



Full Length Article

Current status of exotic insect pests in Korea: comparing border interception and incursion during 1996–2014

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ABSTRACT

Interception data pertaining to Coleoptera, Hemiptera, Lepidoptera, Diptera, Thysanoptera, and Hymenoptera collected at the Korean quarantine border were cross-checked with incursion data during 1996–2014. Overall, 114,636 interception records of 1,075 species belonging to the six orders were detected, while 33 species (out of 2,710 newly recorded species belonging to the six orders) were confirmed as incursion species in Korea. Of the 33 species, only 14 (42.42%) were recorded as being intercepted at the quarantine border. These results indicate that recent incursion species in Korea are not subject to inspection at Korean borders. Of the 33 incursion species, 30 (90.90%) are agricultural pests, and 10 species (30.30%) are hemipteran. About these species, two factors, greenhouse cultivation and parthenogenesis of exotic species, are newly suggested as reasons for successful incursion into Korea. This study reveals that border inspections do not provide useful information to protect against occurrences of exotic incursive species and that the current quarantine system needs improvement.

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Introduction

The Korean government officially enacted the Plant Protection Act in December 1961. Recently, economic growth of Korea has resulted in increased consumer's demand for fresh foods (fruits and vegetables) and/or ornamental products (cut flowers and plants for planting). As a result, plant quarantine regulations have become stricter in Korea. Nevertheless, exotic species continue to be brought into Korea accidentally or intentionally (Hong et al., 2012). When exotic is defined as species introduced to Korea after the beginning of the Greater Korean Empire Era (1897), a total of 170 insect species were considered exotic until 2011 (Hong et al., 2012). On average, 0.85 exotic insect species had been established each year from 1970 to 2011, and 76.6% of the exotic species are economic agricultural pests. Interestingly, most of the exotic insect pests were first found in Japan, then detected in Korea at least 3 years later until the 1990s, but this pattern reversed in the 2000s (Hong et al., 2012). Currently, the annual invasion rate and the pest interceptions from imported cut flowers, planting materials, and/or vegetables have been rapidly increased in Korea.

Identifying the risk of entry and establishment of exotic insect pests into a region is a key component of biosecurity risk analysis and

emergency preparedness (Caley et al., 2015). Propagule pressure is one of the main factors influencing the probability of establishment of incursive insects (Berggren, 2001). Williamson and Fitter (Williamson and Fitter, 1996) suggested that, when introduced species are successfully established in a country, propagule pressure would influence establishment probability. For example, successful invaders have a higher rate of introduction reflected by the number of interceptions through investigation activities. There is increasing interest in the role of foreign trade as a conduit for exotic insect species, resulting in studies that have made preliminary attempts to quantify the rate and risk of this pathway (Stanaway et al., 2001; Work et al., 2005). A logical implementation of the propagule pressure paradigm is to seek indicators, or indexes of propagule pressure, as a means of quantifying invasion risk. Recently, Caley et al. (2015) suggested detections of exotic species at the quarantine border (defined as “interceptions”) as one such measure.

In this study, the rate at which insects belonging to six orders, Coleoptera, Hemiptera, Lepidoptera, Hymenoptera, Diptera, and Thysanoptera, were intercepted at the Korean border was compared with the probability that these groups had been successfully established in Korea (defined as “incursions”) during 1996–2014. Based on available literature and the Pest Information System (PIS) database compiled by the Animal and Plant Quarantine Agency (not public), a total of 140,664 interception records (1,893 species) were documented during 1996–2014, with 114,636 records (1,075 species) belonging to the six orders. During the same period, 2,710 newly recorded species

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Table 1

The numbers of interception record and species, incursions species, and newly recorded species of the six orders Coleoptera, Hemiptera, Lepidoptera, Diptera, Thysanoptera, and Hymenoptera during 1996–2014.

Order	¹ Interceptions		² Newly recorded	
	records	species	species	species
Coleoptera	65,996	507	8	1,085
Hemiptera	36,346	317	10	229
Lepidoptera	4,846	59	3	359
Thysanoptera	4,611	62	2	18
Hymenoptera	2,207	92	3	742
Diptera	630	38	7	277
Total	114,636	1,075	33	2,710

¹ Interception species were collected at Korean borders by quarantine inspectors. ² Newly recorded species were collected on several domestic local regions in Korea by numerous entomological researchers.

belonging to the six orders have been reported in Korea and we confirmed that a total of 33 species had been recorded as exotic insect pests in Korea. We analyzed the interception and incursion datasets according to orders and years and discussed the efficiency of the plant quarantine systems at protecting against invasions of exotic insect pests into Korea.

