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**Exotic Terrestrial Macro-Invertebrate Invaders in California
from 1700 to 2015: An Analysis of Records**

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We document that 1,686 exotic terrestrial macro-invertebrates from 278 families have developed self-sustaining populations in California, USA over the period 1700 to 2015. The majority of exotic arthropods are insects (84.4%) followed by mites (7.5%) and spiders (3.2%). The insect Order Hemiptera, Auchenorrhyncha and Sternorrhyncha combined, has the greatest insect representation at 27.6%. The Aphididae is the most successful group of invaders with 183 species established in California. Small, less mobile plant feeders (e.g., plant feeders like thrips, scales, mealybugs, whiteflies and aphids) have successfully invaded more often than large mobile invertebrates (e.g., bees and wasps, butterflies and moths, grasshoppers and katydids, or beetles). The greatest number of invaders (43.6%) most likely came to California from invasion bridgeheads established elsewhere in North America (USA and Canada). The date of first detection is known for approximately 1,116 (66%) invertebrate species and the temporal invasion rate has not remained constant over time. Fewer invaders were detected over 1970–1989 at a rate of ~6 species per year. This rate increased to ~9.7 new species detected per year from 1990 to 2010, an increase of ~62% since 1989. Invasion rates into California have not increased significantly post 11 September 2001 when the Department of Homeland Security assumed responsibility from United States Department of Agriculture–Animal Plant Health Inspection Service (USDA APHIS) for border protection. It is anticipated that invasion rates for invertebrates will continue to increase and more exotic organisms will establish in California because of increasing trade and tourism and a corresponding lack of increased resources for pest surveillance, detection, and post-incursion management.

KEYWORDS: invasion rates, invasive species, change point analyses, impacts of invasive species

Over the last 25 years there has been growing awareness that exotic invasive organisms can greatly modify our urban, agricultural, and native habitats (Mattson et al. 1994, Barthell et al. 1998, Pimentel et al. 2000, Jass and Klausmeier 2001, Beatty 2002, Huber et al. 2002, Hoddle et al. 2004, Sierwald et al. 2005, Footitt et al. 2006, Haack 2006, Bolger et al. 2000, Kenis et al. 2009, Aukema et al. 2010, Aukema et al. 2011, Engelkes and Mills 2011, Roy et al. 2011a,b). The literature is rich in examples, and generally includes instances of invasive species that adversely affect native

flora and fauna, reduce agricultural productivity, and impact urban areas. Some invasive species affect human, animal, and plant health, while others degrade and deny citizens the use of parklands and wilderness areas (Dowell 1988; Horsfall 1983, Dowell and Gill 1989, Knight and Rust 1990, Dowell and Krass 1992, Daehler and Strong 1995, Holway 1998, Suarez and Case 2002). However, biological invasions are complex processes whose individual components are not easily understood (Kolar and Lodge 2001, Crooks 2005, Barney and Whitlow 2008).

The environmental and economic impacts that result from invasion events are the reason that regulatory agencies like the California Department of Food and Agriculture (CDFA), United States Department of Agriculture Animal Plant Health Inspection Service (USDA-APHIS), and the Department of Homeland Security (DHS) are charged to detect and prevent the establishment of non-native species within their jurisdictions. Following the passage of the 2002 Homeland Security Act, USDA-APHIS personnel were transferred into Customs and Border Protection (CBP) under the auspices of DHS in 2003 and this resulted in the incorporation of the protection of US Agriculture into CBP's anti-terrorism mission (GAO 2006). US agriculture is a \$1 trillion per year enterprise, and this significant change in focus from pest and disease exclusion to detecting terrorist activity raised concerns that US agriculture may experience increased vulnerability to invasive pests and diseases affecting crops and livestock (GAO 2006).

For invasive species managers, researchers, and regulatory agencies, a first step in managing the invasion process is the development of lists of successful invaders and their likely area of origin (Dowell and Gill 1989). This information may help identify likely future invaders and their probable sources, and assist with resource allocation decisions for monitoring, detection, and management programs (Crooks et al. 1983, Dowell and Gill 1989, Work et al. 2005, Koch et al. 2011). Additionally, these lists can be used to look for temporal, geographic origin, and species composition changes in invasion rates. The suggestion that the transfer of pest detection and exclusion responsibilities from USDA-APHIS to CBP could have increased the rate of unwanted pest introductions (GAO 2006) is a hypothesis that can be examined statistically with a chronologically constructed species detection list.

Dowell and Gill (1989) published a list of exotic invaders in California and their likely origins over the period 1955–1988. Although this study (Dowell and Gill 1989) has been cited widely, it encompassed a limited timeframe and utilized one data source. Using Dowell and Gill (1989) as a reference point, the goals of this paper are: 1) to expand the timeframe of analyses to include exotic terrestrial macro-invertebrates that successfully invaded California from 1700 to 2015; 2) to utilize a wider range of information resources that document breeding populations of invasive macro-invertebrates in California; and 3) use these expanded datasets to examine the composition and origins of invading species and how they have changed over time. In particular, this dataset provided an opportunity to determine whether or not invasion rates into California increased after CBP assumed responsibility for managing unwanted pest and disease incursions. Here we refer to exotic invaders in the broadest sense, non-native species that developed reproducing populations in California. These organisms may or may not cause economic or environmental problems, but the commonality underlying this resident community is their non-native status. Additionally, some species that developed reproducing populations in California may have done so temporarily before being successfully eradicated. In the absence of eradication efforts, these species would likely still be in California, and are therefore considered species that successfully developed breeding populations before being deliberately extirpated.

METHODS

CONSTRUCTION OF AN INVASIVE TERRESTRIAL INVERTEBRATE SPECIES LIST FOR CALIFORNIA.— To develop a list of exotic terrestrial macro-invertebrate invaders (Appendix), we examined print and electronic sources for information on breeding populations within the state of California, USA. The following criteria were used to develop a documented evidence list (McGeoch et al. 2012): 1) One or more authorities noted that the organism was found in California, and 2) these sources noted that the organism was not native to California; 3) There was evidence of a breeding population of the organism outside of a quarantine situation initiated to contain a possible incipient infestation. For example, the discovery of a single individual, such as the male Queensland fruit fly, *Bactrocera tryoni* (Diptera: Tephritidae) found in California in 1991, was not considered evidence of a breeding population (Centre for Agriculture and Biosciences International 2016). Organisms discovered in ports, or at nurseries importing stock from outside California were considered to be contaminants and were within the State of California's quarantine system and therefore were not included in the list; 4) For analysis of electronic sources, like *BugGuide*, we included species for which we could find another source to independently confirm the presence of breeding populations or when there were one or more pictures posted on web sites documenting the invader of interest from locations outside of quarantine situations within California; 5) If an organism had invaded California several times, and reproducing populations were detected (e.g., oriental fruit fly, *Bactrocera dorsalis*) (Stephens et al. 2007), only the first successful reproducing population was considered; 6) Arthropod biological control organisms (i.e., predators and parasitoids) that were intentionally released in California were not included in the list. Neither was the deliberately introduced European honey bee, *Apis mellifera*.

The point sources of pests arriving in California may not necessarily correspond with the pest's native home range. Therefore, if a newly detected invasive species was found in California and populations of this pest existed previously elsewhere within North America (i.e., the US or Canada), the parsimonious decision was made that assumed in the absence of contrary evidence (e.g., molecular-based data if it existed) that the population of interest originated from populations already established in North America and did not represent a novel introduction directly from the native range of the invader. This decision was based partly on the volume of traffic entering California each year. In 2010 (most recent data available) some 27.3 million private vehicles entered California along with 7.14 million commercial trucks (California Department of Food and Agriculture 2011). For example, the red imported fire ant, *Solenopsis invicta* (Hymenoptera: Formicidae), almost certainly entered California from long-established populations in the eastern United States and it did not invade California directly from its native South America.

We have identified in the Appendix invertebrates that are classified not native to California and in some instances are classified as pests. For plant, home and garden, and the environment, we identify those invertebrates listed as pests in the University of California IPM online (UC IPM 2014), sheep and goat pests are from Pirelli (2013), dairy cattle pests are those identified by Geden et al. (2010), horse insect pests are from Meyer et al. (1991), swine pests are from Loftin (2013), and chicken pests are from Stafford III (2011). These sources tend to deal with animals that are established in California or are frequently detected there. We have also identified some pests not established in California (IPPC 2007) but which have been detected here and which are generally considered pests in those areas where they occur. These include the gypsy moth (*Lymantria dispar*) (Liebhold 2003), Japanese beetle (*Popillia japonica*) (Anon. 1997), Mexican bean beetle (*Epilachna varivestis*) (Sanchez-Arroyo 2015), oriental fruit fly (*Bactrocera dorsalis*), Mexican fruit fly (*Anastrepha ludens*), Caribbean fruit fly (*Anastrepha suspensa*), peach fruit fly (*Bactrocera zona-*

ta), Mediterranean fruit fly (*Ceratitis capitata*), melon fly (*Bactrocera cucurbitae*), white striped fruit fly (*Bactrocera albistrigata*), guava fruit fly (*Bactrocera correcta*) (White and Elson-Harris 1992), boll weevil (*Anthonomus grandis*) (Lange et al. 2008), varroa mite (*Varroa jacobsoni*) (Bessin 2001), red palm weevil (*Rhynchophorus vulneratus*) (Rugman-Jones et al. 2013), Diaprepes root weevil (*Diaprepes abbreviatus*) (Grafton-Cardwell et al. 2004), Asian longhorn beetle (*Anoplophora glabripennis*) (USDA APHIS 2015), and cereal leaf beetle (Walentra 2014).

The year the organism was identified from California is listed unless there is published information supporting the use of an earlier date. Organisms listed in overview works (e.g., Essig 1915, 1926) are assumed to have entered the state in the decade prior to the work's publication date. For ~34% of recorded exotic invertebrates, the date of introduction was either unknown or was uncertain and therefore not included in analyses.

STATISTICAL ANALYSES.— Change point detection analyses aim to identify when a sequence of time ordered observations changes with respect to the underlying model that generates data. A common type of change point analysis is to look for a change in either the mean or the variance of the data generating model. Change point analyses were used to determine if the model for the annual number of exotic macroarthropods incurred a change point over the period 1935 to 2010. The time period 2011–2015 was not included because of the time lag in the publication of non-native animals discovered in California therein. Although the data source available for analyses extends to periods earlier than 1935, data quality was perceived to be a potential issue that could influence analyses, hence a conservative approach was taken and this 75 yr period was selected. The change point detection method used was CUSUM (cumulative sum) that detects shifts in the mean in the data series under analysis. The software package Change Analyzer, (2013), was used to identify change points using the CUSUM method. Succinctly, the CUSUM analysis was computed as follows: first, the overall average number of exotic arthropods was calculated for the time interval of interest; second, the cumulative sum for the time interval of interest was initialized at zero; and third, cumulative sums were calculated by sequentially adding deviations of current values from the average to the previous cumulative sum. A CUSUM chart, a plot of the cumulative sums versus time, was used to identify transitions or change points in the sequence. Potential change points were evaluated using bootstrap procedures to determine their statistical significance. When a significant change point was detected, its location was determined by identifying the last point before the change and the first point after the change. This sequence was divided at the change point and the CUSUM procedure was repeated on each of the new segments to determine if additional significant change points existed. Of particular interest in change point analyses performed on this data set was that of testing the hypothesis that incursions of invasive arthropods into California increased after 11 September 2001 (GAO 2006).

We used chi-square analysis (Little and Hills 1978) to compare the composition of species established in California to the worldwide composition of the taxa they represent, and to determine if the composition of the invaders by area of origin differs from global composition. All analyzes herein include the exotic organisms listed in an earlier work (Dowell and Gill 1989) and organisms are grouped by family rather than by order as done in Dowell and Gill (1989). Family-level classification provides finer taxonomic resolution and accommodates recent taxonomic nomenclatural changes. We also compared the composition by taxa of invaders from each region to their over-all composition. For this analysis, the expected values were generated by multiplying the percentage of each invading taxa over-all by the total number of invaders from each region. For example the percentage of Coleoptera in the over-all composition of invaders was multiplied by the number of invaders recorded from North America.

RESULTS AND DISCUSSION

COMPOSITION OF INVADERS.— We identified 1,686 species of exotic terrestrial macro-invertebrates that have developed breeding infestations within California over the time period 1700 to 2015 (Appendix). These organisms include earthworms (Annelida: Oligochaeta), mites and spiders (both Arthropoda: Arachnida), centipedes (Arthropoda: Chilopoda), millipedes (Arthropoda: Diplopoda), slugs and snails (both Mollusca: Gastropoda), woodlice (Arthropoda: Isopoda), insects (Arthropoda: Insecta), and one amphipod (Arthropoda: Amphipoda) from 278 different families. The majority of these exotic organisms are insects (84.4%) followed by mites (7.4%) and spiders (3.2%) (Table 1) (Figure 1).

A number of organisms on the list (see Appendix) developed breeding populations in California that were or are being subjected to Official Action (quarantine and eradication) in accordance with internationally accepted guidelines (IPPC 2007) by the California Department of Food and Agriculture often in collaboration with the United States Department of Agriculture. Organisms subject to official action are not considered to be established in California. These include the Mediterranean fruit fly, *Ceratitis capitata*; Mexican fruit fly, *Anastrepha ludens*; peach fruit fly, *Bactrocera zonata*; guava fruit fly, *Bactrocera correcta*; gypsy moth, *Lymantria dispar*; boll weevil, *Anthonomus grandis*; Japanese beetle, *Popillia japonica*; Caribbean fruit fly, *Anastrepha suspensa*; melon fly, *Bactrocera cucurbitae*; Hall scale, *Nilotaspis halli*; red palm weevil, *Rhynchophorus vulneratus*; white striped fruit fly, *Bactrocera albistrigata*; European grapevine moth, *Lobesia botrana*; Mexican Bean Beetle, *Epilachna varivestis*; Asian gypsy moth, *Lymantria dispar asiatica*; and Asian longhorn beetle, *Anoplophora glabripennis*.

TABLE 1. Composition by taxon of exotic terrestrial macro-invertebrates found breeding in California 1700–2010.

Taxon ^a	Number of organisms	Percent of total organisms
Hemiptera: Auchenorrhyncha + Sternorrhyncha	467	27.6
Coleoptera	344	20.4
Lepidoptera	172	10.2
Acari	125	7.4
Diptera	122	7.2
Hymenoptera	96	5.6
Thysanoptera	63	3.7
Hemiptera- Heteroptera	50	2.9
Araneae	53	3.2
Mollusca	43	2.5
Phthiraptera	34	2.0
Dicyptera	19	1.11
Opisthoptera	16	1
Psocoptera	16	1
Isopoda	11	0.6
Orthoptera	9	0.5
Dermaptera	9	0.5
Diploda	9	0.5
Siphonaptera	9	0.5
Thysanura	5	0.3
Collembola	4	0.24
Chilopoda	2	0.12
Embiidina	2	0.12
Amphipoda	1	0.06
Isoptera	1	0.06
Phasmida	1	0.06
Symphyla	1	0.06
Total	1686	

^a See Appendix for list of organisms.



The Hemiptera, Auchenorrhyncha, and Sternorrhyncha combined, has the greatest representation (Table 1) with 27.6% of all organisms. Next speciose are the Coleoptera (20.4%), Lepidoptera (10.2%), Acari (7.4%), Diptera (7.2%) and Hymenoptera (5.6%). Remaining taxa have no more than 3.6% of recorded organisms (Table 1). This differs somewhat from a list of non-native species for all of North America that had the Coleoptera ranked first followed by the Hymenoptera, Hemiptera, Diptera and Lepidoptera (Yamanaka et al. 2015). Yamanaka et al. (2015) included releases of biological control agents and excluded species that were eradicated, the opposite of this study.

As seen in other studies (Lawton et al. 1986, Gaston et al. 2001, Karatayev et al. 2009), the composition of invading animals deviates significantly from random ($\chi^2 = 257.497$; $df = 25$; $p < 0.001$) (Table 2) based on their worldwide numbers (Borror et al. 1989, Brusca 1997, Shelley 1999, Halliday et al. 2000, Triplehorn and Johnson 2005, Chapman 2009, Platnick 2011, Ramel 2011). Hemiptera (Auchenorrhyncha and Sternorrhyncha), Acari, Thysanoptera, Psocoptera, Siphonaptera, Dermaptera, Phthiraptera, Dictyoptera, Isopoda, and Thysanura invaded California more often than expected. Conversely, Coleoptera, Lepidoptera, Diptera, Hymenoptera, Araneae, Collembola, Chilopoda and Orthoptera invaded less often than expected. In general, small, less mobile plant feeders (e.g., whiteflies, thrips, mites, aphids and scales) invaded California more often than expected and larger more mobile insects (e.g., bees and wasps, butterflies and moths, grasshoppers, true bugs, spiders, and beetles) less often than expected. Similar invasion patterns have been seen in other studies (Lawton et al. 1986, Gaston et al. (2001).

The most successful group of invaders was the Aphididae (183 species [10.9% of the total]) (Table 3). After the aphids the most numerous invaders were, in descending order, the Curculionidae (83 species [4.9% of invasive species]), Staphylinidae (74 species [4.4%]), Eriophyidae (72 species [4.2%]), Diaspididae (71 species [4.2%]), and Pseudococcidae (59 species [3.5%]). Other highly successful invaders were in the Cicadellidae (Hemiptera), Thripidae (Thysanoptera), Coccidae (Hemiptera), Psyllidae (Hemiptera), Aleyrodidae (Hemiptera), Formicidae (Hymenoptera), Chrysomelidae (Coleoptera), Tetranychidae (Acari), Miridae (Hemiptera: Heteroptera), Tenebrionidae (Coleoptera), and four families of moths (Lepidoptera: Gelechiidae, Noctuidae, Pyralidae and Tortricidae) (Table 3).

Successful invaders included many well known invertebrates including the codling moth (*Cydia pomonella*), silverfish (*Lepisma saccharina*), European earwig (*Forficula auricularia*), pill-bug (*Armadillidium vulgare*), cabbage butterfly (*Pieris rapae*), American (*Periplaneta americana*) and German (*Blattella germanica*) cockroaches, brown garden snail (*Cornu aspersum*), house fly (*Musca domestica*), praying mantis (*Mantis religiosus*), and Argentine ant (*Linepithema humile*) (Appendix). As discussed below, many successful invaders are important pests of agricultural, horticultural and floricultural crops, wilderness areas, livestock, urban gardens, houses, pets, and people.

ORIGINS OF INVADERS.— The origins of 980 of listed invaders are known or suspected (Table 4). The greatest number of invaders came to California from elsewhere in North America (i.e., USA

FIGURE 1 (left). Examples of non-native macro-terrestrial arthropods that have been detected in California. A. Avocado thrips, *Scirtothrips perseae* Nakahara (Thysanoptera: Thripidae). (Detected 1992). B. Brown widow spider, *Latrodectus geometricus* Koch (Araneae: Theridiidae) (detected 2003). C. Glassy-winged sharpshooter, *Homalodisca vitripennis* (Germar) (Hemiptera: Cicadellidae) (detected 1994). D. Brown marmorated stink bug, *Halyomorpha halys* Stål (Hemiptera: Pentatomidae) (detected 2005). E. Citrus leafminer, *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae) (detected 1999). F. Asian citrus psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae) (detected 2008). G. Palm weevil, *Rhynchophorus vulneratus* (Panzer) (Coleoptera: Curculionidae) (detected 2010) (eradicated 2015). H. Gold spotted oak borer, *Agrilus auroguttatus* Waterhouse (Coleoptera: Buprestidae) (detected 2004).

TABLE 2. Expected versus observed number of exotic invertebrate invaders based on their worldwide numbers.

Taxon	Expected number of invading species ^h	Observed number of invading species ⁱ
Hemiptera: Auchenorrhyncha plus Sternorrhyncha ^a	83	468
Coleoptera ^a	496	312
Lepidoptera ^a	248	167
Acari ^b	70	125
Diptera ^a	248	109
Hymenoptera ^a	190	94
Thysanoptera ^a	7	59
Hemiptera- Heteroptera ^a	58	55
Araneae ^c	80	52
Mollusca ^d	39	43
Phthiraptera ^a	5	34
Psocoptera ^a	5	16
Dictyoptera ^a	10	19
Isopoda ^e	8	11
Diplopoda ^b	16	9
Orthoptera ^a	33	9
Dermaptera ^a	3	9
Siphonaptera ^a	4	8
Thysanura ^a	1	5
Collembola ^a	10	4
Chilopoda ^g	5	2
Embiidina ^a	1	2
Isoptera ^a	4	1
Phasmida ^a	4	1
Symphyla ^g	1	1

^a Based on numbers in Borrer et al. 1989 and Triplehorn and Johnson 2005.

^b Based on numbers in Halliday et al. 2000.

^c Based on numbers in Platnick 2011.

^d Based on numbers in Chapman 2009.

^e Based on numbers in Rusca 1997.

^f Based on numbers in Ramel 2011.

^g Based on numbers in Shelley 1999.

^h rounded to the nearest whole number or to one if less than 0.50.

ⁱ See Appendix for list of organisms. $\chi^2 = 2,688.37$; $df = 25$; $p < 0.001$.

TABLE 3. The twenty families with the largest number of exotic terrestrial macro-invertebrates found breeding in California.

Order	Family	Number of Species ^a
Hemiptera	Aphididae	183
Coleoptera	Curculionidae	83
Coleoptera	Staphylinidae	764
Acari	Eriophyidae	72
Hemiptera	Diaspididae	71
Hemiptera	Pseudococcidae	59
Thysanoptera	Thripidae	49
Hemiptera	Cicadellidae	47
Hemiptera	Psyllidae	37
Hemiptera	Coccidae	35
Coleoptera	Chrysomelidae	30
Lepidoptera	Pyralidae	26
Hymenoptera	Formicidae	25
Hemiptera	Miridae	24
Acari	Tetranychidae	23
Lepidoptera	Tortricidae	21
Hemiptera	Aleyrodidae	20
Lepidoptera	Gelechiidae	20
Coleoptera	Tenebrionidae	19
Lepidoptera	Noctuidae	16

^a See Appendix for list of organisms.

Japan) (10.2%), Tropical America (Central America and South America) (7.2%), Australia (4.9%), Africa (4.7%), Hawaii (2.2%), Mexico (2.0%), and the Pacific Region (areas bordering the Pacific Ocean including New Zealand but excluding Hawaii and Japan) (0.8%) (Table 4).

Mexico and Hawaii are listed separately because of their relatively close proximity to California, high reciprocal volumes of trade and tourist traffic, and the belief that numerous invaders enter California from these two areas (Dowell and Gill 1989). Organisms from the Mediterranean Region were assigned to either Africa or Europe as appropriate. The distribution of recorded invaders was not uniform ($\chi^2 = 1,386.31$; $df = 8$; $p < 0.001$) with more species than expected infiltrating California from North America and Europe and fewer invaders than expected originating from Tropical America, Australia, Africa, Hawaii, Mexico and the Pacific Region (Table 4).

Not all taxa invaded California from all regions (Table 5). Only the Acari, Diptera, Hemiptera Auchenorrhyncha and Sternorrhyncha, and Lepidoptera have representatives from every region.

No region has invaders from every taxa (Table 5). Europe has representatives from 20 of 26 taxa followed by North America (15), Africa (15), Tropical America (11), Asia and Australia (10), Hawaii (9), and Mexico (6).

Chi-square analysis found the composition of invaders from North America ($\chi^2 = 48.04$,

TABLE 4. Number of exotic terrestrial macro-invertebrates by origin.

