Quarantine and invasive species in Ukraine

Kwarantannowe i inwazyjne gatunki występujące na Ukrainie

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Summary

The need for phytosanitary control enhancement in Ukraine is discussed because of the increase in international trade of agricultural commodities posing the risk of the introduction of destructive adventive species. Up to 200 species not distributed in Ukraine, are detected annually in imported agricultural commodities. The entry, establishment, and spread of some of these nonindigenous species can threaten regional agricultural production or/and biodiversity. This article provides a comprehensive review covering the distribution of quarantined species in the Ukraine, with an accent on phytosanitary measures employed for their control.

Key words: adventive species, fungal pathogens, insects, invasive species, nematodes, pests, quarantine

Streszczenie

Stwierdzono potrzebę wzmożonej kontroli fitosanitarnej na Ukrainie, z uwagi na zwiększające się ryzyko zawleczenia szkodliwych, obcych gatunków wraz z rozwojem międzynarodowego handlu artykułami rolniczymi. Corocznie, w importowanych towarach rolniczych, wykrywa się około 200 obcych gatunków, które nie są rozpowszechnione na Ukrainie. Zawleczenie, zadomowienie oraz rozprzestrzenianie się gatunków obcych zagraża produkcji rolniczej oraz bioróżnorodności. W pracy przedstawiono obszerny przegląd dotyczący występowania gatunków kwarantannowych na Ukrainie, ze szczególnym zwróceniem uwagi na środki fitosanitarne do ich zwalczania.

Słowa kluczowe: kwaranntannowe, obce gatunki, gatunki inwazyjne, szkodniki, owady, nicienie, grzyby patogeniczne

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Introduction

An increase in the international trade of agricultural commodities comes with the risk of introducing destructive adventive species. The entry, establishment and spread of these species can threaten agricultural production or/and biodiversity in Ukraine.

The spread of nonindigenous species may occur naturally at a very slow rate. Human activities, though, have helped to speed up this movement. Global trade allows for multiple routes and means of transport. These means have greatly increased the opportunities for species to enter new habitats. These species can then realize biological advantages such as genetic diversity, ability to change behavior or development as well as successful multiplication rate in the absence of natural enemies, parasites, pathogens and predators (López-Darias and Lobo 2008).

Although the consequences of such invasions are often unpredictable some of them may have drastic ecological impacts. There may be the extinction of native species through competition for space or food or even due to direct predation. The establishment of adventive organisms may have social and economic impacts (Leung and Dudgeon 2008). For example, from 100 adventive species introduced into the territory of the former Soviet Union during an 80 year period, 57 have become harmful to plants (8 of which were stated as quarantine species). In the USA, 235 insect species out of 600 known as plant pests are nonindigenous species (while the total number of introduced insect species has reached 1.500). In Japan, among 198 introduced nonindigenous species 72% are considered as plant pests (meanwhile only 7% of native species are pests) (Izhevsky 1990, 2008).

Up to 200 species which are not distributed in Ukraine, are detected annually in imported agricultural commodities (Ustinov *et al.* 2006). For this reason, the importance for phytosanitary control enhancement in Ukraine is needed. Control could hasten the use of modern methods for regulated quarantine and regulated non – quarantine species surveillance, detection, and identification.

Materials and methods

Data was generated and analyzed from surveillance programmes conducted at the Institute of Plant Protection and the State Plant Quarantine Service in 2007–2011 (Phytosanitary 2012). The purpose was to learn about changes in regulated pest status, spread during the years, and introduction of new pests to be used in following pest risk analysis, while developing phytosanitary measures and drafting new policies.

Results and discussion

The national lists of regulated organisms are subjected to national phytosanitary regulation. There are 218 species included, among which 23 are quarantine species locally distributed in Ukraine (Table 1).

Hyphantria cunea Drury was first introduced into Ukraine in 1952 and has invaded most of the country (Schevchenko *et al.* 2004). Ukrainian populations complete two generations per year. Sometimes the larvae from a third generation may hatch, dying soon afterwards because of low autumn temperatures. Recently, the fall webworm has been detected in 20 regions (out of 24) and in the Autonomous Republic of the Crimea on a total area of 69.9 thousand hectares. The pest is widely spread in The Autonomous Republic of the Crimea, and the Dnipropetrovsk, Zaporizhia, Kherson, Kirovohrad, Odesa, Vinnytsa, Kharkiv and Chernivtsi regions. Since 2007, the total area of distribution has decreased to 39.9 thousand hectares due to an eradication program using insecticides and biopesticides applications. To prevent further pest distribution within the country, movement of plant products from infected areas are restricted and must be verified by inspection and certification.

