contributed to a considerable improvement in the quality of imported grains, due to the suppliers being aware of Israeli requirements, and the strict testing
system. However, at the beginning of 1990 the government curtailed its involvement in the trade and import of grains as part of a general policy of privatisation. Consequently, the number of importers and grain consignments increased, while the size of shipments decreased. Sampling for bioassay became impractical and was discontinued.

**Feed of animal origin**

Control of the import of feed of animal origin, such as meat meals, milk powder for animal nutrition, bone meal and fish meal, is carried out by VSAH in accordance with the revised "Animal disease regulations: import and export of animal products, 1988". The producing plant in the country of origin must be approved by that country's veterinary authorities. One of the requirements is an official veterinary inspection of the plant. An import permit is issued only if the importer possesses adequate storage facilities where the entire consignment can be held for at least fourteen days. On arrival, the consignment is sampled for laboratory tests, mainly bacteriological. If it is found to be contaminated, heat treatment is required. The consignment is released after examination and, if necessary, heat treatment.

The annual import of meat meals, including fish meal, is approx. 50,000 tons. In 1989, 186 consignments were imported from ten countries; two of these consignments were refused. *Salmonella* was detected in 66% of the consignments from one of the exporting plants, which was therefore removed from the list of approved plants.

Since scrapie and BSE are absent from Israel, the use of meat and bone meals of mammalian origin for food animals was discontinued in July 1990. This step was temporarily adopted until more knowledge is obtained about the epidemiology of prion disease in man and animals, particularly regarding effective modes for inactivating the infective agent in the meals.

**Sale and distribution of veterinary medicines**

The control of import, manufacture and distribution of all medicines, including veterinary drugs, is within the legal competence of the Ministry of Health, as prescribed by the Pharmacists ordinance. However, in the case of medicines for use in food animals, and the consequent testing of animal products for residues, new regulations were published in 1988. These regulations empower VSAH to exercise control upon the sale of medicines to the farming industry, and are at present in the implementation stage, in collaboration with municipal veterinarians.

In addition, VSAH collaborates with the Ministry of Health in a commission for the approval and registration of veterinary medicines.

**Residue control**

A residue control programme has been operational for years in regard to poultry meat and products intended for export. However, since April 1991, the same programme has been implemented in local poultry slaughterhouses, producing meat for the Israeli market. During 1991, 1,178 samples were analysed.

**DISCUSSION**

The Israeli Veterinary Services are confronted with a specific overall situation and with local problems which may be summarised as follows:
Israel is located within a transition zone between African, Asian and European ecosystems, where small and large ruminants have been domesticated and bred since prehistoric times.

In the two delta areas of the region, large populations of ruminants and insect vectors are present, and they provide an abundant source of wind-borne disease agents.

Traditional husbandry methods have been developed in accordance with the prevailing climatic conditions. These include long-distance herd movements as part of an extensive grazing system, and common dwellings for man and livestock. Consequently, zoonotic diseases may be widely distributed.

The country is small and lacks natural barriers with neighbouring countries, where large ruminant populations may serve as a potential reservoir for epizootic diseases.

Animals of exotic breeds, introduced into Israel on account of their higher production performance, are often highly susceptible to endemic diseases.

In Israel, modern intensive livestock farms may be located in close proximity to traditional, extensively managed flocks, with consequent exposure of the vulnerable livestock to infection.

The centralisation of the animal industry is manifested by large imports of grains, cooperative feed centres and feed mills, zero grazing system, industrialised recycling of animal products, artificial insemination of cows and ewes, central industrial dairies and slaughterhouses, cooperative spraying and decontamination services, etc. A fault in any one of these links may rapidly have widespread disastrous consequences, both for animal and human health.

To cope with these factors, various measures have been adopted. The most important measures include:

a) establishment of an efficient regulatory system and its extensive implementation

b) performance of diagnostic, preventive, eradication and research activities by State employees in a single organisation (VSAH)

c) a central data retrieval system which provides rapid dissemination of information to the periphery

d) State-operated control of all animal movement by means of compulsory certification and registration

e) State control of the production, import and sale of veterinary vaccines, including the testing of each batch

f) large-scale mass vaccinations against endemic as well as against potential disease agents in the region

g) strict controls on import of animals and their products

h) State licensing of veterinary medicines, insecticides and disinfectants and controls on their sale

i) State licensing of inseminators and poultry vaccinating teams

j) accreditation and central control of the municipal veterinarians to direct the slaughterhouses, inspect meat and animal products, license animal establishments, implement the provisions of the Rabies Ordinance and additional responsibilities
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* *

LA SANTÉ PUBLIQUE VÉTÉRINAIRE EN ISRAËL. – A. Shimshony.

Résumé: En Israël, les conditions épizootiologiques et écologiques autant que les structures socio-économiques et agricoles ont créé une situation unique et périlleuse pour la santé publique vétérinaire (SPV). L'auteur décrit différents problèmes de SPV concernant les zoonoses, les produits animaux et l'écologie rurale, ainsi que les tentatives de solutions mises en œuvre par les Services vétérinaires et de santé animale nationaux.


* *

LA SALUD PÚBLICA VETERINARIA EN ISRAEL. – A. Shimshony.

Resumen: Las condiciones epizoootiológicas y ecológicas de Israel, así como las estructuras socioeconómicas y agrícolas, han creado una situación de salud pública veterinaria (SPV) muy particular y arriesgada. El autor describe distintos problemas de SPV relativos a las zoonosis, los productos de origen animal y la ecología rural, así como las tentativas de resolverlos emprendidas por los Servicios estatales veterinarios y de salud animal.


* *
REFERENCES