Origin	Number of organisms ^a	Percent of total
North America	422	43.6
Europe	243	24.8
Asia	100	10.2
Tropical America	71	7.2
Australia	48	4.9
Africa	46	4.7
Hawaii	2227	2.2
Mexico	20	2.0
Pacific Region	8	0.8
Total	980	

^a See Appendix 1 for list of organisms. $\chi^2 = 1,386.31$; $df = 8$; $p < 0.001$. Assumes an average of 108.8 invaders from each region.

and Canada) (422 species; 43.6%). These invaders were comprised of species native to the USA (e.g. the glassy-winged sharpshooter, *Homalodisca vitripennis*, which is native to the southeastern USA) (e.g., indigenous exotics (Dodds et al. [2010]) and species exotic to the USA but which likely invaded California from invasion bridgeheads within the USA (e.g., red imported fire ant and European gypsy moth). Europe was the second largest source of exotic invaders (24.8%) followed by Asia (including

df = 10, $p < 0.001$), Europe ($\chi^2 = 4.975$, df = 11, $P < 0.001$), Africa ($\chi^2 = 13.67$, df = 2, $p < 0.01$), Asia ($\chi^2 = 43.89$, df = 5, $p < 0.001$), Tropical America ($\chi^2 = 11.86$, df = 3, $p < 0.01$), and Australia ($\chi^2 = 20.0$, df = 3, $p < 0.001$) deviated significantly from that seen in Table 1 (Table 5). There were too few species recorded from Hawaii, Mexico and the Pacific region to analyze (Little and Hills 1978).

INVASION FREQUENCIES INTO CALIFORNIA POST SEPTEMBER 11, 2001 — CHANGE POINT ANALYSES.— Count data for the number of recorded invasive species by year over the period 1935–2010 (Fig. 2) and the CUSUM plot for this 75-year data set are shown in Fig. 3. Three significant change points were identified, 1941, 1971, and 1983 (Table 6). The mean number of exot-

TABLE 5. Likely origins of the exotic terrestrial macro-invertebrates found breeding in California by taxon.

Taxon ^a	Mexico	North America	Europe	Africa	Asia	Hawaii	Pacific Region	Tropical America	Australia
Acari	3	24	18	2	4	2	1	4	1
Amphipoda	0	0	0	0	0	0	0	0	1
Araneae	0	4	8	1	0	0	0	4	0
Chilopoda	0	0	2	0	0	0	0	0	0
Coleoptera	1	78	50	4	10	1	0	7	6
Collembola	0	0	3	0	0	0	0	0	0
Dermaptera	0	1	1	1	0	0	0	0	0
Dictyoptera	0	4	2	4	2	0	0	0	0
Diplopoda	0	1	6	0	2	0	0	0	1
Diptera	1	32	17	2	7	4	2	7	5
Embiidina	0	0	2	0	0	0	0	0	0
Hemiptera- Heteroptera	0	17	14	1	43	1	0	3	1
Hemiptera: Auchenorrhyncha + Sternorrhyncha	9	141	58	23	58	8	3	32	21
Hymenoptera	0	33	6	5	5	3	0	3	9
Isopoda	0	0	8	1	0	0	0	0	0
Isoptera	0	0	0	0	0	1	0	0	0
Lepidoptera	5	66	19	1	5	1	1	7	1
Mollusca	0	10	22	1	0	1	0	0	0
Orthoptera	0	5	3	0	0	0	0	0	0
Phasmida	0	1	0	0	0	0	0	0	0
Phthiraptera	0	0	0	0	0	0	0	0	1
Psocoptera	0	0	4	0	0	0	0	0	0
Siphonaptera	0	0	1	0	0	0	0	1	0
Symphyla	0	0	0	0	0	0	0	0	0
Thysanoptera	1	5	9	0	3	0	1	3	1

^a See Appendix for list of organisms.

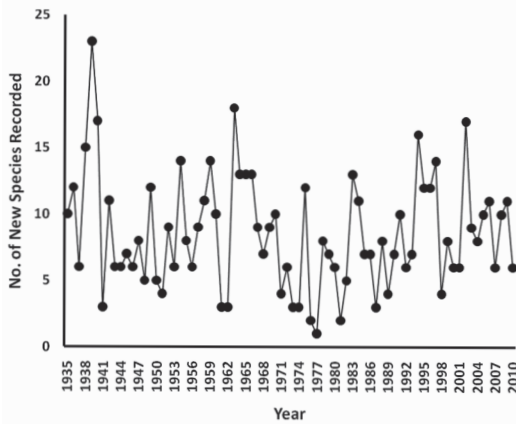


FIGURE 2. Total number of invertebrates detected in California 1935–2010.

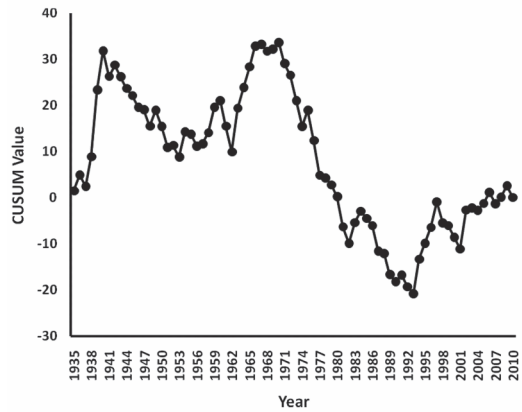


FIGURE 3. Plot of CUSUM values for counts of exotic arthropods recorded in California over the period 1935 to 2010.

ic arthropods before and after the change was detected with 95% confidence intervals for the year of the detected change, and thus the degree of confidence was interpreted as indicating that declaring that the detected change was real. The mean estimates of the numbers of detected exotic arthropods before and after the detected changes are presented in Table 6. There is no statistical evidence to support the hypothesis that the number of invasive species recorded in California increased after 2001. A truncated data set spanning 1991–2010 (20 years) was further analyzed to assess the effect of 2001 on incursion rates in California. Again no significant change points were detected (results not shown) supporting the results of the analyses using the larger 1935–2010 data set.

TABLE 6. Significant change point results indicating year of detected change, 95% confidence interval (in years), level of confidence that the detected change point is real, and the observed change from the mean number of exotic arthropods detected before the change point to the new mean after the change occurred.

Year change was detected	95% confidence interval	Confidence level (%)	Mean number of species before change was detected	Mean number of species after change was detected
1941	1936–1949	96	13.83	8.6
1971	1949–1976	95	8.6	4.92
1983	1978–1996	94	4.92	8.89

The change point analysis detected three transitional points underlying exotic arthropod species records for California over the period 1935–2010, 1941, 1971, 1983. The causes underlying these changes are undetermined and beyond the scope of this study, which sought to determine if a significant change in arthropod numbers occurred after 2001. There are several important caveats to consider here when interpreting the significance of these results. The first concerns intensity and consistency of sampling efforts, resources invested in surveying for invasive pests, and technical capability, especially with regard to recognition and identification of new species. It is highly unlikely that these factors were consistent each year over 1935–2010. Short duration high intensity surveys focusing on invasive ants, spiders, or scale pests, as part of a research project for example, could greatly increase the number of records for new species in a particular taxon. This type of survey work, while valuable, is not uniform through time or across taxa and high intensity

effects with narrow focus probably affects the quality of data sets for analysis. Additionally, data were not adjusted for other covariates that could influence invasion rates and detection and identification of new resident species. These additional factors include increasing rates of tourism, economic development, and population growth, all of which have been correlated with invasion likelihood. Political policies such as the construction and operation of additional border inspection stations, or subsequent closures and reduced hours for stations during economic recessions may also influence the rate at which exotic arthropods enter and establish in California. Although no significant change in the number of exotic arthropods in California was detected after 2001, this does not necessarily mean that the numbers of invasive pests entering and establishing has not changed. There may be a significant lag period before detection and confirmation of new species occurs, and subsequent analyses of data sets with a longer time series post-2001 may be needed to confirm or refute the result presented here.

TEMPORAL PATTERNS OF INVASION.—

Detection times for 1079 exotic terrestrial macro-invertebrates are presented in Table 7. The greatest number (419; 38.8%) of these organisms was detected in California prior to 1930 (Table 7).

The temporal invasion rate has not remained constant over time ($\chi^2 = 61.37$; $df = 7$; $p < 0.01$) with fewer than expected invaders being recorded during the period 1970–1989. The rate of invasion since 1989 has increased to levels similar to those recorded from 1950 to 1969 (Table 7). Other studies concluded that the rate of introduction of exotic pests was increasing (Aukema et al. 2010, Kirkendall and Faccoli 2010, Roy et al. 2011).

The origins of invaders have not remained constant over the time period of this study. There has been a marked increase in the number of invaders from Australia between 1980 and 2010, Asia between 2000 and 2010, Hawaii between 1980 and 1999, and Europe between 1990 and 2010 (Table 8). These trends may reflect increased trade and tourism, which are proxies for propagule pressure.

Similarly, the composition of invaders has not remained constant over time. There were marked increases in the number of Coleoptera (11 versus 45), Diptera (9 versus 33) and Hemiptera (Heteroptera) (5 versus 15) detected between 1990 and 2015 and Hymenoptera (11 versus 25) between 1990 and 1999 compared to the preceding decades (1970–1989) (Table 9).

Examining the origin and composition data over time in the Appendix reveals interesting trends. Eighteen invasive wood boring Coleoptera (Buprestidae, Cerambycidae and Curculionidae) were discovered in California between 2000 and 2015 with five species from Asia, eight from North America, four species from Europe, and one from Africa. There were 10 Hymenoptera from Australia discovered between 1980 and 2010: eight Eulophids and two Encyritids. Australia con-

TABLE 7. Number of exotic terrestrial macro-invertebrates discovered breeding in California by time period in which they were discovered.

Time Period ^a	Number Exotic Invaders	Average number per year
< 1900	112	—
1901–1929	312	108
1930–1939	99	9.9
1940–1949	76	7.6
1950–1959	84	8.4
1960–1969	95	9.5
1970–1979	53	5.9
1980–1989	68	6.8
1990–1999	99	9.96
2000–2010	118	7.9
Total	1116	

^a See Appendix for data. The time periods <1900 and 1901–1929 were excluded from the analysis because we cannot assign the dates of arrival to specific decades. $\chi^2 = 61.37$; $df = 7$; $p < 0.01$ using an average number of invaders of 121.8 per decade. Data from 2011–2015 excluded due to lag in publication of invasive species information.

TABLE 8. Number of exotic terrestrial macro-invertebrates discovered breeding in California by time and likely origin.

Region ^a	<1901	1901–1929	1930–1939	1940–1949	1950–1959	1960–1969	1970–1979	1980–1989	1990–1999	2000–2015
Australia	5	2	1	2	3	0	2	4	4	15
Pacific Region	0	0	1	0	1	4	0	0	0	1
Africa	4	9	6	2	0	2	3	4	3	7
Asia	4	21	8	10	5	6	2	4	4	16
Tropical America	1	10	7	2	1	7	5	7	7	6
Hawaii	0	2	1	0	2	7	4	7	8	6
Mexico	2	1	1	0	1	21	0	1	5	1
Europe	26	53	17	117	9	10	2	10	12	14
North America	32	73	24	23	42	40	21	30	31	36

^a See Appendix for list of organisms.

tributed nine Psyllidae, two Aphalaridae and one Triozidae to the California fauna between 1980 and 2010 (Appendix). These insects, especially the Hymenoptera and Psyllidae must have escaped quarantine detections and were moved to California on living plant material.

COMPARISON WITH THE EARLIER STUDY BY DOWELL AND GILL (1989).— Many of the trends reported by Dowell and Gill (1989) were repeated here. The Hemiptera, Coleoptera, Lepidoptera, Acari, Diptera, and Hymenoptera had the greatest number of invaders but the Acari were second after the Hemiptera. North America was still the origin of the greatest number of invaders entering California but the order after that was the Pacific Region (including Hawaii), Europe, Asia, Tropical America (including Mexico), Africa and Australia. Dowell and Gill (1989) reported that Hawaii contributed more invaders than any the other region except North America and Europe. In this larger analysis, Hawaii is far less important as a point of origin although this US state still contributes more exotic species to California than the rest of the Pacific Region (Table 4).

FACTORS THAT AFFECT THE LIST.— We have adopted a conservative approach to listing organisms with the requirement of evidence of a breeding population within California. This criterion differs from other groups, such as the Lepidopterists Society, that develop regional lists of organisms. In many of these other lists the occurrence of a single individual constitutes a new regional record that in some instances may over-estimate the number of species successfully established in a given area (Rickard and Grishin 2010, Bordelon and Knudson 2011, Rickard and Pasko 2011). This conservative approach has been influenced by regulatory concerns because listing the presence of an exotic organism as opposed to a breeding population may trigger official actions (IPPC 2007) by the CDE and/or United States Department of Agriculture including the imposition of exterior/interior quarantines or eradication programs (Dowell 1988).

As noted elsewhere (Kirkendall and Faccoli 2010), the taxonomy of many arthropod organisms is fluid with changes occurring from the order level (e.g., loss of the order Homoptera and the resurrection of Hemiptera that includes Auchenorrhyncha and Sternorrhyncha), to the family and species level (e.g., Crambidae versus Pyralidae or *Solenopsis invicta* versus *Solenopsis wagneri*). We have attempted to use the most current taxonomy for species listed here realizing there may be professional disagreement about the use of particular species names and classifications.

There are often differences of opinion as to whether an organism is native or exotic to California. This is especially true for those organisms that invaded before or around 1900 (Powell et al.

TABLE 9. Taxons of exotic terrestrial macro-invertebrates found breeding in California by time period in which they were detected.

Taxon ^a	<1900	1901–1929	1930–1939	1940–1949	1950–1959	1960–1969	1970–1979	1980–1989	1990–1999	2000–2015
Acari	5	13	26	14	8	8	7	10	4	
Amphipoda		1								
Araneae			1						4	5
Chilopoda										
Coleoptera	8	59	13	15	10	15	6	5	13	32
Collembola		2	1							1
Dermaptera	2	5			1					
Dictyoptera	1	4	1	2	2	1	2	1		3
Diplopoda										
Diptera	6	32	1	5	3	11	3	6	10	23
Embiidina	1	1								
Hemiptera- Heteroptera	3	7	1	1		4	3	2	7	8
Hemiptera: Auchenorrhyncha + Sternorrhyncha	46	112	42	20	39	26	19	30	30	25
Hymenoptera	5	11	2	4	5	7	3	8	18	7
Isopoda		2								
Isoptera									1	
Lepidoptera	16	21	7	5	12	21	78	4	5	9
Mollusca	7	2	1	4	3	5	1		1	
Orthoptera	1	6	1	1					2	
Phasmida										1
Phthiraptera	1	11	1	1	2	1	3		5	2
Psocoptera		3		1				1		
Siphonaptera										
Symphyla										
Thysanoptera										1
Thysanura										

^a See Appendix for list of organisms.

2000). We have listed the authorities that note that each organism is not native to California recognizing that new information (molecular or phylogenetic analyzes) may change this. For example, the gopher beetle, *Ceratophyus gopherinus*, has long been considered an invasive species in California as all other known species in the genus are found in Europe (Cartwright 1966). However, *C. gopherinus* does not occur in Europe thus casting doubt on the exotic origins of this beetle. Current thinking is that *C. gopherinus* is a native species of limited distribution in California (Arnett et al. 2002).

California does not maintain a statewide survey for invasive invertebrates except for a limited

number of crop pests (Gilbert et al. 2013). The discovery of exotic macro-invertebrates not targeted by CDFA depends on individuals noting and reporting damage to crops or ornamental plants, capturing unidentified organisms in local faunal surveys (e.g., light brown apple moth, *Epiphyas postvittana*) (Brown et al. 2010), or periodic CDFA surveys that target specific groups of organisms (e.g., wood boring beetles, which resulted in the detection of *Scolytus schevyrewi*). One underappreciated avenue to the detection of new organisms that have invaded California are citizens who find species they do not recognize and then send specimens to experts for identification. One citizen scientist has discovered five exotic ant species and one exotic spider species in southern California (Martinez 1992, 1993, 1996, 1997, 2006; Martinez et al. 2011, 2014).

PATHWAYS INTO CALIFORNIA.— There are numerous pathways by which the organisms listed in the Appendix were introduced into California. Human alterations to the landscape (i.e., irrigation of desert areas and propagation of exotic plants) probably facilitated the self-introduction of the giant swallowtail butterfly, *Papilio cresphontes*. Others, especially the wood boring beetles (e.g., *Scolytus schevyrewi* and the Asian longhorn beetle) probably arrived in wooden pallets of commercial goods or in firewood transported across state lines. For example, the gold spotted oak borer (*Agrilus auroguttatus*) was likely introduced in cut oak firewood from the Dragoon Mountains in southern Arizona (Lopez et al. 2014). Large numbers of non-native species are thought to have arrived on living plants either shipped into the state commercially, arriving in vehicles (cars, trucks, and trains) moving here from other states, or via smuggling from overseas (e.g., red palm weevil [Hoddle 2015]). Several pestiferous fruit flies (Tephritidae) (e.g., Mediterranean fruit fly, *Ceratitis capitata*, and the oriental fruit fly, *Bactrocera dorsalis*) probably arrived as larvae in smuggled fruit. During the 1700's to early 1900's soil, as well as and construction debris, was used as ballast in cargo ships and the soil was dumped at the destination port (Lindroth 1957). This route was likely the avenue through which many of the Collembola, Isopoda, Staphylinidae, Dermoptera and Embiidina, among the soil inhabiting invertebrates, were introduced into California.

Some introduction pathways are unusual. Fire ants, *S. wagneri*, arrived in California in the soil of potted plants but also with beehives stacked on pallets originating in fire-ant infested areas of the US brought into California to pollinate crops, especially almonds (CDFA unpublished data). Slate, a fine grain metamorphic rock used for construction, represents another pathway for exotic organisms to enter California. Slate is stored as thin slabs on pallets with gaps between the slabs. These gaps provide dry, cool sites for many organisms, especially slugs, and lygaeid bugs, to overwinter. The pallets, with overwintering organisms included, are shipped to California in unheated boat holds making it more likely that the hitch-hiking organisms will survive and disembark in California alive (California Department of Food and Agriculture, unpublished data)

RUMORS OF BIOTERRORISM.— Speculation exists that pestiferous organisms are being deliberately introduced into California (Paine et al. 2010). For example, Paine et al. (2010) suggested that eucalyptus-specific insects have been deliberately introduced to kill *Eucalyptus* spp., non-native trees that are viewed by some as noxious weeds (Paine et al. 2010). It has been similarly suggested that Mediterranean fruit flies are punitively introduced into California to challenge the State's eradication programs. There are no data to support these suggestions. However, the large number of eucalyptus feeding insects discovered in California since 1990 is considered suspicious because there were essentially no introductions in the preceding 100+ years during which live eucalyptus were imported into the state (Paine et al. 2010).

IMPACTS OF THE EXOTIC SPECIES.— Dowell and Gill (1989) noted that exotic pests accounted for 62% of all reported crop losses in 1978; the last year for which there are data. The economic losses to invasive pests in California were estimated at \$3 billion (US) dollars in 1995 (Metcalf 1995).

Although 314 (19.2%) of the 1,686 exotic invaders are considered as pests in California (see Appendix), exotic invaders account for a disproportionately large number of pest species mentioned in University of California on line IPM guides and elsewhere (Table 10). Over 42% of the pest invertebrates mentioned in the University of California Integrated Pest Management Guidelines for agricultural, ornamental, and native plants are exotic in origin (Table 10; see also Appendix). This overview analysis treats all listed pests equally, which is not the case. For example, cottony cushion scale, now a minor pest of citrus, is given the same weight as California red scale, *Aonidiella aurantii*, which is a major citrus pest even though both have been subjected to classical biological control programs. These observations suggest that exotic pests caused a more disproportionate level of crop losses than would be anticipated by their percent composition in the total pest complex. Exotic invaders represent some of the most common and troublesome urban pests (cockroaches and Argentine ants) supporting an urban pest control industry with annual revenues estimated at \$1 to 2 billion (US) per year (Rust, pers. comm.) that exists to manage these pests.

Non-native species can have a devastating impact on our natural environment. The gold spotted oak borer has killed over 20,000 oaks in southern California since 2008 (Coleman and Seybold 2010). Its continued spread in infested firewood, an unregulated conduit for invasive wood pests, that poses a significant threat to ecosystems dominated by oak trees in California. The Argentine ant has displaced the native ants in many coastal areas of California, and that in turn has adversely affected native horned lizards that feed on native ants, which has contributed to the loss of the horned lizards in some cases (Suarez and Case 2002). The cause of range reduction of the native veined white, *Pieris marginalis*, is thought to have occurred from competition for cruciferous host plants with the pestiferous exotic cabbage butterfly, *Pieris rapae* (Pyle 1981).

CONCLUSION

Terrestrial macro-invertebrates have been invading California since the advent of European traders and settlers. The invasion process is complex with significant changes in the composition and origins of the invaders over time. The one common thread is human activity, especially transportation networks that facilitate rapid and long distance trade and tourism and human-mediated habitat alteration (i.e., gardenification and urbanization). The impacts of increasing numbers of terrestrial macro-invertebrate species on the agriculture, wilderness, and urban areas of California will almost certainly continue to increase.

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Over the years a number of colleagues have examined the list of invaders and we thank them:

TABLE 10. Percentage of exotic terrestrial macro-invertebrates pests listed in University of California on-line IPM Guides.

Situation	Percentage of listed pests that are not native to California ^a
Agricultural crops	55.2
Urban vegetables	70.3
Urban fruit trees and vines	67.7
Urban flowers	64.5
Urban homes, structures, people and pets	53.8
Urban ornamental trees and shrubs	51.4
Natural environment	42.9

^a Available at www.ipm.ucdavis.edu. Accessed 15 December 2014.

F. Andrews, P. Arnaud, J. Beardsley, L. Bezark, D. Burdick, T. Eichlin, E. Fisher, A. Gilbert, R. Goeden, D. Headrick, T. Henry, K. Kim, D. Kissinger, W. Laudenslayer, F. Legner, R. Penrose, J. Powell, M. Rust, T. Seeno, W. Sheppard, R. Somerby, J. Sorensen, P. Ward, D. Weissman, and A. Wheeler. Their input was critical in making the list as accurate as possible. Any errors are the responsibility of the authors. Kevin Hoffman and David Kavanaugh provided comments on drafts of this manuscript. We also thank those scientists who took the time to fully document the occurrence of exotic invertebrates they found.

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Appendix with Addendum

Footnotes to Appendix table

^a an organism that was or is the object of Official Action (quarantine and eradication) by the California Department of Food and Agriculture and is not established in California.

^b We have identified those animals in Appendix 1 that are considered pests in or by California. For plant, home and garden and the environment we identify those animals listed as pests in the University of California IPM online (UC IPM 2013), sheep and goat pests are from Pirelli (2013), Dairy cattle pests are those identified by Geden et al. (2010), Horse insect pests are from Meyer et al. (1991), swine pests are from Loftin (2013) and chicken pests are from Stafford III (2011). These sources tend to deal with animals that are established in California or are frequently detected there. We have also identified some pests not established in California but which have been detected here and which are generally considered pests in those areas where they occur including the gypsy moth (*Lymantria dispar*) (Liebhold 2003), Japanese beetle (*Popillia japonica*) (Anon. 1997), Mexican bean beetle (*Epilachna varivestis*) (Sanchez-Arroyo 2015), oriental fruit fly (*Bactrocera dorsalis*), Mexican fruit fly (*Anastrepha ludens*), Caribbean fruit fly (*Anastrepha suspensa*), peach fruit fly (*Bactrocera zonata*), Mediterranean fruit fly (*Ceratitidis capitata*), melon fly (*Bactrocera cucurbitae*), white striped fruit fly (*Bactrocera albistrigata*), and guava fruit fly (*Bactrocera correcta*) (White & Elson-Harris 1992), boll weevil (*Anthonomus grandis*) (Lange et al. 2008), varroa mite, (*Varroa jacobsoni*) (Bessen 2010), red palm weevil (*Rhynchophorus vulneratus*) (Rugman-Jones et al. 2013), Diaprepes root weevil (*Diaprepes abbreviatus*) (Grafton-Cardwell et al. 2004), Asian longhorn Beetle (*Anoplophora glabripennis*) (United States Department of Agriculture, Animal and Plant Health Inspection Service 2015).