Phthorimaea operculella Zell was first recorded in Ukraine in 1980. It was introduced to The Autonomous Republic of the Crimea with potato tubers imported from India (Koliada *et al.* 1981). The current distribution area of the *P. operculella* is 16.6 thousand hectares (1.0 thousand hectare less than in 2007) and covers not only the Autonomous Republic of the Crimea but also another 5 southern regions of Ukraine. There is a highly efficient eradication program available to control the potato tuber moth in the field in contrast with domestic storage facilities where the pest can successfully survive overwintering. Removal of plant products from infected areas are restricted and must be verified by inspection and certification.

In Ukraine, the *Diabrotica virgifera virgifera* Le Conte was registered in 2001 in one location – the Zakarpattia region. This rootworm has since spread and become established in 5 regions – on a total area of more than 23.0 thousand hectares. *D. virgifera* is a serious threat to agriculture in Ukraine because, as far as cultivation area is concerned, maize is one of the main crops here. Spread of the beetle is through natural migration, but there is also evidence for a passive dispersal of the insect by road and water transport. Since 2007, the total area of infestation has increased 7.8 thousand hectares. An extensive trap monitoring system is already in place for early warning of pest distribution. Application but eradication programs within small scale farms are still restricted because of the ongoing practice of maize monoculture there. In order to define a national long-term strategy against *D. virgifera*, there is a need to carry out an evaluation of phytosanitary measures for their economic, environmental, and social impact and the resulting cost/benefit ratio especially for small farms (Omelyta and Filatova 2001).

Frankliniella occidentalis Pergande was first detected on imported cut flowers in 1994 (Dulgerova and Omeluta 1998). Since then, the pest has spread to 5 regions of Ukraine, on a total area of 6.9 hectares of greenhouse crops. It is considered one of the most destructive pests of greenhouse-grown crops not only due to direct damage of

Table 1. Lists of regulated pests and their distribution in Ukraine

Lists of regulated pests		Distribution [hectares]	
		2007	2011
1	2	3	4
A-1 Quarantine pests absent from the territory of Ukraine			
	Acaries		
1	*Aculops fuchsiae* Keifer		
2	*Oligonychus perditus* Pritchard & Baker		
	Insects		
1	*Acleris gloverana* Wals.		
2	*A. variana* Fern.		
3	*Aeolesthes sarta* Sols.		
4	*Aleurocanthus spiniferus* Quaint.		
5	*A. woglumi* Ashby		
6	*Amauromyza maculosa* Mall.		
7	*Anoplophora chinensis* Forst.		
8	*A. glabripennis* Motsh.		
9	*Anthonomus bisignifer* Schen.		
10	*A. signatus* Say		
11	*Bactrocera dorsalis* Hend.		
12	*B. zonata* Saund.		
13	*Bemisia tabaci* Gen.	0.700	0.08059
14	*Cacoecimorpha pronubana* Hubn.		
15	*Callosobruchus chinensis* Linn.		
16	*C. maculatus* Fabr.		
17	*Carposina niponensis* Wals.		
18	*Caryedon gonagra* Fabr.		
19	*Ceratitis capitata* Wied.	9.900	9.900
20	*C. cosyra* Walk.		
21	*C. rosa* Karch.		
22	*Choristoneura conflictana* Walk.		
23	*Ch. fumiferana* Clem.		
24	*Ch. occidentalis* Freem.		
25	*Ch. rosaceana* Har.		
26	*Conotrachelus nenuphar* Herb.		
27	*Cydia packardi* Zell.		
28	*C. prunivora* Wals.		
29	*Dendrolimus sibiricus* Tschetv.		
30	*Diabrotica barberi* Smith & Lawr.		
31	*D. speciosa* Germ.		
32	*D. undecimpunctata* Man.		
33	*Dinoderus bifoveolatus* Woll.		
34	*Dryocosmus kuriphilus* Yas.		
35	*Epitrix cucumeris* Har.		
36	*E. tuberis* Gent.		
37	*Ips hauseri* Reit.		
38	*I. subelongatus* Motsch.		
39	*Lepidosaphes ussuriensis* Bork.		
40	*Liriomyza huidobrensis* Blanc.		

