

Alarm on Invasion of Harmful Organisms Via Postal Parcels

Wang Jiaying, Cui Junxia, Chen Xianfeng*

Ningbo Academy of Inspection and Quarantine, Ningbo 315012, China

Abstract In recent years, with the rapid development of cross-border e-commerce, international postal parcels have been increasing sharply, thus giving rise to a new way for alien biological invasion. According to the "animal and plant quarantine information platform" of the General Administration of Customs, postal inspection system intercepted a total of 4 975 harmful organisms nationwide. There were 219 quarantine organisms, including 142 insects, 27 weeds, 12 nematodes, 29 fungi, 1 bacterium and 8 viruses. Insects accounted for 64.84% of the quarantine organisms, among which *Hypothenemus hampei* had the highest interception frequency. Up to 71.36% of those harmful organisms were from seedlings, yet 47.31% organisms came from products exported from India. These analyses indicate the direction of future portal quarantine work and lay a theoretical foundation for better guarding the biological security.

Keywords International postal parcels; Postal quarantine system; Biological invasion; Gate biological security

With the development of economic globalization, distance is no longer a barrier to biological invasion. Organisms can spread widely all over the world in multiple approaches. Alien biological invasion has become an economic, environmental and ecological issue of worldwide concern. Those invasions can seriously threaten the local agriculture and forestry, and accelerate the extinction of species which leads to the biodiversity loss^[1]. In recent years, the development of cross-border e-commerce such as online shopping and overseas purchasing has led to the continuous expansion of international logistics. International postal parcels have become an important channel for the introduction of exotic pests which can not be ignored. Our country has become one of those suffering the most from invasions of alien organisms. This paper collected and analyzed quarantine data intercepted by post inspection system from 2018 to 2020, and put forward the focus of follow-up quarantine work.

1 Interception of Harmful Organisms

According to the "animal and plant quarantine information platform" of the

General Administration of Customs, a total of 4 975 harmful organisms have been intercepted by the national mail inspection system in recent two years (2018.1.1 – 2020.1.1). Among them, quarantine organisms took up 4.4% (219), including 142 insects, 27 weeds, 12 nematodes, 29 fungi, 1 bacterium and 8 viruses (Table 1). Most intercepted organisms were from seedling entry products (71.36%, Fig. 1). Nearly half quarantine organisms intercepted came from India (47.31%), followed by the United States (7.53%).

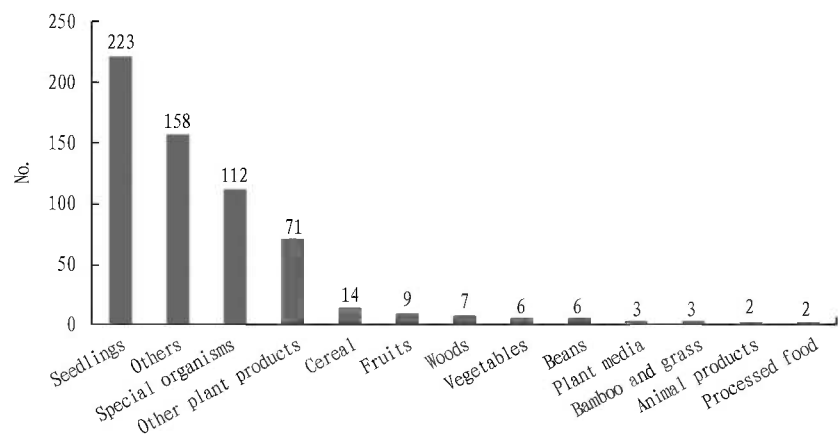


Fig. 1 Sources of harmful organisms intercepted by postal inspection system from 2018 to 2020

2 Insects

In the past two years, insects accounted for more than half (64.84%, Table 1) of the quarantine organisms intercepted by

Table 1 Quarantine organisms intercepted by postal inspection system from 2018 to 2020