APPENDIX. Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Acari-Acaridae				
<i>Acarus siro</i> (Linnaeus 1758)			Essig 1958	
<i>Aleuroglyphus ovatus</i> (Troupeau 1879)	1984		Dowell & Gill 1989	
<i>Rhizoglyphus robini</i> Claparède 1869	<1915		CDFA 1914 3:539	yes
<i>Tyrophagus neiswanderi</i> Johnston & Bruce 1965	1982	Europe	Dowell & Gill 1989	yes
<i>Tyrophagus putrescentiae</i> (Schrank 1781)			Hughes 1976	yes
Acari-Astigmata				
<i>Sancassania berlesi</i> (Michael 1903)			Hughes 1976	
Acari-Cheyletidae				
<i>Chelyletia yasguri</i> (Smiley 1965)	1973	North America	Dowell & Gill 1989	
Acari-Dermanyssidae				
<i>Ornithonyssus bacoti</i> (Hirst 1913)	<1930		CDFA 1941 30:352	
Acari-Eriophyidae				
<i>Abacarus hystrix</i> (Nalepa 1896)	1940		CDFA 1940 29:242	
<i>Acalitus calycophthirus</i> (Nalepa 1891)	1984	North America	Dowell & Gill 1989	
<i>Acaphylla steinwedeni</i> Keifer 1943	1942	Asia	CDFA 1945 34:174	
<i>Acarapis near dorsalis</i> Morgenthaler 1934	1959		Dowell & Gill 1989	
<i>Acarapis woodi</i> (Rennie 1921)	1986	North America	Dowell & Gill 1989	
<i>Acaricalus hederæ</i> (Keifer 1939)	1939		CDFA 1939 28:490	
<i>Aceria ajugæ</i> (Nalepa 1892)	1959		CDFA 1959 48:127	
<i>Aceria aloinis</i> Keifer 1941	1940		CDFA 1940 29:242, Keifer 1952	
<i>Aceria cynodontis</i> Wilson 1959			Keifer et al. 1982	
<i>Aceria diospyri</i> (Keifer 1944)	1943		Keifer 1952	yes
<i>Aceria ficus</i> (Cotte 1920)	1922	Europe	CDFA 1939 28:266	yes
<i>Aceria fraxinivorus</i> (Nalepa 1909)	1944		Keifer et al. 1982, Keifer 1952	
<i>Aceria genistæ</i> (Nalepa 1892)	1994	Europe	Chan & Turner 1998	
<i>Aceria lycopersici</i> (Wolffenstein 1879)	1940	Tropical America	Jeppson et al. 1975	
<i>Aceria mori</i> (Keifer 1939)	1939		Keifer 1952	
<i>Aceria neocynodonis</i> Keifer 1960	1960	North America	CDFA 1960 49:200	
<i>Aceria paradianthi</i> Keifer 1952	1952		CDFA 1952 41:65	
<i>Aceria parthenii</i> Keifer 1952	1952		CDFA 1952 41:147	
<i>Aceria peucedani</i> (Canestrini 1891)			Jeppson et al. 1975	
<i>Aceria sheldoni</i> (Ewing 1937)	1937		CDFA 1937 26:433	
<i>Aceria tulipæ</i> (Keifer 1938)	1938	Europe	CDFA 1938 27:185	
<i>Aculops fuchsiae</i> Keifer 1972	1982	Tropical America	Dowell & Gill 1989	yes
<i>Aculops lycopersici</i> (Masseé 1937)	1940	Australia	Keifer et al. 1982	yes
<i>Aculus cornutus</i> (Banks 1905)	1914	North America	Jeppson et al. 1975	yes
<i>Aculus ligustri</i> (Keifer 1943)	1938		CDFA 1938 27:190	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Aculus schlectendali</i> (Nalepa 1890)	1938		CDFA 1939 28:234	
<i>Aculus teucarii</i> (Nalepa 1892)	1986	North America	Dowell & Gill 1989	
<i>Anthocoptes punctidorsa</i> Keifer 1943	1943		Keifer 1952	
<i>Calacarus adornatus</i> (Keifer 1940)	1939		Keifer 1952	
<i>Calacarus carinatus</i> (Green 1890)			Keifer et al. 1982	
<i>Calepitrimerus mueesebecki</i> Keifer 1940	1954	Mexico	CDFA 1940 29:113	
<i>Calepitrimerus vitis</i> (Nalepa 1905)		Europe	Keifer 1952	
<i>Cecidophyes collegiatus</i> Keifer 1961			Jeppson et al. 1975	
<i>Cecidophyes malpighianus</i> (Canestrini & Massalongo 1893)	1939		Keifer 1952	
<i>Cecidophyopsis grossulariae</i> (Collinge 1907)	1991		CPPDR 1991 10:15	
<i>Colomerus vitis</i> (Pagenstecher 1857)	<1915		Amrine & Stasney 1994	
<i>Coptophylla lamimani</i> (Keifer 1939)	1939		Keifer 1952	
<i>Cosetacus camelliae</i> (Keifer 1945)	1940	Asia	CDFA 1945 34:137	
<i>Diptacus gigantorhynchus</i> (Nalepa 1892)	1938	Europe	Keifer 1952	yrs
<i>Epitrimerus pyri</i> (Nalepa 1870)	1913	North America	CDFA 1915 4:12	yes
<i>Eriophyes ajugae</i> (Nalepa 1892)	1958		Dowell & Gill 1989	
<i>Eriophyes canestrinii</i> (Nalepa 1891)	1950		Keifer 1952	
<i>Eriophyes caricis</i> Keifer 1944	1943	Europe	Keifer 1952	
<i>Eriophyes celtis</i> Kendall 1929	1961	North America	Dowell & Gill 1989	
<i>Eriophyes convolvens</i> (Nalepa 1892)		Europe	Keifer 1952	
<i>Eriophyes cynodontiensis</i> Sayed 1946			Jeppson et al. 1975	yes
<i>Eriophyes eriobotryae</i> (Keifer 1938)	1938		CDFA 1938 27:188	
<i>Eriophyes granati</i> (Canestrini & Massalongo 1893)			Keifer et al. 1982	yes
<i>Eriophyes pyri</i> (Pagenstecher 1857)	1894	North America	CDFA 1915 4:6	yes
<i>Eriophyes spermaphaga</i> (Keifer 1979)	1979		Dowell & Gill 1989	
<i>Eriophyes tiliae</i> (Nalepa 1890)	1932		Keifer 1952	
<i>Eriophyes vaga</i> (Keifer 1962)	1979	Tropical America	Dowell & Gill 1989	
<i>Eriophyes wisteriae</i> Keifer 1939	1939		CDFA 1939 28:329	
<i>Gammaphytoptus camphorae</i> Keifer 1939	1938	Asia	CDFA 1939 28:148	
<i>Mackiella phoenicis</i> Keifer 1939	1938	Africa	Keifer 1952	
<i>Oxypleurites maxwelli</i> (Keifer 1939)	1939	Europe	CDFA 1914 31:175	
<i>Phyllocoptes bougainvilleae</i> Keifer 1959	1996	Tropical America	CPPDR 1997 16:10	
<i>Phyllocoptes calulmi</i> Keifer 1940	1939		CDFA 1940 29:113	
<i>Phyllocoptes destructor</i> Keifer 1940	1940		CDFA 1940 29:161	
<i>Phyllocoptes gracilis</i> (Nalepa 1890)			Jeppson et al. 1975	
<i>Phyllocoptruta oleivora</i> (Ashmead 1879)	1889	North America	CDFA 1934 23:201	yes
<i>Phytoptus avellanae</i> Nalepa 1889	1939	North America	Keifer 1952	
<i>Phytoptus hedericola</i> Keifer 1943	1942		Keifer 1952	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Rhyncaphytoptus ficifoliae</i> Keifer 1939	1939	Africa	CDFA 1939 28:273	
<i>Shevtchenkella depressus</i> (Nalepa 1894)			Keifer 1952	
<i>Tegolophus myersi</i> (Keifer 1939)	1938		Keifer 1952	
<i>Tegolophus zizyphagus</i> (Keifer 1939)	1939		Keifer 1952	
<i>Tegonotus carinatus</i> (Nalepa 1891)	1964	Europe	Dowell & Gill 1989	
<i>Tetra concava</i> (Keifer 1944)	1939	Europe	Keifer 1952	
<i>Trisetacus pseudotsugae</i> Keifer 1965	1969	North America	Dowell & Gill 1989	
<i>Vasates immigrans</i> (Keifer 1940)	1939		Keifer 1952	
<i>Vasates magnolivora</i> (Keifer 1952)	1939	North America	Keifer 1952	
Acari-Glycyphagidae				
<i>Glycyphagus destructor</i> (Schrank 1781)			Hughes 1976	
<i>Glycyphagus domesticus</i> (De Geer 1778)			Hughes 1976	
Acari-Ixodidae				
<i>Argas persicus</i> (Oken 1881)	<1925		Furman & Loomis 1984, Essig 1926a	
<i>Boophilus annulatus</i> (Say 1905)	<1925		Furman & Loomis 1984, Essig 1926a	
<i>Rhipicephalus sanguineus</i> (Latreille 1806)			Furman & Loomis 1984	
Acari-Laelapidae				
<i>Melittiphis alvearius</i> (Berlese 1895)	1988	Europe	Dowell & Gill 1989	
Acari-Penthaleidae				
<i>Penthaleus major</i> (Duges 1834)		Europe	CDFA 1940 29:507	yes
Acari-Phytoptidae				
<i>Phantacrus lobatus</i> Keifer 1965	1978	North America	Dowell & Gill 1989	
Acari-Psoroptidae				
<i>Psxoroptes equi</i> (Raspail 1834)	<1925		Essig 1926a, 1958	
<i>Psoroptes ovis</i> (Hering 1838)	<1925		Essig 1926a, 1958	
Acari-Pyemotidae				
<i>Siteroptes graminum</i> (Reuter 1907)	1965	Hawaii	Dowell & Gill 1989	
Acari-Rhyncaphytoptidae				
<i>Rhyncaphytoptus ulmivagrans</i> Keifer 1939	1939	Europe	CDFA 1939 28:420	
<i>Trimeroptes aleyrodiformis</i> (Keifer 1951)		North America	Jeppson et al. 1975	
Acari-Tarsonemidae				
<i>Steneotarsonemus ananas</i> (Tryon 1898)	1980	Hawaii	Dowell & Gill 1989	
<i>Steneotarsonemus pallidus</i> (Banks 1899)	<1925		Jeppson et al. 1975, Essig 1926a	yes
<i>Tarsonemus setifer</i> Ewing 1939		Europe	Jeppson et al. 1975	
Acari-Tenuipalpidae				
<i>Brevipalpus lewisi</i> McGregor 1949	1942		Pritchard & Baker 1958	yes
<i>Brevipalpus obovatus</i> Donnadieu 1875			Jeppson et al. 1975, Pritchard & Baker 1958	
<i>Brevipalpus phoenicis</i> (Geijskes 1936)			Jeppson et al. 1975, Pritchard & Baker 1958	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Acari-Tetranychidae				
<i>Bryobia praetiosa</i> Koch 1835	1879		Jeppson et al. 1975	
<i>Eotetranychus sexmaculatus</i> (Riley 1890)	<1915		CDFA 1915 4:16	yes
<i>Eotetranychus uncutus</i> Garman 1952		North America	Jeppson et al. 1975	
<i>Eurytetranychus buxi</i> (Garman 1935)			Jeppson et al. 1975	
<i>Eutetranychus banksi</i> (McGregor 1914)	<1915		CDFA 1915 4:13	yes
<i>Mononychellus caribbeanae</i> (McGregor 1950)	1978		CPPDR 1996 15:79	
<i>Mononychellus erythrinae</i> Tuttle, Baker & Abbatiello 1976	1978		Dowell & Gill 1989	
<i>Oligonychus aceris</i> (Shimer 1869)	1959	North America	Dowell & Gill 1989	
<i>Oligonychus ilicis</i> (McGregor 1917)	1935	North America	CDFA 1939 28:240	
<i>Oligonychus perseae</i> Tuttle, Baker & Abbatiello 1976	1992	Mexico	CPPDR 1992 11:46	
<i>Oligonychus pratensis</i> (Banks 1912)			Baker & Tuttle 1994	yes
<i>Oligonychus punicae</i> (Hirst 1926)		Mexico	Baker & Tuttle 1994	
<i>Panonychus citri</i> (McGregor 1916)	1885	North America	Baker & Tuttle 1994	yes
<i>Panonychus ulmi</i> (Koch 1836)	<1925	North America	Essig 1926a	yes
<i>Paraplonobia myops</i> (Pritchard & Baker 1955)			Jeppson et al. 1975	
<i>Petrobia</i> cf. <i>apicalis</i> (Banks 1917)	1978	North America	Dowell & Gill 1989	
<i>Schizonobia</i> sp Wormsley 1940	1965		Dowell & Gill 1989	
<i>Schizotetranychus celarius</i> (Banks 1917)		Asia	Jeppson et al. 1975	
<i>Tetranychus evansi</i> Baker & Pritchard 1960	1965	Pacific Region	Jeppson et al. 1975	
<i>Tetranychus merganser</i> Boudreaux 1954	1963	North America	Dowell & Gill 1989	
<i>Tetranychus tumidus</i> Banks 1900		North America	Jeppson et al. 1975	
<i>Tetranychus urticae</i> (Koch 1836)	1876	Europe	Baker & Tuttle 1994	yes
<i>Tetranychopsis horridus</i> (Canestrini & Fanzago 1876)		Europe	Jeppson et al. 1975	
Acari-Uropodidae				
<i>Fuscuropoda marginata</i> (Koch 1839)	1964		Dowell & Gill 1989	
Acari-Tydeidae				
<i>Lorryia formosa</i> Cooreman 1958	1984	Europe	Dowell & Gill 1989	
Acari-Varroidae				
<i>Varroa jacobsoni</i> Oudemans 1904	1989	North America	CPPDR 1989 8:5	yes
Amphipoda-Talitridae				
<i>Talitrus sylvaticus</i> (Haswell 1880)	1918	Australia	Mallis 1942	
Araneae-Agelenidae				
<i>Agriope trifasciata</i> (Forsk. 1775)			Sierwald et al. 2005, Lew 2010	
<i>Gea heptagon</i> (Hentz 1850)			Sierwald et al. 2005, Lew 2010	
<i>Metazygia zilloides</i> Banks 1989	2009	North America	Martinez et al. 2014	
<i>Tegeneria domestica</i> (Clerck 1757)		Europe	Herbert et al. 1987	
<i>Tegeneria pagana</i> (Koch 1840)			Herbert et al. 1987	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Araneae-Amphinectidae				
<i>Metaltella simoni</i> (Keyserling 1878)	1994	Tropical America	Vetter & Visscher 1994	
Araneae-Araneidae				
<i>Araneus diadematus</i> Clerck 1758			BugGuide 2011, Lew 2010	
<i>Larinoides scolopetarius</i> (Clerek 1757)	2004	North America	Martinez 2006	
<i>Zygiella x-notata</i> Clerck 1757			Lindroth 1957, Lew 2010	
<i>Neoscona crucifera</i> Lucas 1839	1991	North America	Levi 1992	
Araneae-Desidae				
<i>Badumna longinqua</i> (Koch 1867)			Bryant et al. 2010, Lew 2010	
Araneae-Dictynidae				
<i>Dictyna major</i> Menge 1869			Lindroth 1957, Lew 2010	
Araneae -Dysderidae				
<i>Dysdera crocata</i> (Koch 1838)		Europe	Prentice et al. 2001, Bolger et al. 2008	
Araneae –Gnaphosidae				
<i>Haplodrassus signifer</i> Koch 1839			Lindroth 1957, Berrian 2005	
<i>Scotophaeus blackwalli</i> (Thorell 1871)			Herbert 1987, Lew 2010	
<i>Trachyzelotes barbatus</i> (Koch 1866)			Crespo & Mendes 2010, Prentice et al. 1998	
<i>Trachyzelotes jaxartensis</i> (Kroneberg 1875)			Crespo & Mendes 2010, Lew 2010	
<i>Trachyzelotes lyonneti</i> (Audouin 1826)			Bolger et al. 2008, Crespo & Mendes 2010	
<i>Urozelotes rusticus</i> (Koch 1872)			Beatty 2002, Prentice et al. 1998	
<i>Zelotes nilicola</i> (Cambridge 1874)			Prentice et al. 1998, Bolger et al. 2008	
Araneae-Linyphidae				
<i>Pityohyphantes phrygianus</i> (Koch 1836)			Jennings & Graham 2007, Lew 2010	
Araneae-Mimetidae				
<i>Ero furcata</i> (Villers 1789)			Lew 2010, Bolger et al. 2008	
Araneae-Miturgidae				
<i>Cheircanthium mildei</i> Koch 1864			Lew 2010, BugGuide 2011, Hogg et al. 2010	
Araneae -Oecobiidae				
<i>Oecobius annulipes</i> Lucas 1849			Prentice et al. 1998	
<i>Oecobius navus</i> Blackwall 1859			Lew 2010, Bolger et al. 2008	
<i>Oecobius putus</i> (Cambridge 1876)			Lew 2010, Bolger et al. 2008	
Araneae-Philodromidae				
<i>Thanatus vulgaris</i> Simon 1870			Donale & Redner 1978, Lew 2010	
Araneae -Pholcidae				
<i>Artema atlanta</i> Walckenaer 1837			BugGuide 2011, Lew 2010	
<i>Holocnemus plucheii</i> (Scopoli 1763)		Europe	Prentice et al. 2001, Bolger et al. 2008	
<i>Pholcus phalangioides</i> (Fuesslin 1775)		Europe	Lew 2010, Bolger et al. 2008	
<i>Spermophora senoculata</i> (Duges 1836)			Beatty 2002, Lew 2010	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Araneae-Salticidae				
<i>Menemerus bivittatus</i> (Dufour 1831)			Prentice et al. 2001	
<i>Menemerus semilimbatus</i> (Hahn 1827)	1990's	Europe	Manolis & Carmichael 2010	
<i>Phlegra fasciata</i> (Hahn 1826)			Sierwald et al. 2005, Lew 2010	
<i>Salticus scenicus</i> (Clerck 1757)			Jennings & Graham 2007, Lew 2010	
Araneae-Scytodidae				
<i>Scytodes thoracica</i> (Latreille 1802)			Beatty 2002, Lew 2010	
Araneae-Sicariidae				
<i>Loxosceles laeta</i> (Nicolet, 1849)	1936	Tropical America	Robinson 2005	
<i>Loxosceles rufescens</i> (Dufour 1820)		Europe	Lew 2010, Yigit et al. 2008	
Araneae-Sparassidae				
<i>Heteropoda venatoria</i> (Linnaeus 1767)			Sherriffs 1936, Lew 2010	
<i>Olios abnormis</i> (Blackwall 1866)			Platnick 2010, Lew 2010	
Araneae-Theridiidae				
<i>Achaearanea acorensis</i> (Berland 1932)			Lew 2010, Draney 2001	
<i>Achaearanea ohlerti</i> (Thorell 1870)			Lindroth 1957, Lew 2010	
<i>Achaearanea tepediorum</i> (Koch 1841)		Tropical America	Lew 2010, Campbell 2010	
<i>Diplocephala pronata</i> Menge 1868			Lindroth 1957, Berrian 2005	
<i>Enoplognatha ovata</i> (Clerck 1757)			Oxford & Reillo 1994	
<i>Latrodectus geometricus</i> (Koch 1841)	2003	North America	Vincent et al. 2008	yes
<i>Steatoda albomaculata</i> (De Geer 1778)			Sierwald 2005, Lew 2010	
<i>Steatoda grossa</i> (Koch 1838)		Europe	Draney 2001, Lew 2010	yes
<i>Steatoda triangulosa</i> (Walckenaer 1802)			Draney 2001, Prentice et al. 2001	
<i>Theridion hemerobium</i> Simon 1914		Europe	Lindroth 1957, Lew 2010	
<i>Theridion melanurum</i> (Hahn 1820)			Lindroth 1957, Lew 2010	
<i>Theridion murarium</i> (Emerton 1882)			Herbert et al.1987, Lindroth 1957, Lew 2010	
Araneae-Zoropsidae				
<i>Zoropsis spinimana</i> (Dufour 1820)	1996	Africa	Griswold & Ubick 2001	yes
Chilopoda-Scolopendromorpha-Cryptopidae				
<i>Cryptops hortensis</i> (Donovan 1810)		Europe	Shelley 2002	yes
Chilopoda-Scutigeroforma-Scutigerae				
<i>Scutigera coleoptrata</i> Linnaeus 1758	<1915	Europe	Lewis 1981, Essig 1915	yes
Coleoptera-Aderidae				
<i>Aderus populneus</i> (Creutzer in Panzer 1796)			Majka 2011	
Coleoptera-Anobiidae				
<i>Anobium punctatum</i> (De Geer 1774)		Europe	Philips 2002, Evans & Hogue 2006	
<i>Ernobius mollis</i> (Linnaeus 1758)	1990	North America	Seybold & Tupy 1993	
<i>Gibbium psyllodes</i> (Czempinski 1778)			Philips 2002	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Lasioderma haemorrhoidale</i> (Illiger 1807)	1981		White 1990	
<i>Lasioderma serricorne</i> (Fabricius 1792)	<1925		Campbell et al. 1989, Essig 1926a	yes
<i>Mezium affine</i> Boieldieu 1856			Philips 2002	
<i>Mezium americanum</i> Laporte 1840			Philips 2002	
<i>Ptinus fur</i> (Linnaeus 1758)			Bousquet 1990, California Beetle Project 2006	
<i>Niptus holoeucus</i> (Faldermann 1836)			Philips 2002	
<i>Stegobium paniceum</i> (Linnaeus 1758)	<1925		White 1962, Essig 1926a	yes
<i>Tricorynus herbarius</i> (Gorham 1883)			White 1965	
<i>Trigonogenius globulus</i> Solier 1849			Arnett et al. 2002	
Coleoptera-Anthididae				
<i>Anthicus floralis</i> (Linnaeus 1758)			Campbell et al. 1989	
<i>Stricticomus tobias</i> (Marseul 1879)			Peck & Thomas 1998	
Coleoptera-Anthribidae				
<i>Araecerus fasciculatus</i> (De Geer 1775)	1994		CPPDR 1996 15:74	
Coleoptera-Bostrichidae				
<i>Dinoderus minutus</i> (Fabricius 1775)			Campbell et al. 1989	
<i>Heterobostrychus brunneus</i> (Murray 1867)			Ivie 2002a	
<i>Lyctus brunneus</i> (Stephens 1830)	<1925	Europe	Campbell et al. 1989	yes
<i>Lyctus linearis</i> (Goeze 1777)	<1925	Europe	Campbell et al. 1989	
<i>Micrapate</i> sp. Casey 1898	2003		Penrose 2004	
<i>Rhyzopertha dominica</i> (Fabricius 1792)	<1930		Ebling 1975	yes
Coleoptera-Brentidae				
<i>Cylas formicarius</i> (Fabricius 1798)	1993	North America	CPPDR 1993 12:3	yes
<i>Trichapion simile</i> Kirby 1811			Lindroth 1957	
Coleoptera-Buprestidae				
<i>Agrilus anxius</i> Gory, 1841	1992	North America	Dreistadt et al. 2004	yes
<i>Agrilus auroguttatus</i> Schaeffer 1905	2004	North America	Westcott 2005	yes
<i>Agrilus cyanescans</i> (Ratzeburg 1837)	1949	Tropical America	Chamberlin 1949	
<i>Chrysobothris costifrons costifrons</i> Waterhouse 1887	2005	North America	Basham et al. 2015	
<i>Xenorhipis osborni</i> Knull 1936	1947	North America	Thatcher 1948	
Coleoptera-Carabidae				
<i>Amara anthobia</i> Villa & Villa 1833		North America	Lindroth 1957	
<i>Agonum mulleri</i> (Herbst 1784)			Ball & Bousquet 2001	
<i>Carabus nemoralis</i> Müller 1764	1919	North America	Brown 1940	
<i>Laemostenus complanatus</i> (Dejean 1828)		North America	Lindroth 1957	
<i>Perigona nigriceps</i> (Dejean 1831)		North America	Bousquet 2012	
<i>Trechus obtusus</i> Erichson 1837		North America	Lindroth 1957, Kavanaugh & Erwin 1985	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Coleoptera-Cerambycidae				
^a <i>Anoplophorus glabripennis</i> (Motachulsky 1853)	2005	Asia	CPPDR 2006 22:4	yes
<i>Arhopalus syriacus</i> (Reitter 1895)	2002	Europe	Penrose 2003	
<i>Callidellum rufipenne</i> (Motschulsky 1860)			Aukema et al. 2010, California Beetle Project 2006	
<i>Icosium tomentosum</i> Lucas 1854	2006	Europe	CPPDR 2007 23:5, Bohne 2006	
<i>Nathrius brevipennis</i> (Mulsant 1839)	1932	Europe	Linsley 1933	
<i>Neoclytus acuminatus</i> (Fabricius 1775)	2002	North America	Penrose 2004	
<i>Phoracantha recurva</i> Newman 1840	1995	Australia	CPPDR 1997 16:10	yes
<i>Phoracantha semipunctata</i> Fabricius 1775	1984	Australia	Dowell & Gill 1989	yes
<i>Phymatodes testaceus</i> (Linnaeus 1758)		North America	Lindroth 1957	
<i>Saperda populneus</i> (Linnaeus 1758)		Europe	Furniss & Carolin 1977	
Coleoptera-Chrysomelidae				
<i>Acanthoscelides obtectus</i> (Say 1831)	<1915	North America	CDFA 1920 9:344	yes
<i>Altica carduorum</i> (Guerin-Memeville 1858)			Riley et al. 2003	
<i>Amblycerus robiniae</i> (Fabricius 1781)	1970	North America	Dowell & Gill 1989	
<i>Bruchus brachialis</i> Fähræus 1839	1949	North America	Davidson & Lyon 1987, Evans & Hogue 2006	
<i>Bruchus pisorum</i> (Linnaeus 1758)	<1915		CDFA 1915 4:287	
<i>Bruchus rufimanus</i> Boheman 1833	<1915	Europe	CDFA 1915 4:289, Essig 1926a	
<i>Callosobruchus maculatus</i> (Fabricius 1775)	<1915		Campbell et al. 1989	
<i>Cassida nebulosa</i> Linnaeus 1758	<1894	Europe	Barber 1916	
<i>Chaetocnema</i> sp. Stephens 1831	1948		CDFA 1948 37:211	yes
<i>Chelymorpha cassidea</i> (Fabricius 1775)	1909	North America	Essig 1958	
<i>Chrysolina bankii</i> (Fabricius 1775)	2006	Europe	CPPDR 2007 23:5-6	
<i>Chrysophthartam-fuscum</i> Boheman 1859	2003	Australia	CPPDR 2006 22:25	yes
<i>Crioceris asparagi</i> (Linnaeus 1758)	1904	Europe	CDFA 1915 4:267	
<i>Crioceris duodecimpunctata</i> (Linnaeus 1758)	1975		Dowell & Gill 1989	
<i>Diabrotica balteata</i> LeConte 1865	1924	Tropical America	Metcalf 1995	
<i>Diorhabda elongate</i> (Brulle 1832)			Riley et al. 2003	
<i>Epitrix fasciata</i> Bratchley 1918	<1915		CDFA 1915 4:262	yes
<i>Epitrix tuberos</i> Gentner 1944	1968	North America	Dowell & Gill 1989	yes
<i>Galerucella nymphaeae</i> (Linnaeus 1758)	1924		Lindroth 1957	
<i>Longitarsus jacobaeae</i> Waterhouse 1858			LeSage 1988	
<i>Mimosetus nubigens</i> (Motschulsky 1874)	1991	North America	Johnson & Seeno 1993	
<i>Phyllotreta cruciferae</i> (Goeze 1777)			Riley et al. 2003	yes
<i>Phyllotreta striolata</i> (Fabricius 1803)			Campbell et al. 1989, Riley et al. 2003	yes
<i>Specularius impressithorax</i> (Pic 1913)	2003		Gulmahamad 2006	
<i>Trachymela sloanei</i> (Blackburn 1897)	1997	Australia	CPPDR 1998 17:4-6	yes
<i>Xanthogaleruca luteola</i> (Muller 1766)	1924	Europe	Metcalf 1995, Riley et al. 2003	yes