1	2	3	4
41	*L. sativae* Blanc.		
42	*L. trifolii* Burg.		
43	*Maconellicoccus hirsutus* Green		
44	*Malacosoma americanum* Fabr.		
45	*M. disstria* Hub.		
46	*M. parallella* Staud.		
47	*Margarodes vitis* Philippi		
48	*Melanotus communis* Gyll.		
49	*Monochamus alternatus* Hope		
50	*M. carolinensis* Oliv.		
51	*M. marmorator* Kirb.		
52	*M. mutator* Le Cont.		
53	*M. nitens* Bat.		
54	*M. notatus* Drury		
55	*M. obtusus* Cas.		
56	*M. scutellatus* Say		
57	*M. titillator* Fabr.		
58	*Naupactus leucoloma* Boh.		
59	*Numonia pyrivorella* Mats.		
60	*Opogona sacchari* Boj.		
61	*Pissodes nemorensis* Germ.		
62	*P. strobi* Peck.		
63	*P. terminalis* Hop.		
64	*Popillia japonica* Newm.		
65	*Premnotrypes latithorax* Pier.		
66	*P. suturicallus* Kusch.		
67	*P. vorax* Hust.		
68	*Rhagoletis pomonella* Walsh.		
69	*R. cingulata* Loew.		
70	*R. indifferens* Cur.		
71	*Rhizoecus hibisci* Kaw. & Tak.		
72	*Scirtothrips aurantii* Faure.		
73	*S. citri* Moul.		
74	*S. dorsalis* Hood.		
75	*Scolytus morawitzi* Sem.		
76	*Sinoxylon conigerum* Gers.		
77	*Sirex ermak* Sem		
78	*Spodoptera eridania* Cram.		
79	*S. frugiperda* Smith		
80	*S. littoralis* Boisd.		
81	*S. litura* Fabr.		
82	*Tecia solanivora* Pov.		
83	*Tetropium gracilicorne* Reit.		
84	*Thrips palmi* Karn.		
85	*Toxoptera citricida* Kirk.		
86	*Trogoderma granarium* Ev.		
87	*Tuta absoluta* Meyr.		9.000
88	*Unaspis citri* Comst.		

1	2	3	4
89	*Xylotrechus altaicus* Geb.		
90	*X. namanganensis* Heyd.		
91	*Zabrotes subfasciatus* Boh.		
	Fungi		
1	*Apiosporina morbosa* (Schweinitz) von Arx		
2	*Ceratocystis fagacearum* (Bretz) Hunt		
3	*C. fimbriata* Ellis & Halsted f. sp. *platani* Walter		
4	*Chrysomyxa arctostaphyli* Dietel		
5	*Cronartium coleosporioides* J.C. Arthur		
6	*C. comandrae* Peck		
7	*C. comptoniae* J.C. Arthur		
8	*C. fusiforme* Hed. & Hunt ex Cum.		
9	*C. himalayense* Bagchee		
10	*C. kamtschaticum* Jorstad		
11	*C. quercuum* (Berkeley) Miyabe ex Shirai		
12	*Didymella ligulicola* (K.F. Baker, Dimock & L.H. Davis) von Arx.		
13	*Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka		
14	*Gymnosporangium asiaticum* Miyabe ex Yamada		
15	*G. clavipes* (Cooke & Peck) Cooke & Peck		
16	*G. globosum* (Farlow) Farlow		
17	*G. juniperi-virginianae* Schwein		
18	*G. yamadae* Miyabe ex Yamada		
19	*Melampsora farlowii* (J.C. Arthur) J.J. Davis		
20	*M. medusae* Thümen		
21	*Monilinia fructicola* (Winter) Honey		
22	*Mycosphaerella dearnessii* M.E. Barr		
23	*M. gibsonii* H.C. Evans		
24	*M. laricis-leptolepidis* K. Ito, K. Sato & M. Ota		
25	*M. populorum* G.E. Thompson		
26	*Ophiostoma wageneri* (Goheen & Cobb) Harrington		
27	*Phialophora cinerescens* (Wollenweber) van Beyma		
28	*Phellinus weirii* (Murrill) R.L. Gilbertson		
29	*Phoma andigena* Turkensteen		
30	*Phyllosticta solitaria* Ellis & Everhart		
31	*Phymatotrichopsis omnivora* (Duggar) Hennebert		
32	*Phytophthora fragariae* Hickman		
33	*Puccinia horiana* P. Hennings	0.320	1.500
34	*Stenocarpella macrospora* (Earle) Sutton		
35	*Stenocarpella maydis* (Berkeley) Sutton		
36	*Thecaphora solani* (Thirumulachar & O'Brien) Mordue		
37	*Tilletia indica* Mitra		
	Bacteria		
1	*Burkholderia caryophylli* (Burkholder) Yabuuchi *et al.*		
2	*Erwinia stewartii* (Smith) Dye., *Pantoea stewartii*, *Xanthomonas stewartii* Dowson		
3	*Ralstonia solanacearum* (Smith) Yabuuchi		
4	*Xanthomonas campestris* pv. *hyacinthi* (Wakker) Dovson.		
5	*X. oryzae* pv. *oryzae* (Ishyama) Swings *et al.*		
6	*X. oryzae* pv. *oryzicola* (Fang *et al.*) Swings *et al.*		