Category	No.
Insect	142
Fungus	29
Weed	27
Nematode	12
Virus	8
Bacterium	1
Total	219

the national mail inspection system, which confirmed that insects are the main invasive organisms^[2]. Insects pose a great potential hazard to the domestic ecosystem. According to the objects, they can be divided into three categories: (i) Tree pests, including long-horned beetles (Cerambycidae), bark beetles (Scolytidae), and other

insects that harm wood and wood products. (ii) Fruit pests, such as *Sternochetus frigidus*, *Ceratitis capitata*, *Dysmicoccus neobrevipes et al.* (iii) Pests in storage, like seed beetles (Bruchidae) which damage varieties of beans, and species in Dermestidae feeding on fur, textiles, *etc.*

Table 2 Quarantine insects intercepted by postal inspection system from 2018 to 2020

Latin name	No.
<i>Hypothenemus hampei</i>	72
<i>Callosobruchus maculatus</i>	37
<i>Callosobruchus analis</i>	25
<i>Acanthoscelides obtectus</i>	3
<i>Callosobruchus phaseoli</i>	2
<i>Ectomyeloides ceratoniae</i>	1
<i>Trogoderma granarium</i>	1
<i>Zabrotes subfasciatus</i>	1

3 Weeds

Exotic weeds are usually transferred via seeds, fruits, other propagations, and occasionally in the form of seedlings. With the increasing of international communication, postal parcels have gradually become an important way of alien biological invasion. In the past two years, a total of 1 561 weeds were intercepted by the national mail inspection system, of which 27 were in the quarantine category. Quarantine weeds, such as *Amaranthus palmeri*, *Bromus rigidus*, *Cenchrus echinatus*, *Cuscuta sp.*, and *Sorghum halepense*, account for high interception frequency (Table 3).

Table 3 Quarantine weeds intercepted by postal inspection system from 2018 to 2020

Latin name	No.
<i>Amaranthus palmeri</i>	6
<i>Bromus rigidus</i>	4
<i>Cenchrus echinatus</i>	3
<i>Cuscuta sp.</i>	3
<i>Sorghum halepense</i>	3
<i>Amaranthus rudis</i>	1
<i>Ammi majus</i>	1
<i>Chenopodium murale</i>	1
<i>Cuscuta campestris</i>	1
<i>Emex spinosa</i>	1
<i>Euphorbia dentata</i>	1
<i>Flaveria bidentis</i>	1
<i>Xanthium spinosum</i>	1

In this paper, we investigated the status of quarantine regulation on insects in recent two years. Totally 921 insect pests were intercepted by the national postal inspection system, including 142 quarantine insects and 616 living ones. Among the quarantine ones, *Hypothenemus*

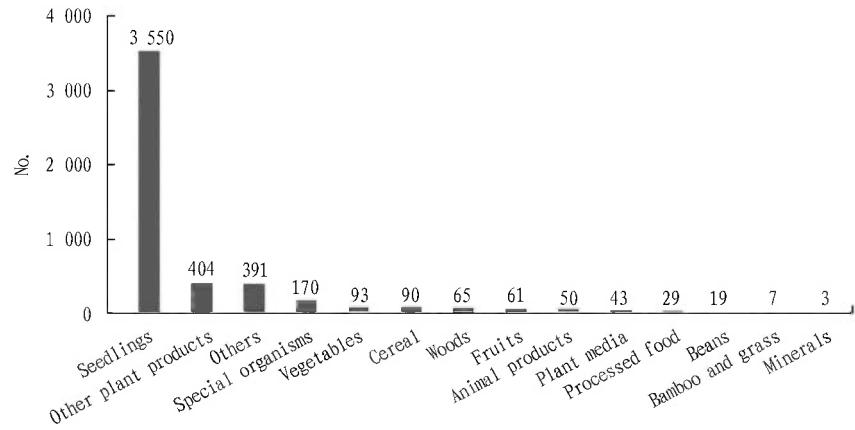


Fig. 2 Sources of insects intercepted by postal inspection system from 2018 to 2020

In order to limit plant invasion, the focus should be placed on inspection. Quarantine regulation is believed to play a vital role in detection and prevention once the cargo goes across the frontier, which really implies an effect of guarding the local biological security^[4].