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Zabrotes subfasciatus</i> Boheman 1833	1965	Tropical America	Dowell & Gill 1989	
<i>Zeugophora scutellaris</i> Suffrian 1840			Riley et al. 2003, California Beetle Project 2009	
Coleoptera-Cleridae				
<i>Necrobia ruficollis</i> (Fabricius 1785)	<1925		Campbell et al. 1989, Essig 1926a	
<i>Necrobia rufipes</i> (De Geer 1775)	<1925		Campbell et al. 1989, Essig 1926a	
<i>Necrobia violacea</i> (Linnaeus 1758)	<1925		Campbell et al. 1989, Essig 1926a	
<i>Paratillus carus</i> (Newman 1840)		Europe	Grace & Wood 1985	
<i>Tarsostenus univittatus</i> (Rossi 1792)			Arnett 1983	
<i>Thaneroclerus buquet</i> (Lefebvre 1835)			California Beetle Project 2006	
Coleoptera-Coccinellidae				
^b <i>Epilachna varivestis</i> Mulsant 1850	1946	North America	CDFA 1946 35:198	yes
Coleoptera-Colydiidae				
<i>Microprius rufulus</i> (Motschulsky 1863)		Europe	Ivie 2002b	
Coleoptera-Cryptophagidae				
<i>Cryptophagus laticollis</i> Lucas 1849			Majka & Langor 2010	
<i>Cryptophagus pilosus</i> Gyllenhal 1827			Campbell et al. 1989	
Coleoptera-Curculionidae				
<i>Agasphaerops nigra</i> Horn 1876	1876		O'Brien & Wibmer 1982	
<i>Amalus haemorrhous</i> (Herbst 1795)			Lindroth 1957	
<i>Anthonomus eugenii</i> Cano 1894	1923	Tropical America	CDFA 1923 12:360	yes
^a <i>Anthonomus grandis</i> (Boheman 1843)	1984	North America	Dowell & Gill 1989	yes
<i>Apion longirostre</i> Olivier 1807	1964	North America	Dowell & Gill 1989	
<i>Araecerus coffeae</i> (Fabricius 1801)	2005	North America	CDFA 2005	
<i>Araptus schwarzi</i> (Blackman 1942)	2010	Mexico	Takahashi 2011	
<i>Atrichonotus taeniatus</i> (Berg 1881)	1997	North America	CPPDR 1997 16:49	
<i>Barypeithes pellucidus</i> (Boheman 1843)	1947	North America	Van Dyke 1947	
<i>Campylirhynchus castor</i> (Fabricius 1792)			O'Brien & Wibmer 1982	
<i>Caulophilus oryzae</i> (Gyllenhal 1838)	<1915		CDFA 1915 4:307	
<i>Ceutorhynchus assimilis</i> (Paykull 1792)	1945	Europe	CDFA 1953 42:204	
<i>Ceutorhynchus rapae</i> Gyllenhal 1837	1920	North America	Lindroth 1957	
<i>Coccotrypes advena</i> Blandford 1894	2006	North America	Penrose 2007, Atkinson 2015	
<i>Coccotrypes dactyliperda</i> (Fabricius 1801)	1931	Africa	Wood 1982	
<i>Coniatus splendidulus</i> Fabricius 1781	2010	North America	Eckberg & Foster 2011	
<i>Cosmobaris americana</i> Casey 1920	1943	North America	O'Brien & Wibmer 1982	
<i>Cosmobaris scolopacea</i> Germar 1818	1939	Europe	Van Dyke 1950	
<i>Cryptorhynchus lapathi</i> (Linnaeus 1758)		Europe	Furniss & Carolin 1977	
<i>Dactylotrypes longicollis</i> (Wollaston 1864)	2009	Africa	LeBonte & Takahashi 2012	
<i>Diaprepes abbreviatus</i> (Linnaeus 1758)	2005	North America	Grafton-Cardwell et al. 2004	yes

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Euwallacea fornicatus</i> (Eichhoff 1868)	2004	Asia	Haack 2006, Atkinson 2015	yes
<i>Gonipterus scutellatus</i> Gyllenhal 1833	1994	Australia	CPPDR 1994 13:4	yes
<i>Gymnetron antirrhini</i> (Paykull 1800)		North America	Lindroth 1957	
<i>Gymnetronpascurorum</i> (Gyllenhal 1813)		North America	Lindroth 1957	
<i>Gymnetron tetrum</i> (Fabricius 1792)	1942	Europe	Lindroth 1957, Cdfa 1942 31:177	
<i>Hylastinus obscurus</i> (Marsham 1802)	1939	North America	Davidson & Lyon 1987, Wood 1982	
<i>Hylurgus ligniperda</i> (Fabricius 1787)	2002	Asia	Penrose 2004, Atkinson 2015	yes
<i>Hypera brunnipennis</i> (Boheman 1834)	1939	North America	Metcalf 1995	yes
<i>Hypera meles</i> (Fabricius 1792)		North America	Davidson & Lyon 1987	
<i>Hypera nigrirostris</i> (Fabricius 1775)	1945	North America	Cdfa 1945 34:175	
<i>Hypera postica</i> (Gyllenhal 1813)	1923	North America	Cdfa 1923 12:359	yes
<i>Hypera punctata</i> (Fabricius 1775)	1908	North America	Davidson & Lyon 1987, Evans & Hogue 2006	yes
<i>Hypothenemus californicus</i> Hopkins 1915			Wood 1982	
<i>Hypothenemus eruditus</i> Westwood 1836		Tropical America	Wood 1982	
<i>Hypurus bertrandi</i> (Perris 1852)			Anderson 2002	
<i>Ips calligraphus calligraphus</i> (Germar 1824)		North America	Connor and Wilkson 1983	
<i>Lissorhoptrus oryzophilus</i> Kuschel 1952	1969	North America	Dowell & Gill 1989	yes
<i>Listroderes costirostris</i> Schonherr 1826	1926	Tropical America	Cdfa 1926 15:116, Evans & Hogue 2006	
<i>Listronotus hyperodes</i> (Dietz 1889)	1959	North America	Dowell & Gill 1989	
<i>Macrancylus littoralis</i> (Broun 1880)	1949		O'Brien & Wibmer 1982	
<i>Magdalis barbicornis</i> (Latreille 1804)	1975	North America	Anderson & Cline 2011	
<i>Mecinus pyraister</i> (Herbst 1795)			Aukema et al. 2010, California Beetle Project 2006	
<i>Naupactus leucoloma</i> (Boheman 1840)	1988	North America	CPPDR 1988 7:8	
<i>Orthotomicus erosus</i> (Wollaston 1857)	2004	Europe	Haack 2004, CPPDR 2006 22:5	yes
<i>Otiorhynchus cribricollis</i> Gyllenhal 1834	1927	Europe	Lindroth 1957, Cdfa 1929 18:567, Evans & Hogue 2006	yes
<i>Otiorhynchus meridionalis</i> Gyllenhal 1834	1931	Europe	Cdfa 1931 20:470, Evans & Hogue 2006	
<i>Otiorhynchus ovatus</i> (Linnaeus 1758)	1923	Europe	Lindroth 1957, Cdfa 1923 12:360, Evans & Hogue 2006	
<i>Otiorhynchus rugostratus</i> (Goeze 1777)	1920	Europe	Lindroth 1957, Cdfa 1930 19:17, Evans & Hogue 2006	
<i>Otiorhynchus sulcatus</i> (Fabricius 1775)	1925	Europe	Lindroth 1957, Cdfa 1927 16:654, Evans & Hogue 2006	yes
<i>Pagiocerus frontalis</i> (Fabricius 1801)	2010	North America	Leathers 2015	
<i>Pantomorus cervinus</i> (Boheman 1840)	1879	Europe	Cdfa 1930 19:17	yes
<i>Phloeosinus armatus</i> Reitter 1887	1989	Africa	Wood 1992	
<i>Phloeotribus liminaris</i> Harris 1852	2002	North America	Penrose 2004	
<i>Pissodes strobi</i> (Peck 1817)	1972	North America	Dowell & Gill 1989	
<i>Proctorus decipiens</i> (LeConte 1876)	1966	North America	Dowell & Gill 1989	
<i>Pselactus spadix</i> (Herbst 1795)	1966	North America	O'Brien 1970	
<i>Rhynchaenus salicis</i> (Linnaeus 1758)			Lindroth 1957	
^a <i>Rhynchophorus vulneratus</i> (Panzer 1789)	2010	Asia	Rugman-Jones, et al. 2013	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Scolytus multistriatus</i> (Marsham 1802)	1951	North America	Powell & Hogue 1979, Wood 1982	yes
<i>Scolytus rugulosus</i> (Ratzburg 1837)	1913	North America	Powell & Hogue 1979, Wood 1982	yes
<i>Scolytus schevyrewi</i> Semenov 1902	2002	Asia	Penrose 2004, Atkinson 2015	yes
<i>Sitona crinitus</i> (Herbst 1795)			O'Brien & Wibmer 1982	
<i>Sitona cylindricollis</i> Fahraeus 1840	1957	North America	Dowell & Gill 1989	
<i>Sitona flavescens</i> (Marsham 1802)	1907	North America	CDFA 1948 37:211, Bright 1994	
<i>Sitona hispidula</i> (Fabricius 1776)	1917	North America	Metcalf 1995, Bright 1994	
<i>Sitona lepidus</i> Gyllenhal 1834	1907	North America	Campbell et al. 1989, CDFA 1948 37:211	
<i>Sitona lineata</i> (Linnaeus 1758)	1966	North America	Dowell & Gill 1989	
<i>Sitona lineellus</i> (Bonsdorff 1785)		North America	Bright 1994	
<i>Sitophilus granarius</i> (Linnaeus 1758)	1769	Europe	Metcalf 1995	
<i>Sitophilus oryzae</i> (Linnaeus 1763)	1769	Europe	Metcalf 1995	
<i>Sitophilus zeamais</i> (Motschulsky 1855)			Campbell et al. 1989	
<i>Sphenophorus venatus</i> Chittenden 1904	1968	North America	Dowell & Gill 1989	
<i>Tranes internatus</i> Pascoe 1870			O'Brien & Wibmer 1982	
<i>Trichobaris trinotata</i> (Say 1831)	1914	North America	CDFA 1915 4:303	
<i>Tychius picirostris</i> (Fabricius 1787)	1950	Europe	CDFA 1950 39:183	
<i>Xyleborinus saxeseni</i> (Ratzeburg 1837)	< 1915		Essig 1915, Wood 1982, Ivie 2002a	
<i>Xyleborus californicus</i> Wood 1975	1944		Ivie 2002a	
<i>Xyleborus dispar</i> (Fabricius 1792)	<1926	North America	Essig 1926a	
<i>Xyleborus pfeili</i> (Ratzeburg 1837)	2002	Europe	Penrose 2004, Atkinson 2015	
<i>Xyleborus xylographus</i> (Say 1826)	1990	North America	Wood 1982, Ivie 2002a	
<i>Xylosandrus germanus</i> Blandford 1894	2002	Asia	Penrose 2004, Atkinson 2015	
Coleoptera-Dermestidae				
<i>Anthrenus coloratus</i> Reitter 1881	1969	Asia	Dowell & Gill 1989	
<i>Anthrenus scrophulariae</i> Linnaeus 1758			Campbell et al. 1989, CDFA 1958 47:238, 163	
<i>Anthrenus verbasci</i> Linnaeus 1767			California Beetle Project 2006	
<i>Attagenus fasciatus</i> (Thunberg 1795)	1974		Dowell & Gill 1989	
<i>Attagenus unicolor</i> (Brahm 1791)			California Beetle Project 2006	
<i>Dermestes ater</i> (De Geer 1774)			Haines 1981	
<i>Dermestes lardarius</i> Linnaeus 1758	<1925		Campbell et al. 1989, Essig 1926a	
<i>Dermestes maculatus</i> De Geer 1774			Powell & Hogue 1979	yes
<i>Dermestes marmoratus</i> Say 1823	<1925		Powell & Hogue 1979, Essig 1926a	
<i>Dermestes sardous</i> Kuster 1846	1967	Europe	Beal 1994	
<i>Trogoderma granarium</i> Everts 1898	1953	Asia	CDFA 1953 42:202	
Coleoptera: Dytiscidae				
<i>Copelatus glyphicus</i> (Say 1823)	1963		Leech 1970	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Coleoptera-Elateridae				
<i>Conoderus bellus</i> (Say 1824)	1924	North America	Stone 1975	
<i>Conoderus exsul</i> Sharp 1877	1937	Hawaii	Stone 1975	
<i>Conoderus falli</i> (Lane 1956)	1963	North America	Stone 1975	
<i>Heteroderes amplicollis</i> (Gyllenhal 1817)	1938	North America	Stone 1975	
Coleoptera-Endomychidae				
<i>Mycetaea subterranea</i> (Fabricius 1801)			Belov 2009	
<i>Symbiotes gibberosus</i> (Lucas 1849)			BugGuide 2011	
Coleoptera-Erotylidae				
<i>Megalodacne fasciata</i> (Fabricius 1777)	1983	North America	Kitayama 1986, Evans & Hogue 2006	
Coleoptera-Histeridae				
<i>Margarinotus merdarius</i> (Hoffman 1803)			Caterino 2010	
Coleoptera-Hydrophilidae				
<i>Sphaeridium lunatum</i> Fabricius 1792	1947	North America	Bixby 1948	
<i>Sphaeridium scarabaeoides</i> (Linnaeus 1758)	1920	Europe	Blackwelder 1931, Evans & Hogue 2006	
Coleoptera-Laemophloeidae				
<i>Laemophloeus ferrugineus</i> (Stephans 1828)	<1925		Campbell et al. 1989, Essig 1926a	
<i>Laemophloeus pusillus</i> (Schonherr 1817)			Campbell et al. 1989	
Coleoptera-Languriidae				
<i>Languria mozardi</i> Latreille 1807			Essig 1958	
<i>Pharaxonotha kirschi</i> Reitter 1875	1956	North America	Dowell & Gill 1989	
Coleoptera-Latridiidae				
<i>Aridius nodifer</i> (Westwood 1839)			Campbell et al. 1989	
<i>Cartodere constricta</i> (Gyllenhal 1827)			Majka et al. 2009	
<i>Corticaria serrata</i> (Paykull 1798)			Majka et al. 2009	
<i>Corticaria gibbosa</i> (Herbst 1793)			Majka et al. 2009	
<i>Dienerella argus</i> (Reitter 1884)			Majka et al. 2009	
<i>Dienerella filum</i> (Aube 1850)			Majka et al. 2009	
<i>Latridius minutus</i> (Linnaeus 1767)			Majka et al. 2009	
Coleoptera-Mycteridae				
<i>Hemipeplus marginipennis</i> (LeConte 1854)	1958	North America	C DFA 1959 48:126	
Coleoptera-Mycetophagidae				
<i>Mycetophagus quadriguttatus</i> Müller 1821			Campbell et al. 1989	
<i>Typhaea stercorea</i> (Linnaeus 1758)			Campbell et al. 1989	
Coleoptera-Nitidulidae				
<i>Aethina tumida</i> Murray 1867	2005	North America	Mussen 2010	
<i>Carpophilus dimidiatus</i> (Fabricius 1792)	<1925		Lindroth 1957, Essig 1926a	
<i>Carpophilus hemipterus</i> (Linnaeus 1758)	<1925		Campbell et al. 1989, Essig 1926a	yes