1	2	3	4
7	*Xylella fastidiosa* Wells *et al.*		
8	*Xylophilus ampelinus* (Panagopoulos) Willems *et al.*		
	Viruses		
1	*Cherry little cherry closterovirus* (non-European)		
2	*Cherry rasp leaf nepovirus*		
3	*Chrysanthemum stem necrosis tospovirus*		
4	*Chrysanthemum stunt pospoviroid*		
5	*Impatiens necrotic spot tospovirus*		
6	*Peach rosette mosaic nepovirus*		
7	*Potato Andean mottle comovirus*		
8	*Potato black ringspot nepovirus*		
9	*Potato yellow dwarf nucleorhabdovirus*		
10	*Potato yellow vein crinivirus*		
11	*Raspberry ringspot nepovirus*		
12	*Strawberry latent C virus*		
13	*Tobacco ringspot nepovirus*		
14	*Tomato ringspot nepovirus*		
	Nematodes		
1	*Aphelenchoides besseyi* Christie		
2	*Bursaphelenchus xylophilus* (Steiner and Buhrer) Nickle		
3	*Globodera pallida* (Stone) Behrens		
4	*Heterodera glycines* Ichinohe		
5	*Meloidogyne chitwoodi* Golden, O'Bannon, Santo & Finley		
6	*M. fallax* Karssen		
7	*Nacobbus aberrans* (Thorne) Thorne & Allen		
8	*Radopholus similis* (Cobb) Thorne		
	Weeds		
1	*Ambrosia psilostachya* D.C.		
2	*Ambrosia trifida* L.		
3	*Bidens pilosa* L.		
4	*B. bipinnata* L.		
5	*Helianthus californicus* D.C.		
6	*H. ciliaris* D.C.		
7	*Ipomea hederaseae* L.		
8	*I. lacunosa* L.		
9	*Iva axillaris* Pursh.		
10	*Polygonum pensylvanicum* L.		
11	*Raimania laciniata* Hill.		
12	*Solanum carolinense* L.		
13	*S. elaeagnifolium* Cav.		
14	*S. triflorum* Nutt.		
15	*Striga lutea* Lour.		
16	*S. euphrasioides* Benth.		
17	*S. hermontica* Benth.		
A-2 Quarantine pests locally presented in Ukraine			
	Insects		
1	*Diabrotica virgifera virgifera* Le Conte	15 203.080	23 019.940
2	*Frankliniella occidentalis* Perg.	1.450	6.990