4 Nematodes

Nematodes are numerous, taking up more than three-fifths of the multicellular organisms in soil. They are widely distributed all over the world, whether in fresh water, sea water, soil, underground or even plants and animals in icy areas. The notorious *Bursaphelenchus xylophilus* is responsible for a major forestry disease sweeping pines in Asia. *B. xylophilus*, in partnership with *Monochamus alternatus*, wreaked havoc on pine trees in China, killing a large area of pine forests, yet causing heavy economic losses^[5].

In the recent two years, a total of 617 nematodes were intercepted by the national postal inspection system, of which 12 were in the quarantine category, including *Ditylenchus destructor* and *Longidorus sp.* (Table 4). Among the intercepted nematodes, 83.95% were from seedlings,

hampei accounts for the highest frequency, followed by *Callosobruchus maculatus* (Table 2). Nearly half of those quarantine insects were from India (49.54%), followed by Brazil (6.42%). Living insects came mainly from imported seedlings (36.20%, Fig. 2).

followed by cultivation media (3.89%, Fig. 3). Half of the intercepted quarantine nematodes came from Japan.

5 Microorganisms (fungi, bacteria, viruses)

According to the data, 70%–80% plant diseases are caused by bacteria or fungi. They are closely related to human life. Quarantine microbes are a group of pests which do great damage to host plants. In the past two years (2018.1.1–2020.1.1), a total of 29 quarantine fungi have been detected via the national mail inspection system, all from India. What's more, 1 bacterium and 8 viruses in the quarantine category have been intercepted as well (Table 5).

Table 4 Quarantine nematodes intercepted by postal inspection system from 2018 to 2020

Latin name	No.
<i>Ditylenchus destructor</i>	3
<i>Longidorus sp.</i>	3
<i>Pratylenchus loosi</i>	2
<i>Pratylenchus scribneri</i>	2
<i>Pratylenchus sp.</i>	1
<i>Trichodorus sp.</i>	1

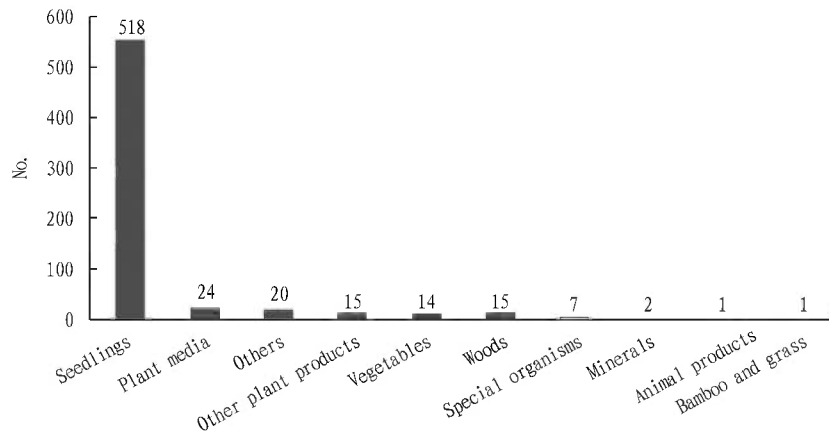


Fig. 3 Sources of nematodes intercepted by postal inspection system from 2018 to 2020

Table 5 Quarantine microorganisms (fungus, bacteria, viruses) intercepted by postal inspection system from 2018 to 2020

Category	Classification	No.	Country of origin
Fungus	<i>Tilletia indica</i>	29	India
Virus	Tobacco Ringspot Virus (TRSV), Cucumber Green Mottle Mosaic Virus (CGMMV), etc.	8	Taiwan China, Germany, Netherlands, etc.
Bacterium	<i>Acidovorax avenae</i> subsp. <i>cattleyae</i>	1	Taiwan China