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Carpophilus lugubris</i> Murray 1864	1974		Dowell & Gill 1989	
<i>Nitidula carnaria</i> (Schall 1783)			Dodge 1937	
<i>Nitidula flavomaculata</i> Rossi 1790	<1933		Dodge 1937, Simms & Fothergill 2014	
<i>Stelidota geminate</i> (Say 1825)	1957	North America	Dowell & Gill 1989	
Coleoptera-Oedemeridae				
<i>Nacerrdes melanura</i> (Linnaeus 1758)			Furniss & Carolin 1977	
Coleoptera-Ptinidae				
<i>Ptinus fur</i> (Linnaeus 1758)			CDFA 1958 47:243	
Coleoptera-Scarabaeidae				
<i>Aphodius fimetarius</i> Linnaeus 1758	1923	Europe	Evans & Hogue 2006, Gordon & Skelley 2007	
<i>Aphodius fossor</i> Linnaeus 1758		Europe	Evans & Hogue 2006	
<i>Aphodius granarius</i> (Linnaeus 1767)		Europe	Campbell et al. 1989	
<i>Aphodius hamatus</i> Say 1824		Europe	Evans & Hogue 2006	
<i>Aphodius lividus</i> (Olivier 1789)		Europe	Evans & Hogue 2006	
<i>Aphodius pardalis</i> LeConte 1857		Europe	Evans & Hogue 2006	
<i>Aphodius pseudolividus</i> Balthasar 1941		Europe	Evans & Hogue 2006	
<i>Aphodius vittatus</i> Say 1825		Europe	Evans & Hogue 2006	
<i>Australaphodius frenchi</i> (Blackburn 1892)	2008	Africa	BugGuide 2011	
<i>Cotinis mutabilis</i> Gory & Percheron 1883	1925	Tropical America	CDFA 1935 24:417, Essig 1926a	yes
<i>Onthophagus taurus</i> (Schreber 1759)	1993	North America	Hoebeke & Beucke 1997	
<i>Pleurophorus caesus</i> (Creutzer 1796)		North America	Hatch 1946	
^a <i>Popillia japonica</i> Newman 1841	1961	North America	Dowell & Gill 1989	yes
Coleoptera-Silvanidae				
<i>Ahasverus advena</i> (Waltl 1834)	<1925		Metcalf 1995, Campbell et al. 1989, Essig 1926a	
<i>Oryzaephilus mercator</i> (Fauvel 1889)			Thomas 2002	yes
<i>Oryzaephilus surinamensis</i> (Linnaeus 1758)	<1921		CDFA 1921 10:142	yes
<i>Silvanus bidentatus</i> Fabricius 1792			California Beetle Project 2006	
Coleoptera: Staphylinidae				
<i>Aleochara bimaculata</i> Gravenhorst 1802			Hatch 1957	
<i>Aleochara fumata</i> Gravenhorst 1802			Klimaszewski 1984	
<i>Aleochara lanuginosa</i> Gravenhorst 1802			Hatch 1957	
<i>Aleochara lata</i> Gravenhorst 1802			Hatch 1957	
<i>Aleochara puberula</i> Klug 1834			Klimaszewski 1984	
<i>Aleochara tristis</i> Gravenhorst 1806			California Beetle Project 2006	
<i>Aleochara villosa</i> Mannerheim 1830			Hatch 1957	
<i>Aloconota cambrica</i> (Wallaston 1855)			California Beetle Project 2006	
<i>Amischa analis</i> (Gravenhorst 1802)			Muona 1984	
<i>Anotylus rugosus</i> (Fabricius 1775)			Moore & Orth 1977	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Anthobium atrocephalum</i> (Gyllenha 1827)			Moore & Legner 1975	
<i>Atheta amicula</i> (Stephens 1832)			Muona 1984	
<i>Atheta coriaria</i> Kraatz 1856			Muona 1984	
<i>Atheta dilutipennis</i> (Motschulsky 1858)			Muona 1984	
<i>Atheta fungi</i> (Gravenhorst 1806)			Muona 1984	
<i>Atheta harwoodi</i> Williams 1930			Muona 1984	
<i>Atheta longicornis</i> (Gravenhorst 1802)			Muona 1984	
<i>Atheta nigricornis</i> (Thomson 1852)			Muona 1984	
<i>Atheta pallidicornis</i> (Thomson 1856)			Muona 1984	
<i>Autalia puncticollis</i> Sharp 1864	1947	North America	Moore & Legner 1975	
<i>Autalia rivularis</i> (Gravenhorst 1802)			Moore & Orth 1977	
<i>Bisnius sordidus</i> (Gravenhorst 1802)			Hatch 1957, Smetana 1995	
<i>Carpelimus pusillus</i> (Gravenhorst 1802)			Moore & Legner 1975	
<i>Cilea silphoides</i> (Linnaeus 1767)			Hatch 1957	
<i>Cordalia obscura</i> (Gravenhorst 1802)			Muona 1984	
<i>Dinaraea angustula</i> (Gyllenhal 1810)			Muona 1984	
<i>Falagria concinnus</i> Erichson 1839			Hoebeke 1985	
<i>Gauropterus fulgidus</i> (Fabricius 1787)	1931		Hatch 1957	
<i>Gyrohypnus angustatus</i> (Stephens 1833)	1931		Klimaszewski 1984	
<i>Gyrohypnus fracticornis</i> (Müller 1776)			Klimaszewski 1984	
<i>Habrocerus capillaricornis</i> Gravenhorst 1806			California Beetle Project 2006	
<i>Homalota plana</i> (Gyllenhal 1810)			California Beetle Project 2006	
<i>Leptacinus intermedius</i> Donisthorpe 1935	1927		Klimaszewski 1984	
<i>Leptacinus pusillus</i> (Stephens 1833)	1894	Europe	Klimaszewski 1984	
<i>Mannerheimia</i> sp.			Newton et al. 2001	
<i>Meotica apicalis</i> Benick 1953			Muona 1984	
<i>Ocypus ater</i> (Gravenhorst 1802)	1936	North America	Evans & Hogue 2006	
<i>Ocypus olens</i> (Müller 1764)	1920	Europe	Van Dyke 1945	
<i>Oligota parva</i> Kraatz 1858			Moore & Legner 1975	
<i>Olisthaerus megacephalus</i> (Zetterstedt 1828)			Moore & Legner 1975	
<i>Omalius caesum</i> Gravenhorst 1806			Moore & Legner 1975	
<i>Omalius rivulare</i> (Paykull 1789)			Moore & Legner 1975	
<i>Oxytela opaca</i> (Gravenhorst 1802)			Moore & Legner 1975	
<i>Oxytelus sculptus</i> Gravenhorst 1806			Hatch 1957	
<i>Paraphloeostiba gayndahensis</i> (MacLeay 1871)	1995	Australia	Newton et al. 2001	
<i>Phacophallus parumpunctatus</i> (Gyllenhal 1827)	1891	Europe	Klimaszewski 1984	
<i>Phacophallus tricolor</i> (Kraatz 1859)	1904	Asia	Klimaszewski 1984	
<i>Philonthus cognatus</i> Stephens 1832			California Beetle Project 2006	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Philonthus debilis</i> Gravenhorst 1802			California Beetle Project 2006	
<i>Philonthus discoideus</i> Gravenhorst 1802	1902		Smetana 1995	
<i>Philonthus jurgans</i> Tottenham 1937			California Beetle Project 2006	
<i>Philonthus longicornis</i> Stephens 1832	1890		Smetana 1995	
<i>Philonthus politus</i> (Linnaeus 1758)			Smetana 1995	
<i>Philonthus rectangulus</i> Sharp 1874			California Beetle Project 2006	
<i>Philonthus ventralis</i> Gravenhorst 1802			California Beetle Project 2006	
<i>Placusa complanata</i> Erichson 1839			Moore & Legner 1975	
<i>Placusa tachyporoides</i> (Waltl 1838)			Moore & Legner 1975	
<i>Porrhodites fenestralis</i> (Zetterstedt 1828)			Campbell 1984	
<i>Quedius mesomelinus</i> (Marsham 1802)			Hatch 1957	
<i>Stenus morio</i> Gravenhorst 1806			Moore & Legner 1975	
<i>Tachyporus abdominalis</i> (Fabricius 1781)			Campbell 1979	
<i>Tachyporus nitidulus</i> (Fabricius 1781)			Campbell 1979	
<i>Xantholinus linearis</i> (Olivier 1794)			Hatch 1957	
<i>Xantholinus longiventris</i> Heer 1839			Newton et al. 2001	
Coleoptera-Tenebrionidae				
<i>Alphitobius diaperinus</i> (Panzer 1797)			Campbell et al. 1989	yes
<i>Alphitophagus bifasciata</i> (Say 1824)			Campbell et al. 1989	
<i>Cynaesus angustus</i> (LeConte 1851)			Campbell et al. 1989	
<i>Eleodes suturalis</i> (Say 1824)	1963	North America	Dowell & Gill 1989	
<i>Gnathocerus cornutus</i> (Fabricius 1798)	<1925		CDFA 1958 47:245, Essig 1926a	
<i>Gnathocerus maxillosus</i> (Fabricius 1801)			CDFA 1958 47:245	
<i>Opatroides punctulatus</i> Brulle 1832	2003	Europe	Aalbu et al. 2009	
<i>Palorus ratzburgi</i> (Wissmann 1848)	1954	North America	Campbell et al. 1989	
<i>Palorus subdepressus</i> (Wollaston 1864)	1942	North America	Campbell et al. 1989	
<i>Sitophagus hololeptoides</i> (Laporte 1840)			Peck & Thomas 1998	
<i>Tenebrio molitor</i> Linnaeus 1758	<1925		Campbell et al. 1989	
<i>Tenebrio obscurus</i> Fabricius 1792	<1925		Campbell et al. 1989, Essig 1926a	
<i>Tribolium audax</i> Triplehorn 1968			Sokoloff 1972	
<i>Tribolium castaneum</i> (Herbst 1797)	<1921		CDFA 1921 10:142	yes
<i>Tribolium confusum</i> duVal 1868	<1925		Campbell et al. 1989, Essig 1926a	yes
<i>Tribolium destructor</i> Uyttenboogaart 1933	<1925		Sokoloff 1972, Essig 1926a	
<i>Tribolium ferrugineum</i> (Fabricius 1781)	<1925		Essig 1926a	
Coleoptera-Trogidae				
<i>Trox scabra</i> (Linnaeus 1767)			Lindroth 1957	
Coleoptera-Trogossitidae				
<i>Lophocateres pusillus</i> Klug 1833	1954	North America	Arnett 1985	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^D
<i>Tenebroides mauritanicus</i> (Linnaeus 1758)	<1925		Hatch 1961, Essig 1926a	
Coleoptera-Zopheridae				
<i>Microprius rufulus</i> (Motschulsky 1863)			Lord et al. 2011	
Collembola-Entomobryidae				
<i>Entomobrya unostrigata</i> Stach 1930	1938		Christiansen & Bellinger 1980	
<i>Seira domestica</i> (Nicolet 1841)	<1925	Europe	Essig 1926a	
<i>Willowsia platani</i> (Nicolet 1841)	2009	Europe	BugGuide 2011	
Collembola-Hypogastruridae				
<i>Xenylla martima</i> Tullberg 1869	<1925	Europe	Essig 1926a	
Dermaptera-Anisolabididae				
<i>Anisolabis maritima</i> (Bonelli 1832)	1921		Langston & Powell 1975	
<i>Euborellia annulipes</i> (Lucas 1847)	1885		Langston & Powell 1975	
<i>Euborellia cincticollis</i> (Gerstaecker 1883)	1946	Africa	CDFA 1950 39:183	
Dermaptera-Chelisochidae				
<i>Chelisoches morio</i> (Fabricius 1775)	1905		Langston & Powell 1975	
Dermaptera-Forficulidae				
<i>Doru lineare</i> (Eschscholtz 1822)	1865		Langston & Powell 1975	
<i>Forficula auricularia</i> Linnaeus 1758	1923	Europe	Langston & Powell 1975	yes
Dermaptera-Labiduridae				
<i>Labidura riparia</i> Pallas 1773	1952	North America	CDFA 1953 42:40	yes
Dermaptera-Labiidae				
<i>Labia minor</i> (Linnaeus 1758)	1909		Langston & Powell 1975	
<i>Marava arachidis</i> (Yersin 1860)	1910		Langston & Powell 1975	
Dictyoptera-Blaberidae				
<i>Pycnoscelus surinamensis</i> (Linnaeus 1758)	1988	North America	Dowell & Gill 1989	
Dictyoptera-Blattellidae				
<i>Blattella germanica</i> (Linnaeus 1767)	<1925		Powell & Hogue 1979, Atkinson et al. 1991, Essig 1926a	yes
<i>Blattella vaga</i> Hebard 1935	1942	Asia	CDFA 1942 31:176	yes
<i>Phyllodromica trivittata</i> (Serville 1839)	2004	Europe	CPPDR 2011 25:7	
<i>Supella longipalpa</i> (Fabricius 1798)	1940	North America	CDFA 1952 41:50	yes
Dictyoptera-Blattidae				
<i>Blatta lateralis</i> Walker 1868	1978	Africa	Dowell & Gill 1989	yes
<i>Blatta orientalis</i> Linnaeus 1758			Powell & Hogue 1979	yes
<i>Neostylopyga rhombifolia</i> (Stoll 1813)	<1925	Asia	Arnett 1985, Essig 1926a	
<i>Periplaneta americana</i> (Linnaeus 1758)	<1925	Africa	Powell & Hogue 1979, Essig 1926a	yes
<i>Periplaneta australasiae</i> (Fabricius 1775)	<1925	Africa	Powell & Hogue 1979, Essig 1926a	
<i>Periplaneta brunnea</i> Burmeister 1838	1970	North America	Dowell & Gill 1989	yes
<i>Periplaneta fuliginosa</i> (Serville 1839)	1966	North America	Dowell & Gill 1989	yes

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Dictyoptera-Ectobidae				
<i>Luridiblatta trivittata</i> (Servile 1839)	2009	Africa	Lee 2010, Bugguide 2015	
Dictyoptera-Mantidae				
<i>Iris oratorius</i> (Linnaeus 1758)	2007	Europe	Arnett 1985	
<i>Mantis religiosus</i> (Linnaeus 1758)	1959		Arnett 1985	
<i>Stagmomantis carolina</i> Johannson 1763			Arnett 1985, Essig 1926a	
<i>Stagmomantis limbata</i> (Hahn 1835)	1864		Buckett 1966	
<i>Tenodera angustipennis</i> Saussure 1869	1952		Arnett 1985	
<i>Tenodera aridifolia</i> Stoll 1813	1932		Arnett 1985	
Diploda-Julida-Julidae				
<i>Brachyiulus lusitanus</i> Verhoeff 1898		North America	Hoffman 1999, Shelley 2002, Reeves 2000	
<i>Cylindroiulus caeruleocinctus</i> (Wood 1864)		Europe	Shelley 2002	
<i>Cylindroiulus truncorum</i> (Silvestri 1896)		Europe	Shelley 2002	
<i>Diploiulus latistriatus</i> (Curtis, 1845)		Europe	Lindroth 1957, Verhoeff 1944	
<i>Ophiulus pilosus</i> (Newport 1843)		Europe	Shelley 2002	
<i>Opiona fisheri</i> Gardner & Shelley 1989		Europe	Shelley 2002	
Diploda-Polydesmida-Paradoxosomatidae				
<i>Akamptogonus novarae</i> (Humbert & DeSaussure 1869)		Australia	Shelley 2002	
<i>Oxidus gracilis</i> (Koch 1847)		Asia	Shelley 2002	
Diploda-Polydesmida-Polydesmidae				
<i>Oxidus gracilis</i> (Koch 1847)		Asia	BugGuide 2011	
Diptera-Agromyzidae				
<i>Chromatomyia syngenesiae</i> Hardy 1849	1914		Spencer 1981	
<i>Liriomyza brassicae</i> (Riley 1885)			Spencer 1981	
<i>Liriomyza sativae</i> Blanchard 1938			Spencer 1981	yes
<i>Liriomyza langei</i> Frick 1951		Tropical America	Spencer 1981	yes
<i>Melanagromyza splendida</i> Frick 1953	1967	Hawaii	Dowell & Gill 1989	
<i>Ophiomyia simplex</i> (Loew 1869)	<1915		Spencer 1981	
<i>Phytomyza crassiseta</i> Zetterstedt 1860	1962	Pacific Region	Dowell & Gill 1989	
<i>Phytomyza ilicicola</i> Loew 1872	<1915		Davidson & Lyon 1987	
<i>Phytomyza ranunculi</i> (Schränk 1803)	1965	Pacific Region	Dowell & Gill 1989	
<i>Phytomyza rufipes</i> Meigen 1830	2006	Europe	Scheffer & Winkler 2008	
Diptera-Anthomyiidae				
<i>Delia antiqua</i> (Meigen 1826)	<1925	North America	Davidson & Lyon 1987, Essig 1926a	
<i>Delia platura</i> (Meigen 1826)	<1915	North America	Spencer 1981, CDFA 1915 4:334	
<i>Delia radicum</i> Linnaeus 1758		North America	Griffiths 1991	
<i>Pegomya hyoscyami</i> (Panzer 1809)	<1925		Essig 1926a	
<i>Pegomya betae</i> (Curtis 1847)	1893		CDFA 1915 4:331	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Pegomya wygodzinskyi</i> Albuquerque 1954	1948	Australia	CDFA 1948 37:204	
Diptera-Bibionidae				
<i>Dilophus sayi</i> (Hardy 1966)	1950	North America	Powell & Hogue 1979	
Diptera-Braulidae				
<i>Braula coeca</i> Nitzsch 1818			Amett 1985	
Diptera-Calliphoridae				
<i>Calliphora vicina</i> Robineau-Desvoidy 1830			Powell & Hogue 1979, James 1955	
<i>Calliphora vomitoria</i> (Linnaeus 1758)			James 1955	
<i>Chrysomya megacephala</i> (Fabricius 1794)	1988	Tropical America	Dowell & Gill 1989	
<i>Chrysomya rufifacies</i> (MacQuart 1843)	1987	North America	Dowell & Gill 1989	
<i>Cochliomyia hominivorax</i> (Coquerel 1858)			James 1955	
<i>Lucilia illustris</i> (Meigen 1826)	1769	Europe	Metcalf 1995	
<i>Lucilia silvarum</i> (Meigen 1826)			James 1955	
<i>Lucilia sericata</i> (Meigen 1826)	1769		Metcalf 1995, James 1955	
<i>Phormia regina</i> (Meigen 1826)	<1925		James 1955, Essig 1926a	
<i>Pollenia rudis</i> (Fabricius 1794)	<1925		Cole 1969, James 1955, Essig 1926a	
Diptera-Cecidomyiidae				
<i>Cecidomyia balsamicola</i> (Linter 1888)	1963	North America	Dowell & Gill 1989	
<i>Contarinia sorghicola</i> (Coquillett 1899)	1960	Asia	Dowell & Gill 1989	
<i>Dasineura affinis</i> (Kieffer 1886)	1992	Europe	CPPDR 1992 11:6	
<i>Dasineura balsamicola</i> (Lintner 1888)	1964		CDFA 1965 54:81	
<i>Dasineura gleditschiae</i> (Osten Sacken 1866)	1978	North America	Dowell & Gill 1989	yes
<i>Dasineura leguminicola</i> (Lintner 1879)	<1925	North America	Pritchard 1953, Essig 1926a	
<i>Dasineura rhodophaga</i> (Coquillett 1900)	1996	North America	CPPDR 1996 15:77	
<i>Mayetiola destructor</i> (Say 1817)	1879	North America	Pritchard 1953	
<i>Mayetiola violicola</i> (Coquillett 1900)	1967	North America	Dowell & Gill 1989	
<i>Monarthropalpus flava</i> (Schrank 1776)	1915	Europe	Cole 1969	yes
<i>Rhopalomyia chrysanthemi</i> (Ahlberg 1939)	<1925		Cole 1969, Essig 1926a	
<i>Sitodiplosis mosellana</i> (Géhin 1857)		North America	Davidson & Lyon 1987	
Diptera-Chaoboridae				
<i>Mochlonyx cinctipes</i> (Coquillett, 1903)	2003-2008	North America	Woodward et al. 2010	
Diptera: Chironomidae				
<i>Goeldichironomus amazonicus</i> (Fittkau 1968)	1990	Tropical America	Sublette & Mulla 1991	
Diptera-Chloropidae				
<i>Meromyza americana</i> Fitch 1856	<1925	North America	Davidson & Lyon 1987, Essig 1926a	yes
<i>Oscinella frit</i> (Linnaeus 1758)	<1925		Davidson & Lyon 1987, Essig 1926a	
Diptera-Culicidae				
<i>Aedes aegypti</i> (Linnaeus 1762)	1979	North America	Dowell & Gill 1989	yes