1	2	3	4
3	*Hyphantria cunea* Drury	105 829.868	69 855.864
4	*Phthorimaea operculella* Zell.	17 633.030	16 594.980
	Fungi		
1	*Mycosphaerella linicola* Naumov	593.450	735.000
2	*Synchytrium endobioticum* (Schilbersky) Percival	8 047.094	2 755.730
	Bacteria		
1	*Erwinia amylovora* (Burrill) Winslow *et al.*	45.940	61.0072
	Viruses		
1	*Beet necrotic yellow vein furovirus*	1 659.100	2 146.940
2	*Plum pox potyvirus*	4 544.900	4 013.2764
	Nematodes		
1	*Globodera rostochiensis* (Wollenweber) Behrens	57 80.550	50 59.6448
	Weeds		
1	*Acroptilon repens* L.	443 320.510	309 118.220
2	*Ambrosia artemisiifolia* L.	2 713 818.555	3 672 814.348
3	*Cenchrus longispinus* Fernald.		25 446.000
4	*Cuscuta alba* J. Presl et C. Presl		
5	*C. approximata* Bab.		
6	*C. australis* R. Br.		
7	*C. basarabica* Buia		
8	*C. campestris* Yunck.	39 875.643	32 909.313
9	*C. epilinum* Weihe		
10	*C. epithymum* L.		
11	*C. europaea* L.		0.001
12	*C. gronovii* Willd.		
13	*C. lupuliformis* Krock.		
14	*C. monogyna* Vahl.	0.01	3.940
15	*C. suaveolens* Ser.		
16	*C. trifolii* Bab.		
17	*C. viciae* Schultz		
18	*C. Lehmanniana* Bge.	4.591	4.591
19	*Sorghum halepense* (L.) Pers.	819.900	911.900
20	*Solanum rostratum* Dunal.	843.400	234.000
	Regulated non-quarantine pests (plants for planting)		
	Insects		
1	*Lopholeucaspis japonica* Cock.		
2	*Quadraspidiotus perniciosus* Comst.		
3	*Viteus vitifolii* Fitch.		
	Bacteria		
1	*Clavibacter michiganensis* subsp. *sepedonicum* (Spieckermann & Kotthoff)		
2	*Xanthomonas arboricola* pv. *pruni* (Smith) Vauterin *et al.*		
3	*X. vesicatoria* (ex Doidge) Vauterin *et al.*		
	Viruses		
1	*Potato spindle tuber pospiviroid*		
2	*Tomato spotted wilt tospovirus*		
	Nematodes		
1	*Ditylenchus destructor* Thorne		
2	*D. dipsaci* Filipjev		

1	2	3	4
	Weeds		
1	*Ailanthus altissima* (Mill.) Swingle		
	Total area infested	3 358 031.991	4 165 712.166

plants, but indirect damage by vectoring the viruses and tospoviruses. Phytosanitary measures include surveillance, cultural, physical, biological, and to a much lesser extent – insecticidal strategies. The latter is attributed not only to the restricted number of insecticides permitted for use in greenhouse production but to the fact that currently available insecticides only kill the nymphs or adult, with no activity on either egg or pupae stages. Control of *F. occidentalis* should be holistic, utilizing sanitation and biological control practices to avoid the sole reliance on insecticide application.

Beet nekrotic yellow vein furovirus was found in 8 regions of Ukraine, on a total area of 2.1 thousand hectares. The majority of infested fields were situated in the Lviv area (1.4 thousand hectares). In most cases, detection was confirmed by an ELISA (Enzyme-Linked Immunosorbent Assay) test conducted in quarantined laboratories. An increase of 0.4 thousand hectares infested since 2007, can be attributed to the spread of infected sugar beet roots, stecklinges, other root crops such as potato, and soil movement primarily done by machinery.

Plum pox potivirus was detected in the Autonomous Republic of the Crimea and 5 regions of Ukraine on a total area of 4.01 thousand hectares. Whilst the total area infested has decreased by 0.54 thousand hectares since 2007, the distribution pattern has changed more drastically. For example, the outbreak in the Chernivtsi region on 10.3 hectares was totally eradicated, yet *Plum pox potivirus* was observed in a new area – the Donetsk region on 9.2 hectares. The areas infested in Zakarpattia, Ternopil, and Lviv regions has decreased 0.53, 0.006, and 0.001 thousand hectares, respectively. Meanwhile, the distribution area in the Odesa region has nearly doubled from 10.5 hectares in 2007 to 18.5 in 2011. This proves the necessity for improving the monitoring system, with the help of modern methods for virus detection and identification, in asymptomatic samples.

The same situation was observed for another horticultural crop pathogen *Erwinia amylovora* (Burrill) Winslow. Outbreaks of this pathogen, in 2007 were registered in the Zakarpattia and Chernivtsi regions on a total area of 45.9 hectares while in 2011 they were detected in the Vinnytsa, Lviv, and Rivne regions on 61.0 hectares. Once again, this proves the necessity for improving the monitoring system, with the help of modern methods for virus detection and identification, in asymptomatic samples.