6 Discussion

China is one of those countries most seriously affected by alien biological invasion in the world. Biological invasion has become an important factor threatening food security, ecological security and economic security in China. According to *PayPal Cross-Border Consumer Research 2015*, 35% of Chinese consumers bought commodities through "cross-border online shopping" in 2015, with an increase of 9% compared with that in 2014^[6]. In 2016, the overall transaction scale of China's cross-border e-commerce reached 6.3 trillion yuan. While in 2018, the overall transaction scale of China's cross-border e-commerce reached 8.8 trillion yuan, and the number of domestic "cross-border online shopping" users reached 74 million. In addition to international postal parcels derived from cross-border e-commerce, inbound parcels generated by personal purchasing and travel post have been increasing year by year. It is worth mentioning that highly convenient international logistics also contributes to the momentum of this "cross-border postal parcel fever". Meantime, reports about intercepting harmful organisms in international postal

parcels emerged in succession. A variety of quarantine weeds were intercepted from "Web celebrity" lavender bear by customs quarantine when entering China^[7]. A prolonged period of succulent plants fever has attracted many people to take the risk of trying to import new varieties by parcels from abroad, which has been reported many times^[8]. Living lizards, insects (live or specimen), pet frogs and other exotic creatures have also been intercepted from international postal parcels^[9]. Thus, with the increasing international post parcels, the potential risk of harmful organism invasion is gradually exposed^[10], and it is urgent to prevent international postal parcels from becoming a new way of harmful organism invasion.

This paper collected and analyzed the quarantine data intercepted by post inspection system from 2018 to 2020, and put forward the focus of follow-up quarantine work. It is reported that invasive insects account for 70% of the known invasive organisms in China in the past 20 years, which have posed constant threat to national ecological and economic security^[2]. In recent years, with the acceleration of

economic globalization, epidemic of invasive insects has kept breaking out, and the diffusion pattern of invasive insects is intensified^[11]. The results of data analysis in this paper confirmed that insects were the main members of entry harmful organisms, accounting for about half of the total interception. After the successful invasion of alien insects into China, insects can spread more easily using their flying ability due to their high reproduction strength, wide host range, strong adaptability to the environment, which undoubtedly increases the difficulty of epidemic prevention and control^[12]. They can also assist other organisms' spread, such as nematodes, fungi, or viruses in some occasions, thus taking the damage to another level. In addition, the species of insects intercepted at ports vary with the types of imported products^[13]. Taking all the characteristics into consideration, insects are the dominant group of alien biological invasion and the focus of quarantine work.

Among quarantine objects, seedling products carry the greatest number of harmful organisms^[14]. In recent years, China has continued to introduce plant breeding materials and products from abroad, and the trade of import and export of agricultural products has been intensified. Thus, the risk of introduction and spread of alien organisms with seedlings has largely increased^[15]. Relevant quarantine regulation should focus on strengthening seedling risk analysis and enhancing quarantine^[16]. It is noteworthy that nearly half of outbreaks collected in this study came from products exported from India.

Recently, the outbreak of novel coronavirus brought the concept of "biological security" back to the public's concern. Port quarantine work has always been an important way to guard the gate biosecurity and resist the invasion of alien organisms.

References

- [1] JU RT, LI H, SHI ZR, *et al.* Progress of biological invasions research in China over the last decade [J]. *Biodiversity Science*, 2012, 20

(Continued on page 34)

are used to control the occurrence of insect pests; *Bacillus thuringiensis* (bacterium) is used to control *P. xylostella* and *P. litura*; *Beauveria bassiana* (fungus) is used to control underground pests such as grubs.

(iii) Control pests with insect hormones. The synthesis and release of male pheromone effectively traps and kills female insects, which can not only kill adult insects, but also further control the reproduction of offspring. In addition, endocrine hormone of insects can be used to disrupt insect metamorphosis, and insects are unable to carry out normal reproductive activities, thus effectively controlling insect pests. For instance, when elder larvae are ready to pupate, spraying juvenile hormone makes larva intermediate between pupa and larva, and larvae can not emerge normally; or although adults are emerged,

they do not have reproductive ability.

3.2.4 Chemical prevention and control. Chemical prevention and control refers to the application of chemical pesticides for prevention and control of diseases and insect pests of strawberry. Chemical control often receives obvious and direct effect, and is often timely used when the above methods are not effective for prevention and control of diseases and insect pests. The use of chemical agents should be in accordance with national regulations, and safe pesticides with high efficiency, minute toxicity or low toxicity and short residual period are selected, while it is strictly prohibited to use pesticides with high toxicity and high residue, or teratogenic, carcinogenic, mutagenic pesticides. Additionally, although partial pesticides can be used on strawberry, the use frequency and use amount should be con-

trolled strictly. Forecast of diseases and pests should be strengthened as far as possible when using chemical agents, to avoid the use of single pesticide, and timely rotation and reasonable mix should be ensured. Meantime, the safety interval of pesticides should be paid attention, to reduce pesticide residues.