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Culex erraticus</i> (Dyar & Knab 1906)	1994	North America	Lothrop et al. 1995	
<i>Culex pipiens</i> Linnaeus 1758	< 1920	North America	Essig 1926a	
Diptera-Drosophilidae				
<i>Dettozomyia nigrovittata</i> (Malloch 1924)	1949	Australia	Wheeler 1951	
<i>Drosophila sukukii</i> Matsumura 1931	2008	Asia	Walsh et al. 2011	yes
<i>Drosophila virilis</i> Sturtevant 1916			Cole 1969	
<i>Drosophila bifurca</i> Patterson & Wheeler, 1942	2010		Castrezana 2010	
<i>Zaprionus indianus</i> Gupta 1970	2010		Castrezana et al. 2010	
Diptera-Ephydriidae				
<i>Hydrellia griseola</i> (Fallén 1813)	1922	North America	Metcalf 1995	
<i>Ochthera mantis</i> (De Geer 1776)	<1925	Europe	Essig 1926a	
Diptera-Fanniidae				
<i>Fannia canicularis</i> (Linnaeus 1761)	<1925		Huckett 1975, Essig 1926a	yes
<i>Fannia incisurata</i> (Zetterstedt 1838)			Cole 1969	
<i>Fannia manicata</i> (Meigen 1826)			Cole 1969	
<i>Fannia scalaris</i> (Fabricius 1794)	<1925		Cole 1969, Essig 1926a	
Diptera-Hippoboscidae				
<i>Melophagus ovinus</i> Linnaeus 1758	<1925	North America	Bequeart 1953-1954, Essig 1926a	
<i>Pseudolynchia canariensis</i> (Macquart 1839)	<1945	Europe	Cole 1969	
Diptera-Lonchaeidae				
<i>Dasiops alveofrons</i> McAlpine 1961	1945	North America	Cole 1969	
Diptera-Muscidae				
<i>Coenosia attenuate</i> Stein 1903	2002		Hoebcke et al. 2003	
<i>Haematobia irritans</i> (Linnaeus 1758)	<1900	North America	Davidson & Lyon 1987, Essig 1926a	yes
<i>Musca autumnalis</i> De Geer 1776	1968	North America	Dowell & Gill 1989	yes
<i>Musca domestica</i> Linnaeus 1758	1769	Europe	Metcalf 1995	yes
<i>Stomoxys calcitrans</i> (Linnaeus 1758)	<1932		Cole 1969	
Diptera-Oestridae				
<i>Gasterophilus haemorrhoidalis</i> (Linnaeus 1758)	<1925		Cole 1969, Essig 1926a	yes
<i>Gasterophilus intestinalis</i> (De Geer 1776)	<1925		Cole 1969, Essig 1926a	yes
<i>Gasterophilus nasalis</i> (Linnaeus 1758)	<1925		Cole 1969, Essig 1926a	yes
<i>Hypoderma bovis</i> (Linnaeus 1758)	<1925	North America	Cole 1969, Essig 1926a	yes
<i>Hypoderma lineatus</i> (De Villiers 1789)	<1925	North America	Cole 1969, Essig 1926a	yes
<i>Oestrus ovis</i> Linnaeus 1758	<1925	Europe	Cole 1969, Essig 1926a	
Diptera-Otitidae				
<i>Euxesta stigmatias</i> Loew 1868	1996	Tropical America	CPPDR 1996 15:154	
Diptera-Phoridae				
<i>Chonocephalus bentacaisei</i> (Santos Abreu 1921)	2008	Africa	Disney & Brown 2009	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Megaselia scutellaris</i> (Wood 1909)	2008	Europe	Disney & Brown 2009	
<i>Megaselia seticauda</i> (Malloch 1914)	1996	Mexico	CPPDR 1996 15:153	
Diptera-Piophilidae				
<i>Piophila casei</i> (Linnaeus 1758)	<1925	North America	Cole 1969, Essig 1926a	
Diptera: Platystomatidae				
<i>Pogonortalis doclea</i> (Walker 1849)		Australia	McAlpine 2001	
Diptera-Psilidae				
<i>Psila rosae</i> (Fabricius 1794)	1963	Europe	Dowell & Gill 1989	
Diptera-Sciaridae				
<i>Pnyxia scabiei</i> (Hopkins 1895)			Cole 1969	
Diptera-Sepsidae				
<i>Decachaetophora aeneipes</i> (Meijere 1913)			Cole 1969	
Diptera-Stratiomyidae				
<i>Inopus rubriceps</i> (Macquart 1847)	1948	Australia	Kessel 1948	yes
<i>Neoxaireta spinigera</i> (Weidemann 1830)	1966	Hawaii	Dowell & Gill 1989	
Diptera-Syrphidae				
<i>Eristalinus taeniops</i> (Wiedemann 1818)	2006	Africa	Hauser 2006	
<i>Eristalis arbustorum</i> (Linnaeus 1758)			Nayar 1968	
<i>Eristalis tenax</i> (Linnaeus 1758)	<1925	Europe	Powell & Hogue 1979, Essig 1926a	
<i>Eumerus narcissi</i> Smith 1928	1927		CDFA 1930 19:760, Davidson & Lyon 1987	yes
<i>Eumerus strigatus</i> (Fallén 1817)	<1925		CDFA 1930 19:575, Essig 1926a	yes
<i>Eumerus tuberculatus</i> Rondani 1857			CDFA 1933 22:142	
<i>Merodon equestris</i> (Fabricius 1794)	1914	Europe	Metcalf 1995	yes
<i>Myatropa florum</i> (Linnaeus 1758)	2006	Europe	BugGuide 2011	
<i>Syritta flaviventris</i> Macquart 1842	2006	Europe	Hauser 2007	
<i>Syrphus ribesi</i> (Linnaeus 1758)	<1925	Europe	Essig 1926a	
Diptera-Tephritidae				
^a <i>Anastrepha ludens</i> (Loew 1873)	1954	North America	CDFA 1954 43:168	yes
^a <i>Anastrepha suspensa</i> (Loew 1862)	1984	North America	Dowell & Gill 1989	yes
^a <i>Bactrocera albistrigata</i> (Meijere 1911)	2009	Asia	CPPDR 2011 25:9	yes
^a <i>Bactrocera correcta</i> (Bezzi 1916)	1986	Asia	Dowell & Gill 1989	yes
^a <i>Bactrocera cucurbitae</i> (Coquillett 1849)	1956	Hawaii	Dowell & Gill 1989	yes
^a <i>Bactrocera dorsalis</i> (Hendel 1912)	1960	Hawaii	Dowell & Gill 1989	yes
^b <i>Bactrocera zonata</i> (Saunders 1842)	1985	Asia	Dowell & Gill 1989	yes
<i>Bactrocera oleae</i> (Gmelin 1790)	1998	Europe	CPPDR 1998 17:66	yes
^a <i>Bactrocera scutellata</i> (Hendel 1912)	2009	Asia	CPPDR 2011 25:9	
^a <i>Ceratitis capitata</i> (Weidemann 1824)	1975	Tropical America	Dowell & Gill 1989	yes
<i>Chaetorellia succinea</i> (Costa 1844)	1996	North America	Pitcairn et al. 2000	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Rhagoletis completa</i> Cresson 1929	1925	North America	CDFA 1930 19:249	yes
<i>Rhagoletis pomonella</i> (Walsh 1867)	1983	North America	Dowell & Gill 1989	yes
<i>Terellia fuscicornis</i> (Loew 1844)	1994	Europe	CPPDR 1994 13:57	
Diptera-Tipulidae				
<i>Tipula paludosa</i> Meigan 1830	1999	North America	Umble & Rao 2005	yes
<i>Tipula oleracea</i> Linnaeus 1758	2003	North America	Umble & Rao 2005, CPPDR 2006 22:7	yes
Embiidina-Oligotomidae				
<i>Haploembia solieri</i> (Rambur 1842)	<1900	Europe	Powell & Hogue 1979, Ross 1957	
<i>Oligotoma nigra</i> Hagen 1866	1890	Europe	Powell & Hogue 1979, Ross 1957	
Hemiptera-Aclerididae				
<i>Aclerda tokionis</i> (Cockerell 1896)	1900	Asia	Gill 1993	
Hemiptera-Adelgidae				
<i>Adelges abietis</i> (Linnaeus 1758)		North America	Martineau 1984	
<i>Adelges nordmannianae</i> (Eckstein 1890)		North America	Furniss & Carolin 1977	
<i>Adelges piceae</i> (Ratzeburg 1844)	1928	North America	Blackman & Eastop 1994, Ragenvich & Mitchell, 2006	
Hemiptera-Aleyrodidae				
<i>Aleurodicus dugesii</i> Cockerell 1896	1992	Mexico	CPPDR 1992 11:78	yes
<i>Aleuroplatus berbericolus</i> Quaintance & Baker 1917	1935	North America	Mound & Halsey 1978	
<i>Aleurothrixus floccosus</i> (Maskell 1896)	1966	Tropical America	Dowell & Gill 1989	yes
<i>Aleurotuba jelinekii</i> (Frauenfeld 1867)	1963	Europe	Dowell & Gill 1989	
<i>Aleurotuberculatus aucubae</i> (Kuwana 1932)	2002	Asia	CPPDR 2006 22:15	
<i>Aleurotuberculatus jasmini</i> (Takahashi 1932)	1997	Hawaii	CPPDR 1996 15:156	
<i>Aleyrodes proletella</i> (Linnaeus 1758)	2001	Europe	Penrose 2001	
<i>Bemisia argentifolii</i> Bellows & Perring 1994	1991	North America	Bellows et al. 1994	yes
<i>Bemisia tabaci</i> (Gennadius 1889)		North America	Mound & Halsey 1978	yes
<i>Dialeurodes citri</i> (Ashmead 1885)	1906	North America	Metcalf 1995,	yes
<i>Dialeurodes citrifolii</i> (Morgan 1893)	1985	North America	Dowell & Gill 1989	
<i>Parabemisia myricae</i> (Kuwana 1927)	1978	Asia	Dowell & Gill 1989	
<i>Paraleyrodes minei</i> Iaccarino 1990@	1983	Mexico	Dowell & Gill 1989	
<i>Siphoninus phillyreae</i> (Haliday 1835)	1988	Europe	Dowell & Gill 1989	yes
<i>Tetraleurodes acaciae</i> (Quaintance 1914)	1900	Mexico	Mound & Halsey 1978	
<i>Tetraleurodes</i> sp Cockerell 1902	1983	Tropical America	Dowell & Gill 1989	
<i>Trialeurodes packardi</i> (Morrill 1903)		North America	Mound & Halsey 1978	
<i>Trialeurodes ruborum</i> (Cockerell 1897)	1953	North America	CDFA 1953 42:203	
<i>Trialeurodes vaporariorum</i> (Westwood 1856)	<1915	North America	CDFA 1915 4:197	yes
<i>Trialeurodes variabilis</i> (Quaintance 1900)	2002	North America	CPPDR 2003 21:10	
Hemiptera-Anthocoridae				
<i>Anthocoris nemoralis</i> (Fabricius 1794)	1990	North America	Hagen & Dreistadt 1990; Lattin 2007	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Buchananiella continua</i> (White 1880)	1934	Europe	Lattin 2001	
<i>Dufouriellus ater</i> (Dufour 1833)			Henry & Froeschner 1988; Lattin 2007	
<i>Macrotrachelia nigronitens</i> (Stal 1860)	2001	Tropical America	Lewis et al. 2005; Lattin 2007	
<i>Xylocoris galactinus</i> (Fieber 1837)			Lattin 2007	
<i>Xylocoris sordidus</i> (Reuter 1871)			Lattin 2007	
Hemiptera-Aphalaridae				
<i>Ctenarytaina eucalypti</i> (Maskell 1890)	1991	Australia	CPPDR 1991 10:5	yes
<i>Ctenarytaina spatulata</i> Taylor 1977	1991	Australia	CPPDR 1991 10:42	
<i>Psyllopsis fraxinicola</i> (Föerster 1848)	1920	Europe	Hodkinson 1988	
Hemiptera-Aphididae				
<i>Acyrtosiphon festucae</i> (Theobald 1917)	1970		Blackman & Eastop 1994	
<i>Acyrtosiphon kondoi</i> Shinji 1938	1975	Asia	Dowell & Gill 1989	
<i>Acyrtosiphon lactucae</i> (Passerini 1860)			Blackman & Eastop 1984, Footit et al. 2006	
<i>Acyrtosiphon loti</i> (Theobald 1913)	1975		Blackman & Eastop 1984	
<i>Acyrtosiphon malvae</i> (Mosley 1841)			Smith & Parron 1978	
<i>Acyrtosiphon pisum</i> (Harris 1776)	<1915	North America	Davidson & Lyon 1987, Footit et al. 2006	yes
<i>Aloephagus myersi</i> Essig 1950	1939	Africa	Blackman & Eastop 1994, Footit et al. 2006	
<i>Aphis arundinis</i> (Fabricius 1775)	1881	North America	Blackman & Eastop 1994, Essig 1917	
<i>Aphis citricola</i> Van der Goot 1912		Mexico	Blackman & Eastop 1994	yes
<i>Aphis craccivora</i> Koch 1854	<1915	Tropical America	Blackman & Eastop 1994, Footit et al. 2006	yes
<i>Aphis cytisorum</i> Hartig 1841			Smith & Parron 1978, Footit et al. 2006	
<i>Aphis fabae</i> Scopoli 1763	<1915	North America	CDFA 1915 4:104, Footit et al. 2006	yes
<i>Aphis gossypii</i> Glover 1877	<1915		CDFA 1915 4:89, Footit et al. 2006	yes
<i>Aphis hederiae</i> Kaltenbach 1843	1910		Blackman & Eastop 1994, Essig 1917, Footit et al. 2006	yes
<i>Aphis middletonii</i> (Thomas 1879)		North America	Smith & Parron 1978	
<i>Aphis nasturtii</i> Kaltenbach 1843			Blackman & Eastop 1984, Footit et al. 2006	
<i>Aphis nerii</i> Fonscolombe 1841	<1915		CDFA 1915 4:91, Footit et al. 2006	
<i>Aphis pomi</i> De Geer 1773	<1915	North America	CDFA 1915 4:92, Footit et al. 2006	
<i>Asiphonella cynodonti</i> (Das 1918)	1958	North America	CDFA 1959 48:127	
<i>Aulacorthum circumflexum</i> (Buckton 1876)			Blackman & Eastop 1984, Footit et al. 2006	
<i>Aulacorthum solani</i> (Kaltenbach 1843)			Blackman & Eastop 1994, Footit et al. 2006	yes
<i>Betulaphis brevipilosa</i> Börner 1940			Blackman & Eastop 1994, Footit et al. 2006	
<i>Brachycaudus cardui</i> (Linnaeus 1758)	<1916		Blackman & Eastop 1994, Essig 1917	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Brachycaudus persicae</i> (Passerini 1860)	1910	North America	Blackman & Eastop 1984, Foottit et al. 2006	yes
<i>Brachycaudus rumexicolens</i> (Patch 1917)	1984	Europe	Dowell & Gill 1989	
<i>Brachycaudus schwartzi</i> (Borner 1931)	1975	Europe	Blackman & Eastop 1994, Foottit et al. 2006	
<i>Brachycaudus tragopogonis</i> (Kaltenbach 1843)	1975	Europe	Dowell & Gill 1989	
<i>Brachycolus asparagi</i> Mordvilko 1928	1984	North America	Dowell & Gill 1989	
<i>Brevicoryne brassicae</i> (Linnaeus 1758)	1876	North America	Davidson & Lyon 1987, Foottit et al. 2006	yes
<i>Calaphis betulicola</i> (Kaltenbach 1843)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Calaphis flava</i> Mordvilko 1928			Blackman & Eastop 1994	
<i>Calaphis juglandis</i> Goeze 1778	1952	Asia	CDFA 1952 41:180	yes
<i>Callipterinella calliptera</i> (Hartig 1841)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Callipterinella minutissima</i> (Stroyan 1953)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Capitophorus hippophaes</i> (Walker 1852)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Carolinaia howardi</i> (Wilson 1911)	1916		Essig 1915	
<i>Cavariella pastinacae</i> (Linnaeus 1758)			Blackman & Eastop 1994	
<i>Cerataphis lataniae</i> (Boisduval 1867)	<1916		Blackman & Eastop 1984, Essig 1917, Foottit et al. 2006	yes
<i>Cerataphis orchidearum</i> Westwood 1879			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Chaetosiphon tetraerhodum</i> (Walker 1849)			Blackman & Eastop 1984, Foottit et al. 2006	
<i>Chaitophorus leucomelas</i> Koch 1854	1966	Europe	Blackman & Eastop 1994, Foottit et al. 2006	yes
<i>Chromaphis juglandicola</i> (Kaltenbach 1843)	1896	Europe	CDFA 1915 4:82, Foottit et al. 2006	
<i>Cinara atlantica</i> (Wilson 1919)			Blackman & Eastop 1994	
<i>Cinara cupressi</i> (Buckton 1881)	1916	Europe	Foottit et al. 2006	yes
<i>Cinara pilicornis</i> (Hartig 1841)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Cinara tujafilina</i> (del Guercio 1909)			Furniss & Carolin 1977, Foottit et al. 2006	
<i>Colopha ulmicola</i> (Fitch 1859)			Blackman & Eastop 1994	
<i>Coloradoa rufomaculata</i> (Wilson 1908)			Blackman & Eastop 1984	
<i>Cryptomyzus ribis</i> (Linnaeus 1758)			Blackman & Eastop 1984, Foottit et al. 2006	
<i>Diuraphis noxia</i> (Mordvilko 1913)	1988	North America	Dowell & Gill 1989	yes
<i>Drepanaphis acerifoliae</i> Thomas 1878	<1916		CDFA 1914 3:85	yes
<i>Drepanosiphum oregonensis</i> Granovsky 1939			Blackman & Eastop 1994, Foottit et al. 2006	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Drepanosiphum platanoides</i> (Schrank 1801)	1908	Europe	Footitt et al. 2006	
<i>Dysaphis apiifolia</i> (Theobald 1923)			Blackman & Eastop 1984, Footitt et al. 2006	yes
<i>Dysaphis crataegi</i> (Kaltenbach 1843)			Blackman & Eastop 1984, Footitt et al. 2006	yes
<i>Dysaphis foeniculus</i> (Theobald 1922)			Blackman & Eastop 1984, Footitt et al. 2006	yes
<i>Dysaphis plantaginae</i> (Passerini 1860)			Blackman & Eastop 1984, Footitt et al. 2006	
<i>Dysaphis tulipae</i> (Fonscolombe 1841)	<1925	Europe	Blackman & Eastop 1984, Essig 1926a, Footitt et al. 2006	yes
<i>Elatobium abietina</i> (Walker 1849)	1915	Europe	Furniss & Carolin 1977, Footitt et al. 2006	
<i>Eriosoma americana</i> (Riley 1879)	<1916		Blackman & Eastop 1984	yes
<i>Eriosoma lanigera</i> (Hausmann 1802)	1870	North America	Metcalf 1995	
<i>Eriosoma pyricola</i> Baker & Davidson 1916	<1925	North America	Blackman & Eastop 1994, Essig 1926a, Footitt et al. 2006	
<i>Eriosoma rileyi</i> Thomas 1878	1913	North America	Blackman & Eastop 1984	
<i>Eucallipterus tiliae</i> (Linnaeus 1758)	1909	North America	Davidson 1909, Footitt et al. 2006	
<i>Eucarazzia elegans</i> (Ferrari 1872)	1984	Africa	Dowell & Gill 1989	
<i>Euceraphis betulae</i> Koch 1855			Blackman & Eastop 1994, Footitt et al. 2006	
<i>Euceraphis punctipennis</i> (Zetterstedt 1828)			Furniss & Carolin 1977, Footitt et al. 2006	
<i>Eulachnus agilis</i> (Kaltenbach 1843)			Blackman & Eastop 1994, Footitt et al. 2006	
<i>Eulachnus rileyi</i> (Williams 1843)			Blackman & Eastop 1994, Footitt et al. 2006	
<i>Euthoracaphis umbellulariae</i> (Essig 1932)	1929	Asia	CDFA 1941 30:353, Blackman & Eastop 1994, Footitt et al. 2006	yes
<i>Forda formicaria</i> Heyden 1837			Blackman & Eastop 1984, Footitt et al. 2006	
<i>Forda marginata</i> Koch 1857			Blackman & Eastop 1984, Footitt et al. 2006	
<i>Hayhurstia atriplicis</i> (Linnaeus 1761)			Footitt et al. 2006	
<i>Hyadaphis coriandri</i> (Das 1918)	1999	Europe	CPPDR 1999 18:19, Footitt et al. 2006	
<i>Hyadaphis foeniculi</i> (Passerini 1860)			Blackman & Eastop 1984, Footitt et al. 2006	yes
<i>Hyalopterus pruni</i> (Geoffroy 1762)	1881	North America	Metcalf 1995, Footitt et al. 2006	yes
<i>Hyperomyzus lactucae</i> (Linnaeus 1758)	<1916		Blackman & Eastop 1984, Footitt et al. 2006	
<i>Hysteroneura setariae</i> (Thomas 1878)	1955	North America	CDFA 1966 55:93, Dowell & Gill 1989	
<i>Idiopterus nephrolepidis</i> Davis 1909	<1915		CDFA 1915 4:101, Footitt et al. 2006	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Illinoia azaleae</i> (Mason 1925)	1954		CDFA 1954 43:76	
<i>Illinoia liriiodendri</i> (Monell 1879)	1974	North America	Blackman & Eastop 1994	yes
<i>Lipaphis erysimi</i> (Kaltenbach 1843)			Blackman & Eastop 1984	yes
<i>Macrosiphoniella sanborni</i> (Gillette 1908)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Macrosiphum eurphorbiae</i> (Thomas 1878)			Blackman & Eastop 1994	yes
<i>Macrosiphum avenae</i> (Fabricius 1775)	1916		Essig 1915, Davidson & Lyon 1987, CDFA 1915 4:86	yes
<i>Macrosiphum rosae</i> (Linnaeus 1758)	<1915		CDFA 1915 4:105, Foottit et al. 2006	
<i>Macrosiphum tiliae</i> (Monell 1879)			Blackman & Eastop 1994	
<i>Melanaphis sacchari</i> (Zehntner 1895)	1997	Asia	CPPDR 1997 16:49, Foottit et al. 2006	yes
<i>Melanocallis caryaefoliae</i> (Davis 1910)	1958	North America	CDFA 1959 48:127	
<i>Melaphis rhois</i> (Fitch 1866)	<1916	North America	Essig 1915	
<i>Metopolophium festucae</i> (Theobald 1917)	1970		Foottit et al. 2006	
<i>Mindarus abietinus</i> Koch 1857			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Monellia caryella</i> (Fitch 1855)	<1932		Blackman & Eastop 1984	yes
<i>Monelliopsis caryae</i> (Monell 1879)	<1925	North America	Essig 1926a	yes
<i>Myzaphis rosarum</i> (Kaltenbach 1843)	<1915		Blackman & Eastop 1984, Foottit et al. 2006	
<i>Myzocallis castaneae</i> (Fitch 1856)	1914		Essig 1915	
<i>Myzocallis castanicola</i> Baker 1916	1914	Europe	Blackman & Eastop 1984, Foottit et al. 2006	
<i>Myzocallis coryli</i> (Goeze 1778)	<1916	North America	Blackman & Eastop 1994, Foottit et al. 2006	
<i>Myzocallis punctatus</i> (Monell 1879)		North America	Blackman & Eastop 1994	
<i>Myzocallis walshii</i> (Monell 1879)		North America	Blackman & Eastop 1994	
<i>Myzus ascalonicus</i> Doncaster 1946		North America	Blackman & Eastop 1984, Foottit et al. 2006	
<i>Myzus cerasi</i> (Fabricius 1775)	<1915		Davidson & Lyon 1987, CDFA 1915 4:96, Foottit et al. 2006	yes
<i>Myzus certus</i> (Walker 1849)			Blackman & Eastop 1984, Foottit et al. 2006	
<i>Myzus dianthicola</i> Hille Ris Lambers 1966			Blackman & Eastop 1984	
<i>Myzus formosanus</i> Takahashi 1923	1958		Essig 1958	
<i>Myzus hemerocallis</i> Takahashi 1921	1959	Asia	Dowell & Gill 1989	
<i>Myzus ligustri</i> (Mosley 1841)			Blackman & Eastop 1984, Foottit et al. 2006	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Myzus lythri</i> (Schrank 1801)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Myzus ornatus</i> Laing 1932	1926	Europe	Essig 1926b	
<i>Myzus persicae</i> (Sulzer 1776)	<1915	North America	Blackman & Eastop 1994, CDFA 1915 4:98	yes
<i>Myzus varians</i> Davidson 1912		Asia	Blackman & Eastop 1984	
<i>Nasonovia ribisnigri</i> (Mosley 1841)	2001	North America	CPPDR 1998 17:69, Foottit et al. 2006	yes
<i>Nearctaphis bakeri</i> (Cowen 1895)	<1915		Blackman & Eastop 1984	
<i>Neophyllaphis araucariae</i> Takahashi 1937			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Neophyllaphis podocarpi</i> Takahashi 1920	1954	Australia	Blackman & Eastop 1994, Foottit et al. 2006	yes
<i>Neotoxoptera formosana</i> Takahashi 1921	1927	Asia	Blackman & Eastop 1984, Essig 1958, Foottit et al. 2006	
<i>Neotoxoptera oliveri</i> (Essig 1935)	1927	Asia	Blackman & Eastop 1984, Foottit et al. 2006	
<i>Neotoxoptera violae</i> Pergande 1900	<1915		Blackman & Eastop 1984, CDFA 1915 4:101	
<i>Ovatus crataegarius</i> (Walker 1850)			Smith & Parron 1978, Foottit et al. 2006	
<i>Pachypappa pseudobyrsa</i> (Walsh 1863)	1953	North America	Smith & Parron 1978	
<i>Pemphigus betae</i> Doane 1900	<1915		CDFA 1915 4:75	yes
<i>Pemphigus bursarius</i> (Linnaeus 1758)	1955		CDFA 1955 44:164, Foottit et al. 2006	yes
<i>Pentalonia nigronervosa</i> Coquerel 1859	<1916		Blackman & Eastop 1994, Foottit et al. 2006	
<i>Periphyllus californiensis</i> (Shinji 1917)			Furniss & Carolin 1977, Foottit et al. 2006	yes
<i>Periphyllus lyropictus</i> (Kessler 1886)			Furniss & Carolin 1977, Foottit et al. 2006	yes
<i>Periphyllus testudinaceus</i> (Ferne 1852)			Furniss & Carolin 1977, Foottit et al. 2006	yes
<i>Phorodon humuli</i> (Schrank 1801)	1890	North America	Blackman & Eastop 1994, Foottit et al. 2006	
<i>Phyllaphis fagi</i> (Linnaeus 1767)		Europe	Blackman & Eastop 1994, Foottit et al. 2006	yesS
<i>Pleotrichophorus chrysanthemi</i> (Theobald 1920)			Foottit et al. 2006	
<i>Pterocallis alni</i> (De Geer 1773)		Europe	Blackman & Eastop 1994, Foottit et al. 2006	
<i>Pterocomma populea</i> (Kaltenbach 1843)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Pterocomma salicis</i> (Linnaeus 1758)			Blackman & Eastop 1994, Foottit et al. 2006	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Rhopalomyzus poae</i> (Gillette 1908)	1955	North America	Dowell & Gill 1989	
<i>Rhopalosiphoninus latusiphon</i> (Davidson 1912)			Foottit et al. 2006	
<i>Rhopalosiphoninus staphyleae</i> (Koch 1854)			Blackman & Eastop 1984, Foottit et al. 2006	
<i>Rhopalosiphum insertum</i> (Walker 1849)	1955	North America	Smith & Parron 1978	
<i>Rhopalosiphum maidis</i> (Fitch 1856)	<1916		Blackman & Eastop 1994, Essig 1917, Foottit et al. 2006	yes
<i>Rhopalosiphum nymphaeae</i> (Linnaeus 1761)	<1916		CDFA 1917 6:65, Foottit et al. 2006	
<i>Rhopalosiphum padi</i> (Linnaeus 1758)			Blackman & Eastop 1994	yes
<i>Rhopalosiphum rufiabdominalis</i> (Sasaki 1899)			Blackman & Eastop 1984, Foottit et al. 2006	
<i>Sarucallis kahawaluokalani</i> (Kirkaldy 1907)	1937	North America	Blackman & Eastop 1994	yes
<i>Schizaphis graminum</i> (Rondani 1852)	<1925	North America	Metcalf 1995, Essig 1926a, Foottit et al. 2006	yes
<i>Schizolachnus pineti</i> (Fabricius 1781)			Blackman & Eastop 1984, Foottit et al. 2006	
<i>Shivaphis celti</i> Das 1918	2002	North America	CPPDR 2006 22:8-9, Foottit et al. 2006	yes
<i>Sinomegoura citricola</i> (van der Goot 1917)	2009	Asia	CPPDR 2011 25:16	
<i>Sipha flava</i> (Forbes 1884)			Smith & Parron 1978	yes
<i>Sipha maydis</i> Passerini 1860	2007	Europe	CPPDR 2011 24:9-11	
<i>Sitobion fragariae</i> (Walker 1848)			Foottit et al. 2006	
<i>Smynthuroides betae</i> Westwood 1849			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Takecallis arundicolens</i> (Clarke 1903)	1903	Asia	Blackman & Eastop 1994, CDFA 1915 4:84, Foottit et al. 2006	yes
<i>Takecallis arundinariae</i> (Essig 1917)	1911	Asia	Blackman & Eastop 1994, Foottit et al. 2006	
<i>Takecallis taiwanus</i> (Takahashi 1926)		Asia	Blackman & Eastop 1994, Foottit et al. 2006	
<i>Tetraneura nigriabdominalis</i> (Saski 1899)			Blackman & Eastop 1994	
<i>Tetraneura ulmi</i> (Linnaeus 1758)			Blackman & Eastop 1994, Foottit et al. 2006	
<i>Thecabius affinis</i> (Kaltenbach 1843)			Blackman & Eastop 1994	
<i>Therioaphis riehlmi</i> (Borner 1949)	1956		Dowell & Gill 1989	
<i>Therioaphis trifolii</i> (Monell 1882)	1954	Europe	Metcalf 1995, Foottit et al. 2006	
<i>Tinocallis platani</i> (Kaltenbach 1842)	1935	Europe	Blackman & Eastop 1994, Foottit et al. 2006	
<i>Tinocallis ulmifolii</i> (Monell 1879)	1914	North America	Blackman & Eastop 1994	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Tinocallis ulmiparvifoliae</i> Matsumura 1998	2001	Asia	CPPDR 1998 17:10	
<i>Tinocallis zekowae</i> (Takahashi 1919)	1983	Asia	Dowell & Gill 1989	
<i>Toxoptera aurantii</i> (Fonscolombe 1841)	1907	Asia	CDFA 1915 4:78, Footit et al. 2006	yes
<i>Tuberculatus annulatus</i> (Hartig 1841)			Blackman & Eastop 1994, Footit et al. 2006	
<i>Uroleucon achilleae</i> Koch 1855	1966	Europe	Blackman & Eastop 1984, Footit et al. 2006	
<i>Vesiculaphis caricis</i> (Fullaway 1910)	1962		Dowell & Gill 1989	
Hemiptera-Artheneidae				
<i>Holcocranum saturejæ</i> (Kolenati 1845)	1997	Europe	Wheeler & Stoops 1999	
Hemiptera-Asterolecaniidae				
<i>Asterolecanium arabidis</i> (Signoret 1876)	1940	North America	Gill 1993	
<i>Asterolecanium bambusae</i> (Boisduval 1869)		Asia	Gill 1993	
<i>Asterolecanium grandiculum</i> Russell 1941		Tropical America	Gill 1993	
<i>Asterolecanium minus</i> Russell 1941		North America	Gill 1993	
<i>Asterolecanium quercicola</i> (Bouché 1851)		North America	Gill 1993	yes
<i>Asterolecanium variolosum</i> (Ratzeburg 1970)	1913	Europe	Gill 1993	
<i>Planchonia stentæ</i> (Brain 1920)	1980	Africa	Miller et al. 2005	
<i>Pollinia pollini</i> (Costa 1828)	1892	Europe	Gill 1993	
Hemiptera-Cercopidae				
<i>Philaenus spumarius</i> (Linnaeus 1758)			BugGuide 2011, Karban & Strauss 2004	
Hemiptera-Cicadellidae				
<i>Agalliota barretti</i> (Ball 1900)	1972	North America	Dowell & Gill 1989	
<i>Allygus mixtus</i> Fabricius 1794	2007	North America	CPPDR 2011 24:6	
<i>Anoscopus flavostriatus</i> (Donovan 1799)		North America	Hamilton 1983	
<i>Anoscopus serratulae</i> (Fabricius 1775)		Europe	Hamilton 1983	
<i>Aphrodes costatus</i> (Panzer 1799)		Europe	Hamilton 1983	
<i>Balclutha rosea</i> Scott 1876	1982	Tropical America	Dowell & Gill 1989	
<i>Circulifer tenellus</i> (Gillette & Baker 1895)	1899	Africa	CDFA 1915 4:64, Hamilton 1983	yes
<i>Empoasca bipunctata</i> (Oshanin 1871)	1955	Europe	Hamilton 1983	
<i>Empoasca fabae</i> (Harris 1841)	<1915	North America	CDFA 1915 4:62, 21:377	yes
<i>Empoasca</i> cf. <i>guevarai</i> Gonzalez 1955	1996	Tropical America	CPPDR 1996 15:5	
<i>Empoasca mexara</i> Ross & Moore 1957	1964	Mexico	CDFA 1965 54:81	
<i>Erythroneura comes</i> (Say 1825)	1868	North America	CDFA 1929 18:766	
<i>Eupteryx decemnotata</i> Rey 1891	2009	Europe	CPPDR 2011 25:13	
<i>Eupteryx melissae</i> Curtis 1837	1903	Europe	Hamilton 1983	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Euscelis obsoleta</i> (Kirschbaum 1858)	1956	North America	Hamilton 1983, Bugguide 2006	
<i>Euscelis variegata</i> (Kirshbaum 1858)	1947	Europe	Gross 2006	
<i>Fieberiella florii</i> (Stål 1864)	1947	North America	Hamilton 1983	yes
<i>Graphocephala versuta</i> (Say 1830)	2003		CPPDR 2006 22:43	
<i>Homalodisca vitripennis</i> (Germar 1821)	1994	North America	CPPDR 1994 13:8	yes
<i>Idiocerus decimaquartus</i> (Schrank 1776)	1928	Europe	Hamilton 1983	
<i>Idona minuenda</i> (Moznette 1919)	1970	Tropical America	Dowell & Gill 1989	
<i>Japananus hyalinus</i> (Osborn 1900)	1975	North America	Dowell & Gill 1989	
<i>Latalus misellus</i> (Ball 1899)	1980	North America	Dowell & Gill 1989	
<i>Macropsis mendax</i> (Fieber 1868)	1944	Europe	Hamilton 1983	
<i>Macropsis ulmi</i> (Scott 1873)	1955	Europe	Dowell & Gill 1989	
<i>Negosiana dualis</i> (DeLong 1942)	1979	North America	Dowell & Gill 1989	
<i>Opsiis stactogalus</i> Fieber 1866	1914	Europe	Hamilton 1983	
<i>Psamnotettix emarginatus</i> Greene 1971	1979	North America	Dowell & Gill 1989	
<i>Rhytidodus decimasquartus</i> (Schrank 1776)		North America	Hamilton 1983	
<i>Ribantiana tenerrima</i> (Herrich-Schaeffer 1834)			BugGuide 2011	
<i>Ribantiana ulmi</i> (Linnaeus 1758)	1926	Europe	Hamilton 1983	
<i>Sanctanus sonorus</i> DeLong & Hershenberger 1946	1986	North America	Dowell & Gill 1989	
<i>Scaphytopius nitridus</i> (DeLong 1943)	1975	Tropical America	Dowell & Gill 1989	
<i>Sophonia rufofascia</i> Kuoh & Kuoh 1983	1995	Hawaii	CPPDR 1996 15:4	yes
<i>Stirellus</i> cf. <i>bicolor</i> Van Duzee 1892	1987	North America	Dowell & Gill 1989	
<i>Texananus gladius</i> DeLong 1938	1963	North America	Dowell & Gill 1989	
<i>Thamnotettix zelleri</i> (Kirschbaum 1868)	1995	Europe	CPPDR 1995 14:4	
<i>Trypanalebra balli</i> Young 1957	1983	North America	Dowell & Gill 1989	
<i>Typhlocyba prunicola</i> Edwards 1914	1949	Europe	Hamilton 1983	
<i>Typhlocyba quercus</i> (Fabricius 1777)	1955	North America	Hamilton 1983	
<i>Typhlocyba rosae</i> (Linnaeus 1758)			BugGuide 2011	
Hemiptera-Cimicidae				
<i>Cimex lectularius</i> Linnaeus 1758	<1900		Milne & Milne 1980	yes
Hemiptera-Coccidae				
<i>Ceroplastes cistudiformis</i> Cockerell 1893	1897	Tropical America	Gill 1988	yes
<i>Ceroplastes sinensis</i> Del Guercio 1900	1887	Asia	Gill 1988	yes
<i>Coccus hesperidum</i> Linnaeus 1758	1880	Africa	Gill 1988, Miller et al. 2005	
<i>Coccus longulus</i> (Douglas 1881)	1909	Africa	Gill 1988, CDFA 1915 4:140	
<i>Coccus pseudomagnoliarum</i> (Kuwana 1914)	1900	Asia	Gill 1988	yes
<i>Eucalymnatus tessellatus</i> (Signoret 1873)	1897	Tropical America	Gill 1988, CDFA 1915 4:139, Miller et al. 2005	
<i>Eulecanium caryae</i> (Fitch 1857)	1936	North America	Gill 1988	
<i>Eulecanium cerasorum</i> (Cockerell 1899)	1909	Asia	Gill 1988, Miller et al. 2005	yes