Since the only eradication option available to control either *Plum pox potivirus* or *E. amylovora* is infected tree distraction, the investment in a surveillance program and improvement of laboratory capacity seems to be cost effective.

The outbreak of *Mycosphaerella linicola* Naumov in the Zhytomir region registered in 2007 was eradicated, then it was detected in 2011, in the Odesa region on 1.5 hectares.

The spread of *Synchytrium endobioticum* (Schilbersky) Percival has a long history in Ukraine. A successful eradication program employing Ukrainian potato resistant cultivars dropped the area infested from 8.05 thousand hectares in 2007 to 2.76 thousand hectares in 2011.

While resistance to the potato wart disease is obligatory for potato cultivars registered in Ukraine, the resistance to another potato pathogen distributed in Ukraine – *Globodera rostochiensis* (Wollenweber) – is only a desirable characteristic. As a result, the spread of the potato cyst nematode in Ukraine shows more of a fluctuation rate; increasing some years and decreasing in other years. In 2011, the infected area covered 5.06 thousand hectares.

Quarantine weeds distributed in Ukraine are: *Acroptilon repens* L., *Solanum rostratum* Dunal, *Cuscuta campestris* Yunck., *C. lehmanniana* Bge., *C. europaea* L., *C. monogyna* Vahl., *Sorghum halepense* (L.) Pers., *Ambrosia artemisiifolia* L. But *A. artemisiifolia* is of most concern for public health due to the allergenic properties of its pollen. *A. artemisiifolia* has heavily colonized the country. This weed was distributed in all regions and in The Autonomous Republic of the Crimea on 3672.8 thousand hectares, in total. In 2007, it was recorded on 2713.8 thousand hectares. Dispersion of this invasive species occurs naturally through seed drop, movement by animals and surface water, and often follows human activities entering the different regions by transport with agricultural machines and excavated material. There is a need to implement a state eradication program implementation. Such a program, however, requires a sufficient amount of money not available at the moment due to the present state of the economy. Therefore, a nationwide campaign should be launched aimed at making ragweed known to the population. This will allow for ragweed to be eradicated in private gardens, thus, reducing seed production. Meanwhile, the high efficiency of phytocenotic control of *A. artemisiifolia* was determined by creating artificial phytocenosis of perennial grasses (Mar'ushkina 2002a, b).

The quarantine status of 11 species of the genus *Cuscuta*, listed as „Quarantine pests locally presented in Ukraine", uld be revised as there is no official confirmation of their distribution in Ukraine.

Recent outbreaks of the quarantine pests mentioned above led to a new improved system of pest surveillance, detection, and identification conducted by the State Plant Quarantine Service in 2011. The result was distribution records for 4 pests officially stated as „Quarantine pests absent from the territory of Ukraine"(A1 List of regulated pests):

– *Ceratitis capitata* Wied – in the Odesa region on 9.9 hectares;

– *Tuta absoluta* Meyr – in The Autonomous Republic of the Crimea (1.0 hectare), and the Odesa region (8.0 hectares);
– *Bemisia tabaci* Gen – in the Lviv region on 0.08 hectare;
– *Puccinia horiana* P. Hennings – in the Odesa region on 1.5 hectare.

The outbreaks of *C. capitata*, *B. tabaci* and *P. horiana* had been previously registered in Ukraine followed by successful eradication programs (*C. capitata* – 9.9 hectares in 2007; *B. tabaci* – 0.7 hectare in 2007). Meanwhile detection of *T. absoluta* was initial but in compliance with the pest risk analysis conducted earlier at the Institute of Plant Protection. This analysis provided useful information on the most appropriate monitoring scheme for quarantine inspectors and diagnostic keys for quarantine laboratories (Fedorenko and Pylypenko 2008; Kudina 2010; Kudina and Pylypenko 2010).