Materials and Methods

Interception and incursion data sources 1996–2014

The interception data were calculated using the Pest Information System (PIS) database compiled by the Animal and Plant Quarantine Agency in Korea (not public). The interception data contains all records of intercepted insect species during 1996–2014. We recalculated the number of insect species belonging to the six orders, Coleoptera, Hemiptera, Lepidoptera, Hymenoptera, Diptera, and Thysanoptera, which included a high number of quarantine pest insects. The newly recorded species and incursion data belonging to the six orders were calculated based on several studies published during 1996–2014. Only interception records including identifications at the species level the species level were analyzed (excluding unidentified species), and all deliberately introduced biocontrol agents and pollinators were removed from this dataset prior to analyses.

Importation data sources 1996–2014

The importation data were calculated using the PIS. The importation data contains all records of importations that were subject to inspection during 1996–2014. We recalculated the number of source regions

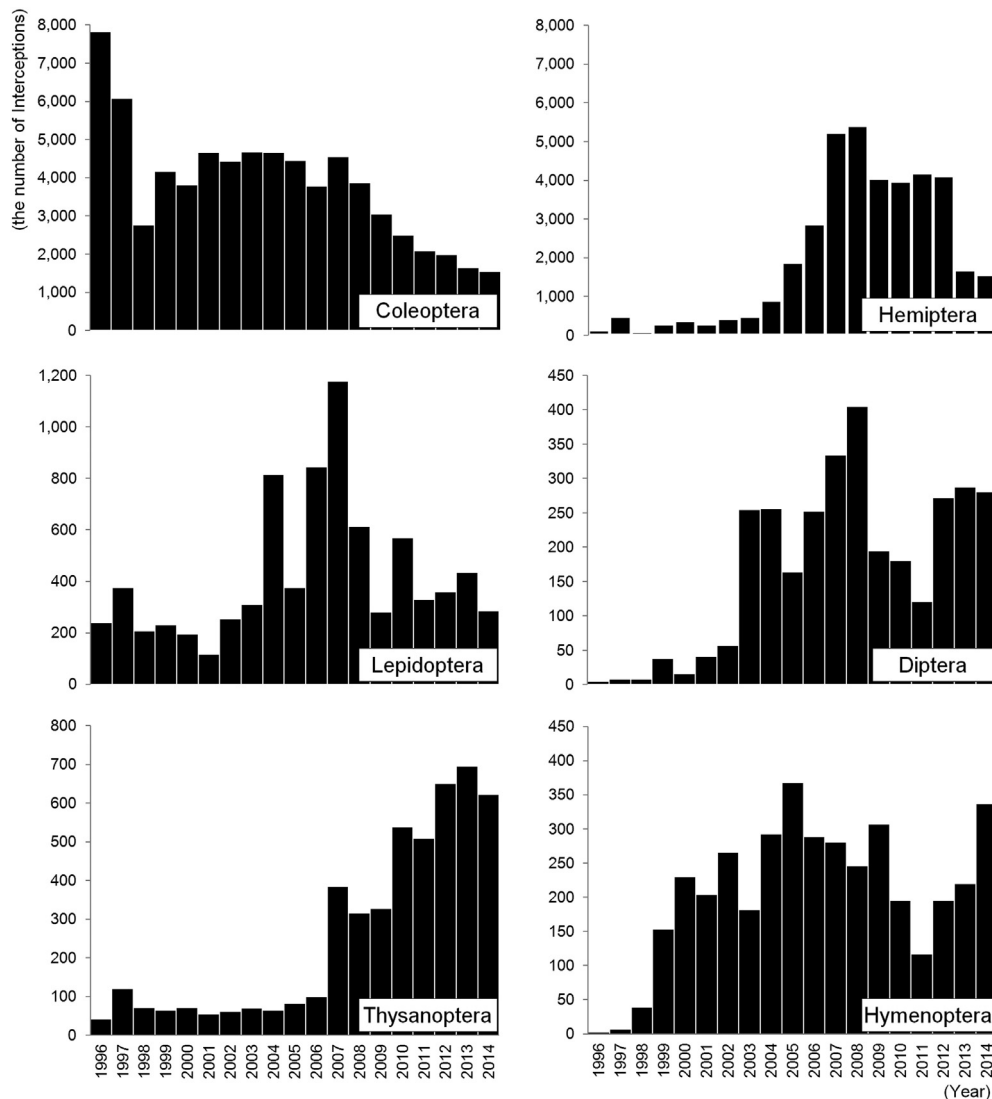


Fig. 1. Frequency of interception records of the six orders Coleoptera, Hemiptera, Lepidoptera, Hymenoptera, Thysanoptera, and Diptera, in Korea (1996–2014).

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