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Eulecanium excrescens</i> (Ferris 1920)	<1925	Asia	Gill 1988, Essig 1926a	
<i>Eulecanium kunoense</i> (Kuwana 1907)	1896	Asia	Gill 1988	
<i>Eulecanium tiliae</i> (Linnaeus 1758)	1984	North America	Gill 1988	
<i>Neopulvinaria innumerabilis</i> (Rathvon 1854)	<1915	North America	Gill 1988, CDFA 1915 4:135	
<i>Parasaissetia nigra</i> (Nietner 1861)	1906	Asia	Gill 1988	
<i>Parthenolecanium corni</i> (Bouché 1844)	1881	North America	Gill 1988	
<i>Parthenolecanium fletcheri</i> (Cockerell 1893)	1889	North America	Gill 1988, Miller et al. 2005	
<i>Parthenolecanium persicae</i> (Fabricius 1776)	1897	Europe	Gill 1988, Miller et al. 2005	
<i>Parthenolecanium pruinosum</i> (Coquillett 1891)	<1915	Tropical America	Gill 1988	yes
<i>Parthenolecanium quercifex</i> (Fitch 1859)		North America	Gill 1988	
<i>Physokermes hemicryphus</i> (Dalman 1825)	1958	Europe	CDFA 1959 48:127	
<i>Physokermes piceae</i> (Schrank 1801)	1958	North America	Dowell & Gill 1989	
<i>Protopulvinaria pyriformis</i> (Cockerell 1894)	1945	North America	Gill 1988	
<i>Pulvinaria citricola</i> Kuwana 1914	1939	North America	Gill 1988	
<i>Pulvinaria delottoi</i> Gill 1979	1973	Africa	Gill 1988, Miller et al. 2005	
<i>Pulvinaria floccifera</i> (Westwood 1870)		North America	Gill 1988	yes
<i>Pulvinaria hydrangeae</i> Steinweden 1946		North America	Gill 1988	
<i>Pulvinaria mesembryanthemi</i> (Vallot 1829)	1971	Africa	Miller et al. 2005	
<i>Pulvinaria phariae</i> Lull 1899	1906	Asia	Gill 1988, Miller et al. 2005	
<i>Pulvinaria psidii</i> Maskell 1893	1992	Hawaii	CPPDR 1992 11:6	yes
<i>Pulvinaria rhois</i> Ehrhorn 1898		North America	Gill 1988	
<i>Pulvinaria urbicola</i> Cockerell 1893	1993	North America	CPPDR 1992 11:8	
<i>Pulvinaria vitis</i> (Linnaeus 1758)	<1915	North America	Gill 1988, CDFA 1915 4:135	
<i>Saissetia coffeae</i> (Walker 1852)	1914	Africa	Gill 1988, Miller et al. 2005	yes
<i>Saissetia miranda</i> (Cockerell & Parrott 1899)		Tropical America	Gill 1988	
<i>Saissetia oleae</i> (Olivier 1791)	1862	Africa	Gill 1988	yes
Hemiptera-Coreidae				
<i>Anasa tristis</i> (De Geer 1773)	1854	Tropical America	Metcalfe 1995, Essig 1926a	yes
<i>Centrocoris variegatus</i> Kolenati 1845	2009	Europe	CPPDR 2011 25:13	
Hemiptera-Dactylopiidae				
<i>Dactylopius opuntiae</i> (Cockerell 1896)		Mexico	Gill 1993	
<i>Dactylopius tomentosus</i> (Lamarck 1801)		Mexico	Gill 1993	
Hemiptera-Delphacidae				
<i>Delphacodes fulvidorsum</i> (Metcalfe 1923)	1982	Tropical America	Dowell & Gill 1989	
<i>Eurysa magnifrons</i> (Crawford 1914)	1959		CDFA 1959 48:147	
<i>Liburniella ornata</i> (Stål 1862)	1939	North America	Wilson & Gill 1985	
<i>Nilaparvata wolcottii</i> Muir & Giffard 1924	1975	North America	Dowell & Gill 1989	
<i>Peregrinus maidis</i> (Ashmead 1890)	1933	Tropical America	CDFA 1934 23:414	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Sogatella kolophon</i> (Kirkaldy 1907)	1985	Tropical America	Dowell & Gill 1989	
Hemiptera-Diaspididae				
<i>Abgrallaspis cyanophylli</i> (Signoret 1869)	1931	Tropical America	Gill 1997	
<i>Abgrallaspis degeneratus</i> (Leonardi 1896)	1928	Europe	Gill 1997	
<i>Aonidia lauri</i> (Bouché 1833)	1940	Asia	Gill 1997	
<i>Aonidiella aurantii</i> (Maskell 1879)	1872	Asia	Gill 1997	yes
<i>Aonidiella citrina</i> (Coquillett 1891)	1872	Asia	Gill 1997	yes
<i>Aspidiotus nerii</i> (Bouché 1833)	1882	Europe	Gill 1997	yes
<i>Aspidiotus spinosus</i> (Comstock 1883)	1932	Asia	Gill 1997	
<i>Aulacaspis rosae</i> (Bouché 1833)	1931	Europe	Metcalf 1995	
<i>Carulaspis juniperi</i> (Bouché 1851)		Europe	Gill 1997	
<i>Carulaspis minima</i> Targioni-Tozzetti 1868	1931	Europe	Gill 1997	yes
<i>Chionaspis americana</i> Johnson 1896	1933	North America	Gill 1997	
<i>Chionaspis corni</i> Cooley 1899	1900	North America	Gill 1997	
<i>Chionaspis etrusca</i> Leonardi 1908	1923	Africa	Gill 1997	
<i>Chionaspis wistariae</i> Cooley 1897	<1925	Asia	Gill 1997, Miller et al. 2005, Essig 1926a	
<i>Chrysomphalus aonidium</i> (Linnaeus 1758)	<1925		Essig 1926a	
<i>Chrysomphalus bifasciculatus</i> Ferris 1938	1930	Asia	Gill 1997, Miller et al. 2005	
<i>Chrysomphalus dictyospermi</i> (Morgan 1889)	1909	Asia	Gill 1997	
<i>Clavaspis ulmi</i> (Johnson 1896)	1967	North America	Gill 1997	
<i>Comstockiella sabalis</i> (Comstock 1883)	1917	North America	McKenzie 1956	
<i>Diaspidiotus ancylus</i> (Putnam 1878)	1931	North America	Gill 1997	
<i>Diaspidiotus liquidambaris</i> (Kotinsky 1903)	1942	North America	Gill 1997	
<i>Diaspidiotus osborni</i> (Newell & Cockerell 1898)	1904	North America	McKenzie 1956	
<i>Diaspidiotus uvae</i> (Comstock 1881)	1946	North America	Gill 1997	
<i>Diaspis boisduvalii</i> Signoret 1869	1930	Tropical America	Gill 1997	
<i>Diaspis bromeliae</i> (Kerner 1778)	1934	Tropical America	Gill 1997	
<i>Diaspis cocois</i> Lichtenstein 1882	1919	Tropical America	McKenzie 1956, Miller et al. 2005	
<i>Diaspis echinocacti</i> (Bouché 1833)	1931	Tropical America	Gill 1997	
<i>Dynaspidiotus britannicus</i> (Newstead 1898)	1939	Europe	Gill 1997	
<i>Epidiaspis leperii</i> (Signoret 1869)	1882	Europe	Gill 1997	yes
<i>Fiorinia fioriniae</i> (Targioni-Tozzetti 1867)	1931	North America	Gill 1997	
<i>Fiorinia japonica</i> Kuwana 1902	2008	Asia	CPPDR 2011 25:17-18	
<i>Furcadaspis zamiae</i> (Morgan 1890)	1906	Europe	Gill 1997, Miller et al. 2005	yes
<i>Hemiberlesia candidula</i> (Cockerell 1900)	1957	North America	Dowell & Gill 1989	
<i>Hemiberlesia lataniae</i> (Signoret 1869)	1931	North America	Gill 1997	yes
<i>Hemiberlesia rapax</i> (Comstock 1881)	1928	Hawaii	Gill 1997	yes
<i>Kuwanaspis pseudoleucaspis</i> (Kuwana 1902)	1938	Asia	Gill 1997	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Lepidosaphes beckii</i> (Newman 1869)	1889	North America	Gill 1997	yes
<i>Lepidosaphes chinensis</i> Chamberlin 1925	1927	Asia	Gill 1997, Miller et al. 2005	
<i>Lepidosaphes conchiformis</i> (Gmelin 1789)	1904	Africa	Gill 1997	yes
<i>Lepidosaphes gloverii</i> (Packard 1869)	<1925	Asia	Gill 1997, Essig 1926a	
<i>Lepidosaphes pinnaeformis</i> (Bouche 1851)	1936	Asia	Gill 1997	
<i>Lepidosaphes noxia</i> McKenzie 1946	1944	Asia	McKenzie 1956	
<i>Lepidosaphes pallida</i> (Green 1896)	1935	Hawaii	Gill 1997	
<i>Lepidosaphes sciadopitysi</i> McKenzie 1955	1949	Asia	Gill 1997	
<i>Lepidosaphes ulmi</i> (Linnaeus 1758)	1870	Europe	Gill 1997	yes
<i>Leucaspis portaeureae</i> Ferris 1942	1938	Pacific Region	Gill 1997	
<i>Lindingaspis rossi</i> (Maskell 1891)	1892	Australia	Gill 1997	yes
<i>Melanaspis obscurus</i> (Comstock 1881)	1897	North America	Gill 1997	yes
<i>Mercetaspis harperi</i> (McKenzie 1949)	1949	Asia	Gill 1997	
^a <i>Nilotaspis halli</i> (Green 1923)	1934	Africa	Gill 1997	
<i>Odonaspis penicillata</i> (Green 1905)	1936	Asia	Gill 1997	
<i>Odonaspis ruthae</i> Kotinsky 1907	1931	North America	Gill 1997	yes
<i>Parlatoresopsis chinensis</i> (Marlatt 1908)	1948	Asia	Gill 1997	
<i>Parlatoria blanchardi</i> (Targioni-Tozzetti 1892)	1905	Africa	Gill 1997	
<i>Parlatoria camelliae</i> Comstock 1883	1886	Asia	McKenzie 1956, Miller et al. 2005	
<i>Parlatoria crotonis</i> Douglas 1881	1935	Asia	Gill 1997	
<i>Parlatoria oleae</i> (Colvee 1880)	1890	Europe	C DFA 1934 23:415	yes
<i>Parlatoria pergandei</i> Comstock 1881	1889	North America	Gill 1997	
<i>Parlatoria pittospori</i> Maskell 1891	1935	Australia	Gill 1997, Miller et al. 2005	
<i>Pinnaspis aspidistrae</i> (Signoret 1896)	1896	North America	Gill 1997, Miller et al. 2005	
<i>Poliaspis cycadis</i> Comstock 1883	1993		Gill 1997	
<i>Pseudaulacaspis pentagona</i> Targioni-Tozzetti 1855	1888	Asia	Gill 1997	
<i>Quadraspidiotus forbesi</i> (Johnson 1896)	1934	North America	Gill 1997	
<i>Quadraspidiotus juglansregiae</i> (Comstock 1881)	1913	North America	Gill 1997	yes
<i>Quadraspidiotus ostraeformis</i> (Curtis 1843)	1959	North America	Dowell & Gill 1989	
<i>Quadraspidiotus perniciosus</i> (Comstock 1881)	1870	Asia	Gill 1997, Miller et al. 2005	yes
<i>Selenaspis albus</i> McKenzie 1953	1935	Africa	Gill 1997	
<i>Selenaspis rubidus</i> McKenzie 1953	1936	Africa	Miller et al. 2005	
<i>Toumeyella liriodendri</i> (Gmelin 1790)	1942	North America	Gill 1988	yes
<i>Unaspis euonymi</i> (Comstock 1881)	1945	Asia	Gill 1997	yes
Hemiptera-Eriococcidae				
<i>Acanthococcus araucariae</i> (Maskell 1897)	1880	Australia	Gill 1993, Miller et al. 2005	
<i>Acanthococcus coccineus</i> (Cockerell 1894)			Gill 1993	
<i>Acanthococcus insignis</i> (Newstead 1891)		Europe	Gill 1993	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Acanthococcus pittospori</i> (Ferris 1955)	1954	Australia	Gill 1993	
<i>Gossyparia spuria</i> (Modeer 1778)	1893	Europe	Gill 1993	yes
Hemiptera-Flatidae				
<i>Siphanta acuta</i> (Walker 1851)	1983	Hawaii	Dowell & Gill 1989	
Hemiptera-Issidae				
<i>Acanalonia conica</i> (Say 1830)	2002	North America	CPPDR 2001 20:8	
<i>Agalmatium bilobum</i> (Fieber) 1877	1946	Europe	Gnezdilov & O'Brien 2006	
<i>Asarcopus palmarum</i> Horvath 1921	1924	Africa	Essig 1926a	
<i>Caliscelis bonellii</i> (Latreille 1807)	1965	Europe	O'Brien 1967	
Hemiptera-Lecanodiaspididae				
<i>Lecanodiaspis prosopidis</i> (Maskell 1894)		North America	Gill 1993	
Hemiptera-Leptopodidae				
<i>Patapius spinosus</i> (Rossi 1790)	1941	Europe	Slater & Baranowski 1978	
Hemiptera-Lygaeidae				
<i>Blissus insularis</i> Barber 1918	1967	North America	Dowell & Gill 1989	yes
<i>Blissus leucopterus</i> (Say 1832)	1885	North America	CDFA 1915 4:208	
<i>Lachnesthus singalensis</i> (Dohrn 1860)	1965	Asia	Slater & Lattin 1965	
<i>Lamprodema maura</i> (Fabricius 1803)	1979		Dowell & Gill 1989	
<i>Megalonotus sabulicola</i> (Thomson 1870)	1921	North America	Henry & Froeschner 1988	
Hemiptera-Margarodidae				
<i>Icerya purchasi</i> Maskell 1876	1868	Australia	Gill 1993	yes
<i>Kuwania quercus</i> (Kuwana 1902)	1966	Asia	Dowell & Gill 1989	
<i>Margarodes meridionalis</i> Morrison 1927	1954	North America	CDFA 1954 43:134	
Hemiptera-Membracidae				
<i>Idioderma</i> sp.	1988	North America	Dowell & Gill 1989	
Hemiptera-Miridae				
<i>Calocoris norwegicus</i> (Gmelin 1790)	1920		Henry & Froeschner 1988	yes
<i>Campyloneura virgula</i> (Herrick-Schaeffer 1835)	1964		Dowell & Gill 1989	
<i>Capsus ater</i> (Linnaeus 1758)			Wheeler & Henry 1992	
<i>Cyrtopeltis tenuis</i> Reuter 1895			Henry & Froeschner 1988	
<i>Halticotoma valida</i> Townsend 1892			CDFA 1943 32:279	
<i>Heterotoma planicorne</i> (Pallas 1772)	1964	North America	Dowell & Gill 1989	
<i>Lopus decolor</i> (Fallen 1807)			Wheeler & Henry 1992	
<i>Melanotrichus concolor</i> (Kirschbaum 1856)			Wheeler & Henry 1992	
<i>Melanotrichus virescens</i> (Douglas & Scott 1865)			Wheeler & Henry 1992	
<i>Pilophorus clavatus</i> (Linnaeus 1767)			Henry & Froeschner 1988	
<i>Plagiognathus chrysanthemii</i> (Wolff 1804)			Wheeler & Henry 1992	
<i>Polymerus unifasciatus</i> (Fabricius 1794)			Henry & Froeschner 1988	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Psallus ancorifer</i> (Fieber 1858)	1914	Europe	Wheeler & Henry 1992	
<i>Pseudatomoscelis seriatus</i> (Reuter 1876)		North America	CPPDR 26:264	
<i>Taylorilygus pallidulus</i> (Blanchard 1852)	1917	North America	Wheeler & Henry 1992	
<i>Trigonotylus tenuis</i> Reuter 1893			Wheeler & Henry 1992	yes
<i>Trigonotylus uhleri</i> (Reuter 1876)	1993	North America	Daehler & Strong 1995	
Hemiptera-Nabidae				
<i>Anaptus major</i> (Costa 1842)			Henry & Froeschner 1988	
Hemiptera-Ortheziidae				
<i>Orthezia insignis</i> Brown 1887	1911		Gill 1993, CDFA 1915 4:110, Miller et al. 2005	
Hemiptera-Oxycarenidae				
<i>Metopoplax ditomoides</i> (Costa 1847)	2002	Europe	CPPDR 2006 22:9-10	
Hemiptera-Pentatomidae				
<i>Agonoscelis puberula</i> Stal 1854	1997	North America	CPPDR 2007 23: 6-7	
<i>Aelia americana</i> Dallas 1851	1980	North America	Dowell & Gill 1989	
<i>Bagrada hilaris</i> (Burmeister 1835)	2008	Africa	CPPDR 2011 25:14-15	
<i>Elasmucha lateralis</i> (Say 1831)	1969	North America	Dowell & Gill 1989	
<i>Euschistus servus</i> (Say 1832)			Henry & Froeschner 1988	yes
<i>Halyomorpha halys</i> (Stal 1855)	2005	North America	CPPDR 2006 22:8-9	yes
<i>Murgantia histrionica</i> (Hahn 1834)	<1915	North America	CPPDR 1983 2:630, Essig 1917	
<i>Nezara viridula</i> (Linnaeus 1758)	1986	North America	Dowell & Gill 1989	yes
Hemiptera-Phoenicococcidae				
<i>Phoenicococcus marlatti</i> Cockerell 1899	1890	Africa	Gill 1993	
Hemiptera-Phylloxeridae				
<i>Daktulosphaira vitifoliae</i> (Fitch 1855)	1852	North America	Metcalfe 1995	yes
<i>Phylloxera stellata</i> Duncan 1922	1953	North America	CDFA 1953 42:172	
Hemiptera-Pseudococcidae				
<i>Allococcus</i> sp.	1980	Africa	Dowell & Gill 1989	
<i>Antonina crawi</i> Cockerell 1900	1900	Asia	McKenzie 1967, Miller et al. 2002	
<i>Antonina graminis</i> (Maskell 1897)	1957	North America	Dowell & Gill 1989	
<i>Antonina pretiosa</i> Ferris 1953	1915	Asia	McKenzie 1967, Miller et al. 2005	
<i>Balanococcus diminutus</i> (Leonardi 1918)	1906	Europe	McKenzie 1967	
<i>Brevinnia rehi</i> (Lindinger 1943)	1967	Asia	Miller et al. 2002	
<i>Cataenococcus olivaceus</i> (Cockerell 1896)	1960	Tropical America	Dowell & Gill 1989	
<i>Chorizococcus brevicurvis</i> McKenzie 1960	1965	Hawaii	Dowell & Gill 1989	
<i>Chnaurococcus trifolii</i> (Forbes 1885)	1916	North America	McKenzie 1967	
<i>Chorizococcus rostellum</i> (Lobdell 1930)	1932	North America	McKenzie 1967	
<i>Crisicoccus azaleae</i> (Tinsley 1898)	1898	Asia	McKenzie 1967	
<i>Crisicoccus pini</i> (Kuwana 1902)	1918	Asia	McKenzie 1967, Miller et al. 2002	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Deltoctococcus</i> cf. <i>confusus</i> De Lotto 1977	2006	Africa	CPPDR 2007 23:10	
<i>Dysmicoccus brevipes</i> (Cockerell 1893)	1938	North America	McKenzie 1967	
<i>Eriococcus pittospori</i> (Ferris 1955)			Gill 1993	
<i>Ferrisia gilli</i> Gullan 2003	1968	North America	CPPDR 2006 22:16	yes
<i>Ferrisia malvastra</i> (McDaniel 1962)	1960's	Pacific Region	CPPDR 1997 16:8-9	
<i>Ferreisia virgata</i> (Cockerell 1893)	1963	Tropical America	Dowell & Gill 1989	
<i>Heterococcus nudus</i> (Green 1926)	1959	North America	Dowell & Gill 1989	
<i>Hypogeococcus spinosus</i> Ferris 1953	1951	North America	McKenzie 1967	
<i>Maconellicoccus hirsutus</i> (Green 1908)	1999	North America	CPPDR 1999 18:69	yes