Conclusions

1. For 2011, quarantine outbreaks of 7 species of insects, 3 fungal pathogens, 2 viruses, 1 bacteria, 1 plant parasitic nematode and 9 weeds were registered in Ukraine on 4165.7 thousand hectares. That is 807.7 thousand hectares more than in 2007.
2. To prevent further quarantine species distribution within the country, movement of plant products from an infected area must be restricted and verified by inspection and certification.
3. To define a national long-term strategy against *D. virgifera*, there is a need to carry out an evaluation of phytosanitary measures for their economic, environmental, and social impact. The resulting cost/benefit ratio is necessary, especially for small farms.
4. The control of *F. occidentalis* should be holistic, utilizing sanitation and biological control practices to avoid the sole reliance on insecticides application.
5. The monitoring system for quarantine plant viruses and bacteria should be improved, with the help of modern methods, for pathogens detection and identification in asymptomatic samples.
6. The ongoing threat of the further spread of *A. artemisiifolia* requires a nationwide campaign to be launched. The aim would be to make ragweed known to the population so that it may be eradicated in private gardens and thus, reduce the seed production.
7. Quarantine status of 11 species of genus *Cuscuta* listed as „Quarantine pests locally present in Ukraine" should be revised as there is no official confirmation of such a pest distribution in Ukraine.

References

Dulgerova V.O., Omeluta V.P. 1998. New quarantine pest in Ukraine – the western flower thrips *Frankliniella occidentalis* (Thysanoptera, Thripidae). p. 51–52. In: Proc. 5th meeting of Ukrainian entomological society. Vestnik zoologii 9, 204 pp.

Izhevsky S.S. 1990. Nonindigenous pests in USSR. Plant Prot. 9: 30–32.

Izhevsky S.S. 2008. Invasion of nonindigenous pests in European part of Russion Federation continues. Plant Prot. Quarantine 6: 25–28.

Fedorenko V., Pylypenko L. 2008. Pest Risk Analysis – Ukrainian experience. p. 14. In: Abstr. 3rd Ann. Balkan Week of Plant Health. Bulgaria, May, 12–16, 2008, 47 pp.

Koliada V.K., Kudina J.D., Ustinov I.D., Babchuk I.V., Simonenko A.V. 1981. Instruction for the potato tuber moth detection and control. K.: Urozhay, p. 22.

Kudina J.D. 2010. Pest risk analysis for *Bemisia tabaci* Gen (Homoptera, Aleyrodidae) in Ukraine. Quarantine Plant Prot. 8: 24–27.

Kudina J.D., Pylypenko L.A. 2010. Gelechiid moths. Harmful species from Quarantine list (*Insecta*, *Lepidoptera*, *Gelechiidae*). Quarantine Plant Prot. 6: 2–5.

Leung K.M.Y., Dudgeon D. 2008. Ecological risk assessment and management of exotic organisms associated with aquaculture activities. p. 67–100. In: „Understanding and Applying Risk Analysis in Aquaculture (M.G. Bondad-Reantaso, J.R. Arthur, R.P. Subasinghe, eds). FAO Fisheries and Aquaculture Technical Paper, Rome, FAO, 519 pp.

López-Darias M., Lobo J.M. 2008. Factors affecting invasive species abundance: the Barbary Ground Squirrel on Fuerteventura Island, Spain. Zool. Studies. 47 (3): 268–281.

Mar'ushkina V.Y. 2002a. Variants of ragweed phytocenotic control. Aspects of Bioindicators and Ecology 7 (1): 10–21.

Mar'ushkina V.Y. 2002b. Variants of ragweed phytocenotic control. Aspects of Bioindicators and Ecology 7 (2–3): 39–56.

Omelyta V., Filatova N. 2001. Western corn rootform (*Diabrotica virgifera virgifera* Le Conte) in Ukraine: reality and outlook. IWGO-Newsletter 22 (1–2): 35–37.

Phytosanitary situation in the Autonomous Republic of Crimea and regions of Ukraine. Electronic resource. http://golovderzhkarantyn.gov.ua/index.php?option=com_content&task=view&id=145&Itemid. Accessed: 28.05.2012.

Schevchenko N.G., Kryvoscheev S.P., Omeluta V.P. 2004. The forecast for the fall webworm development in Kyiv region. Plant Prot. Quarantine 50: 208–214.

Ustinov I.D., Ostryk I.M., Konstantinova N.A., Kudina J.D., Pylypenko L.A. 2006. Plant quarantine (summary report for scientific projects conducted in 2005). Ukrgolovderzkarantyn, p. 23.