References

- [1] ZHANG YT, WANG GX, DONG J, *et al.* Safe production manual of pollution-free strawberry [M]. Beijing: China Agriculture Press, 2008. (in Chinese).
- [2] YANG L, YANG L, LI L. Key techniques of strawberry cultivation [M]. Beijing: Chemical Industry Press, 2015. (in Chinese).
- [3] PAN Y, SUN Q. Diagnosis and prescription of complicated strawberry diseases by picture comparison [M]. Beijing: China Agriculture Press, 2018. (in Chinese).
- [4] SHI ZW, YAO WG. Elementary analysis on invasive characteristics of alien insect species and prevention strategy[J]. Entomological Knowledge, 2004, 41(4): 371-374. (in Chinese).
- [5] XI GH, GAO BL. The first batch of imported durian was unqualified in quarantine at Ningbo Airport [EB/OL]. <http://zhanjiang.customs.gov.cn/customs/302249/302425/2053513/index.html>, 2018-10-24. (in Chinese).
- [6] WEI S, YUAN JJ, LIU YL, *et al.* Research advances on molecular markers of quarantine weed [J]. Inspection and Quarantine Science, 2014, 24(5): 71-74. (in Chinese).
- [7] NING T, FANG YL, TANG J, *et al.* Advances in research on *Bursaphelenchus xylophilus* and its key vector *Monochamus* spp. [J]. Entomological Knowledge, 2004, 41(2): 97-104. (in Chinese).
- [8] PayPal&Ipsos: The second global cross border trade report in 2015[EB/OL]. <http://www.199it.com/archives/424759.html>, 2016-01-02. (in Chinese).
- [9] Australia's "lavender bear" has been banned from entering China[J]. Enterprise Standardization, 2014, 34(7): 51. (in Chinese).
- [10] ZHANG MZ, XU LL, WU Y, *et al.* Zhejiang Inspection and Quarantine Bureau intercepted a large number of endangered Cactaceae plants [J]. Plant Quarantine, 2014, 36(5): 54-54. (in Chinese).
- [11] WANG Q, FU Y. Thinking on the inspection and quarantine towards the entry of animals and animal products at post ports[J]. China Journal of Animal Quarantine, 2017, 34(2): 55-57. (in Chinese).
- [12] HU SH, WANG JQ, NIE L, *et al.* Harm and prevention and cure of biological invasion[J]. Journal of Biology, 2003, 21(5): 12-15. (in Chinese).
- [13] XU DD, CHEN L, WANG XW, *et al.* Advances in the research on invasive insects in China [J]. Entomological Knowledge, 2017, 54(6): 885-897. (in Chinese).
- [14] ZANG LS, JIANG MX, LIU SS. Control of agricultural invasive insects[J]. China Nature, 2004, 25(2): 48-50. (in Chinese).
- [15] LI HM, HAN HX, ZHANG RZ, *et al.* The list of invasive insects in mainland China [A]. Research Progress of Entomology[C]. 2005. (in Chinese).
- [16] LI KB, TAN J, LI WW, *et al.* Guard against the introduction of seedlings carrying harmful organisms[J]. China Plant Protection, 2013, 33(2): 55-57. (in Chinese).
- [17] MO RH, WU JJ. Discussion on the risk and countermeasures of the introduction of harmful organisms into the seedlings of imported plants[J]. Inspection and Quarantine Science, 2006, 16(B12): 109-112. (in Chinese).
- [18] LI KB, LI HL, TAN J, *et al.* Analysis on harmful organism conditions intercepted from entering forest seedlings in China in 2011[J]. Guizhou Agricultural Sciences, 2013, 40(11): 70-77. (in Chinese).

(Continued from page 30)