<i>Nipaecoccus aurilanatus</i> (Maskell 1890)	1895	Australia	McKenzie 1967	yes
<i>Nipaecoccus nipae</i> (Maskell 1893)	1897	Tropical America	McKenzie 1967, Miller et al. 2002	yes
<i>Palmicultor lumpurensis</i> (Takahashi 1950)	2006	North America	CPPDR 2011 24: 11-12	
<i>Phenacoccus aceris</i> (Signoret 1875)	1971	North America	Dowell & Gill 1989	
<i>Phenacoccus celtisifoliae</i> Hollinger 1917	1936	North America	McKenzie 1967	
<i>Phenacoccus dearnessi</i> King 1901	1922	North America	McKenzie 1967	
<i>Phenacoccus gossypii</i> Townsend & Cockerell 1898			McKenzie 1967	
<i>Phenacoccus graminicola</i> Leonardi 1908	1953	Europe	CDEA 1959 48:127	
<i>Phenacoccus madeirensis</i> Green 1923	1911	North America	McKenzie 1967	yes
<i>Planococcus citri</i> (Risso 1813)	1880	Europe	Metcalf 1995	yes
<i>Planococcus ficus</i> (Signoret 1875)	1994	Africa	CPPDR 1994 13:8	
<i>Planococcus kraunhiae</i> (Kuwana 1902)	1915	Asia	McKenzie 1967	
<i>Pseudantonina arundinariae</i> McConnell 1941	1959	North America	McKenzie 1967	
<i>Pseudococcus affinis</i> (Maskell 1894)	1946	North America	McKenzie 1967	
<i>Pseudococcus calceolariae</i> (Maskell 1897)	1915	Australia	Metcalf 1995, Miller et al. 2002	yes
<i>Pseudococcus comstocki</i> (Kuwana 1902)	1967	North America	Dowell & Gill 1989	yes
<i>Pseudococcus importatus</i> McKenzie 1960	1963	Tropical America	Dowell & Gill 1989	
<i>Pseudococcus longispinus</i> (Targioni-Tozzetti 1867)	1916	Asia	Metcalf 1995	yes
<i>Pseudococcus maritimus</i> (Ehrhorn 1900)	1909	North America	McKenzie 1967	yes
<i>Pseudococcus microcirculus</i> McKenzie 1960	1954	Tropical America	McKenzie 1967, Miller et al. 2002	
<i>Pseudococcus nakaharai</i> Gimpel & Miller 1996	1973	North America	Miller et al. 2005	
<i>Pseudococcus sorghiellus</i> (Forbes 1885)	1964	North America	McKenzie 1967	
<i>Rhizoecus arabicus</i> Hambleton 1976	1996	Tropical America	CPPDR 1996 15:5	yes
<i>Rhizoecus associatus</i> (Hambleton 1946)	1964	Tropical America	McKenzie 1967	yes
<i>Rhizoecus cacticans</i> (Hambleton 1946)	1948	Tropical America	McKenzie 1967	yes
<i>Rhizoecus falcifer</i> Kunckel d'Herculeis 1878	1917	North America	McKenzie 1967, Miller et al. 2002	
<i>Rhizoecus kondonis</i> Kuwana 1923	1921	Asia	McKenzie 1967	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Rhizoecus leucosomus</i> (Cockerell 1901)	1956	North America	McKenzie 1967	
<i>Rhizoecus nakaharai</i> Hambleton 1976			McKenzie 1967	
<i>Rhizoecus dianthi</i> Green 1926	1954	Asia	McKenzie 1967, Miller et al. 2002	
<i>Spilococcus geraniae</i> (Rau 1938)	1966	North America	Dowell & Gill 1989	
<i>Spilococcus mamillariae</i> (Bouche 1844)	1938		Miller et al. 2002	
<i>Trionymus americanus</i> (Cockerell 1899)	1940	North America	McKenzie 1967	
<i>Trionymus caricis</i> McConnell 1941	1961	North America	McKenzie 1967	
<i>Trionymus mocus</i> Ferris 1953	1952		McKenzie 1967	
<i>Vryburgia amaryllidis</i> (Bouché 1873)	1925	Africa	McKenzie 1967, Miller et al. 2005	
<i>Vyburgia brevicurris</i> (McKenzie 1960)	1935		McKenzie 1967	
<i>Vrybergia trionymoides</i> DeLotto 1961	1994	Africa	CPPDR 1994 13:84	
Hemiptera—Psyllidae				
<i>Acizzia acaciae-baileyanae</i> (Froggatt 1901)	1987	Australia	Dowell & Gill 1989	yes
<i>Acizzia</i> cf. <i>jucunda</i> (Tuthill 1952) (undescribed #22)	1992	Australia	CPPDR 1992 11:7	
<i>Acizzia</i> cf. <i>hakeae</i> (Tuthill 1952)	2000	Australia	CPPDR 2000 19:27-28	
<i>Acizzia uncatoides</i> (Ferris & Klyver 1932)	1954	Pacific Region	C DFA 1955 44:164	yes
<i>Agonoscena pistaciae</i> Burckhardt & Lauterer 1989			Percy 2005	
<i>Arytaina genistae</i> (Latreille 1804)	2010	North America	Percy et al. 2012	
<i>Arytainilla spartiophila</i> Forster 1848	1995	North America	Percy et al. 2012	
<i>Bactericera cockerelli</i> (Sulc 1909)	1930's	North America	Liu & Trumble 2007	yes
<i>Blastopsylla occidentalis</i> Taylor 1985	1983	Australia	Hodkinson 1988	
<i>Boreioglycaspis melaleucaae</i> Moore 1964	2009	North America	Arakelian 2009	yes
<i>Cacopsylla buxi</i> (Forster 1848)	1934	Europe	C DFA 1931 20:694	
<i>Cacopsylla fatsiae</i> (Jensen 1957)	1937	Asia	Hodkinson 1988	
<i>Cacopsylla pyricola</i> (Föerster 1848)	1883	North America	C DFA 1954 43:42, Essig 1915	yes
<i>Cacopsylla tobirae</i> Miyatake 1964	2007	Asia	Percy et al. 2012	yes
<i>Calophya schini</i> Tuthill 1959	1984	Tropical America	Dowell & Gill 1989	yes
<i>Cryptoneossa triangula</i> Taylor 1990	1995	Australia	CPPDR 1995 14:31	
<i>Ctenarytaina eucalypti</i> (Maskell 1895)	1991	Australia	CPPDR 1991 10: 5-7	yes
<i>Ctenarytaina longicauda</i> Taylor 1987	1983	Australia	Dowell & Gill 1989	
<i>Ctenarytaina spatulata</i> Taylor 1997	1991	Australia	Percy et al. 2012	
<i>Diaphorina citri</i> Kuwayama 1908	2008	North America	CPPDR 2011 25:19	yes
<i>Eucalyptolyma maideni</i> Froggatt 1901	2000	Australia	CPPDR 2000 19:26	yes
<i>Euphyllura olivine</i> (Costa 1877)	2007	Europe	CPPDR 2011 24:7	yes
<i>Freysuila dugesi</i> Aleman 1887	1997	Mexico	Percy et al. 2012	
<i>Glycaspis brimblecombei</i> Moore 1964	1998	Australia	CPPDR 1998 17:4-10	yes
<i>Freysuila dugesii</i> Aleman 1887	1997	Mexico	CPPDR 1997 16:42	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Heteropsylla cubana</i> Crawford 1914	1986	Hawaii	Dowell & Gill 1989	
<i>Heteropsylla flexuosa</i> Muddiman, Hodkinson & Hollis 1992	1996	Tropical America	CPPDR 1996 15:5	
<i>Homotoma ficus</i> (Linnaeus 1758)	1969	Europe	Dowell & Gill 1989	
<i>Pachypsylla celtidismamma</i> (Fletcher 1882)	1989	North America	CPPDR 1989 8:9	
<i>Pachypsylla celtidisvesicula</i> (Riley 1884)	1960	North America	Dowell & Gill 1989	
<i>Platycorypha nigrivirga</i> Burckhardt 1987	2008	Tropical America	CPPDR 2011 25:18	
<i>Pseudacysta perseae</i> (Heidemann 1908)	2004	Tropical America	CPPDR 2006 22:10-11	yes
<i>Psylla uncatoides</i> (Ferris & Klyver 1932)	1955	Hawaii	Dowell & Gill 1989	
<i>Trioza alacris</i> Flor 1861	1911	Europe	Percy et al. 2012	
<i>Trioza eugeniae</i> Froggatt 1901	1988	Australia	Percy et al. 2012	
Hemiptera-Pyrrhocoridae				
<i>Scantius aegyptius</i> Linnaeus 1758	2009	Europe	Bryant 2009	yes
Hemiptera-Rhopalidae				
<i>Jadera haematoloma</i> (Herrich-Schaeffer 1847)	< 1917	Tropical America	Henry and Froeschner 1988, Van Duzee 1917	
<i>Liorhysus hyalinus</i> (Fabricius 1794)	<1925	Europe	Essig 1926a	
<i>Rhopalus tigrinus</i> (Schilling 1817)	1998	Asia	Wheeler & Hoebeke 1999	
Hemiptera-Rhyparochromidae				
<i>Raglius alboacuminatus</i> Goeze 1778	2002	Europe	Henry 2004, CPPDR 2006 22:12	
<i>Xanthochilus saturnius</i> (Rossi 1790)	1997	Europe	Henry & Adamski 1998	
Hemiptera-Tingidae				
<i>Corythucha gossypii</i> (Fabricius 1794)	2000	Hawaii	CPPDR 2007 23: 8	
<i>Corythucha montivaga</i> Drake 1919	1971		Dowell & Gill 1989	
<i>Gargaphia arizonica</i> Drake & Carvalho 1944	1970	North America	Dowell & Gill 1989	
<i>Pseudacysta perseae</i> (Heidemann 1908)	2004	North America	CPPDR 2006 22:10-11	
<i>Stephanitis pyriodes</i> (Scott 1874)		Asia	Gyeltshen & Hodges 2006	
<i>Teleonemia scrupulosa</i> Stål 1873	1994	North America	CPPDR 1994 13:84	
Hemiptera-Trioizidae				
<i>Trioza alacris</i> Flor 1861	1911	Europe	CDFA 1911-12 1:86	
<i>Trioza chenopodii</i> Reuter 1876	1997	Europe	CPPDR 1997 16:41	
<i>Trioza eugeniae</i> Froggatt 1901	1988	Australia	Dowell & Gill 1989	yes
Hymenoptera-Agaonidae				
<i>Acophila</i> sp. Ishii 1934	1997	Hawaii	Beardsley & Rasplus 2010	
<i>Blastophaga psenes</i> (Linnaeus 1758)	1891	Europe	Arnett 1985, CDFA 1915 4:366	
<i>Eupristina verticillata</i> Waterston 1921	1994		CPPDR 1994 13:62	
<i>Josephiella microcarpa</i> Beardsley & Rasplus 2001	1997	Asia	Beardsley & Rasplus 2010	
<i>Odontofroggata galili</i> Wiebes 1980	1994		CPPDR 1994 13:62	
<i>Odontofroggata ishii</i> Wiebes 1980	1994		CPPDR 1994 13:62	
<i>Walkerella microcarpa</i> Boucek 1993	1994		CPPDR 1994 13:62	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Hymenoptera-Anthophoridae				
<i>Ceratina dallatorreana</i> (Fries 1869)	1949	Africa	Daly 1973	
Hymenoptera-Apidae				
<i>Apis mellifer scutellata</i> Lepeletier 1836	1985	North America	Dowell & Gill 1989	yes
Hymenoptera-Argidae				
<i>Schizocerella pilicornis</i> Holmgren 1868		North America	University of California 2011	
Hymenoptera-Braconidae				
<i>Dendrosoter protuberans</i> (Nees 1834)	1978	North America	Hajek & Dahlsten 1981	
Hymenoptera-Cephidae				
<i>Cephus cinctus</i> Norton 1872	1890	Asia	Ivie 2001	
Hymenoptera-Ceraphronidae				
<i>Ceraphron abnormis</i> Perkins 1910			Krombein & Hurd 1979	
Hymenoptera-Chrysididae				
<i>Chrysis angolensis</i> Radoszkowski 1881	1959	North America	CDFA 1959 48:127	
<i>Pseudomalus auratus</i> (Linnaeus 1758)			Bohart & Kimsey 1982	
Hymenoptera-Colletidae				
<i>Hylaeus bisinuatus</i> Forster 1871			Krombein & Hurd 1979	
<i>Hylaeus punctatus</i> (Brullé 1832)	1981	Europe	Snelling 1982	
Hymenoptera-Cynipidae				
<i>Plagiotrochus suberi</i> Weld 1926	1926	Europe	Zuparko 1996	
Hymenoptera-Encyritidae				
<i>Psyllaephagus parvus</i> Riek 1962	2007	Australia	Jones et al. 2011	
<i>Psyllaephagus perplexus</i> Riek 1962	2007	Australia	Jones et al. 2011	
Hymenoptera-Eulophidae				
<i>Aprostocetus diplosidis</i> Crawford 1907	1972	North America	Summers 1976	
<i>Aprostocetus</i> sp. #1 Westwood 1833	1991	Australia	CPPDR 1991 10:42	
<i>Aprostocetus</i> sp. #2 Westwood 1833	1994	Australia	CPPDR 1995 14:5, Headrick et al. 1995	
<i>Cirrospilus</i> sp. #1	1991	Australia	Headrick et al. 1995	
<i>Epichrysocharis burwelli</i> Schauff 2000	1999	Australia	CPPDR 1999 18:16	
<i>Oncastichus goughi</i> Headrick & LaSalle 1995	1980's	Australia	Headrick et al. 1995	
<i>Quadrastichodella nova</i> Girault 1922	1957	Australia	Timberlake 1957	
<i>Selitrichodes globulus</i> La Salle & Gates 2009	2008	Australia	La Salle et al. 2009	
Hymenoptera-Eupelmidae				
<i>Macroneura versicularis</i> (Retzius 1783)		North America	Krombein & Hurd 1979	
Hymenoptera-Eurytomidae				
<i>Bruchophagus gibba</i> Boheman 1836	<1915		CDFA 1915 4:368	
<i>Bruchophagus platypterus</i> (Walker 1834)		North America	Davidson & Lyon 1987	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Bruchophagus roddi</i> (Gussakovsky 1933)			Davidson & Lyon 1987	
<i>Eurytoma orchidearum</i> (Westwood 1869)	1914	Tropical America	Krombein & Hurd 1979, Essig 1915	
<i>Eurytoma tumoris</i> Bugbee 1962	1964		Krombein & Hurd 1979	
<i>Harmolita grandis</i> (Riley 1884)	1915	North America	Metcalf 1995	
<i>Harmolita websteri</i> (Howard 1896)	<1925		Krombein & Hurd 1979, Essig 1926a	
<i>Sycophila</i> sp. Walker 1871	1994	Hawaii	CPPDR 1994 13:62	
<i>Systole geniculata</i> Foerster 1861		Europe	Krombein & Hurd 1979	
<i>Tetramesa tritici</i> (Fitch 1859)	1853		Metcalf 1995	
Hymenoptera-Figitidae				
<i>Melanips opacus</i> (Hartig 1840)		Europe	Krombein & Hurd 1979	
Hymenoptera-Formicidae				
<i>Brachymyrmex patagonicus</i> Mayr 1868	2010	North America	Martinez et al. 2011	
<i>Camponotus sayi</i> Emery 1893	1963	North America	Dowell & Gill 1989	
<i>Cardiocondyla ectopia</i> Snelling 1974	1972		Mackay 1995	
<i>Cardiocondyla nuda</i> (Mayr 1866)	1958	Asia	Dowell & Gill 1989	
<i>Hypoponera gleadowi</i> (Forel 1895)	1999		CPPDR 1999 18:19	
<i>Hypoponera punctatissima</i> (Roger 1859)			Krombein & Hurd 1979	
<i>Linepithema humile</i> (Mayr 1868)	1908	Tropical America	Knight & Rust 1990	yes
<i>Monomorium pharaonis</i> (Linnaeus 1758)	<1925	Africa	Knight & Rust 1990, Essig 1926a	yes
<i>Ochetomyrmex auropunctata</i> (Roger 1863)		Tropical America	Arnett 1985	
<i>Paratrechina currens</i> (Mostchoulsky 1863)	1964		CDFA 1965 54:81	
<i>Paratrechina longicornis</i> (Latreille 1802)	1967	North America	Dowell & Gill 1989	
<i>Paratrechina vividula</i> (Nylander 1846)		Mexico	Smith 1979, Ward 2005	
<i>Pheidole fervens</i> Smith 1858	1995	Hawaii	Martinez 1996	
<i>Pheidole moerens</i> Wheeler 1908	1995	North America	Martinez 1997	
<i>Pheidole teneriffana</i> Forel 1893	1989	Africa	Snelling 1992, Davidson & Lyon 1987, Martinez 1992	
<i>Plagiolepis alluaudi</i> Emery 1894		Africa	Wetterer 2013	
<i>Solenopsis wagneri</i> Santschi 1916	1997	North America	CPPDR 1997 16:41	yes
<i>Strumigenys silvestri</i> Emery 1906			Ward 2005	
<i>Tapinoma melanocephalum</i> (Fabricius 1793)	1991	North America	CPPDR 1991 10:68	yes
<i>Tetramorium bicarinatum</i> (Nylander 1846)	1990	North America	Martinez 1993	
<i>Tetramorium caespitum</i> (Linnaeus 1758)	<1925	North America	Knight & Rust 1990, Essig 1926a	yes
<i>Tetramorium insolens</i> (Smith 1861)			Bolton 1979	
<i>Tetramorium pacificum</i> Mayr 1870	1944		Krombein & Hurd 1979	
<i>Tetramorium simillium</i> (Smith 1851)			Bolton 1979	
<i>Trichoscapa membranifera</i> (Emery 1869)	1963	North America	Dowell & Gill 1989	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Hymenoptera-Ichneumonidae				
<i>Stilpnus gagates</i> Gravenhorst 1807	1985	North America	Dowell & Gill 1989	
Hymenoptera-Megachilidae				
<i>Megachile apicalis</i> Spinola 1808	1982	North America	Barthell et al. 1998, Cooper 1984	
<i>Megachile argentata</i> (Fabricius 1793)	1949	North America	Hurd 1954	
<i>Megachile concinna</i> Smith 1879		North America	Barthell et al. 1998	
<i>Megachile rotundata</i> (Fabricius 1787)	1949	North America	Powell & Hogue 1979, Barthell et al. 1998	
Hymenoptera-Pteromalidae				
<i>Anisopteromalus calandrae</i> (Howard 1881)			Krombein & Hurd 1979	
<i>Cerocephala rufa</i> (Walker 1833)			Krombein & Hurd 1979	
<i>Cyclogastrella deplanata</i> (Nees 1834)			Krombein & Hurd 1979	
<i>Theocolax elegans</i> (Westwood 1874)			Krombein & Hurd 1979	
<i>Trichomalus perfectus</i> (Walker 1837)			Krombein & Hurd 1979	
Hymenoptera-Spechidae				
<i>Cemonus lethifer</i> (Shuckard 1837)		North America	Krombein & Hurd 1979	
<i>Rhopalum clavipes</i> (Linnaeus 1758)			Lindroth 1957	
Hymenoptera-Tenthredinidae				
<i>Ardis sulcata</i> (Cameron 1882)	1937	Europe	Middlekauff 1958	
<i>Caliroa cerasi</i> (Linnaeus 1758)	1875	North America	Metcalf 1995	yes
<i>Cladius difformis</i> (Panzer 1799)	1921		Metcalf 1995	
<i>Endelomyia aethiops</i> (Fabricius 1781)		North America	Krombein & Hurd 1979	
<i>Fenusia dohrnii</i> (Tischbein 1846)	1986	North America	Dowell & Gill 1989	
<i>Nematus ribesii</i> (Scopoli 1763)		North America	Arnett 1985	
<i>Pachynematus sporax</i> Ross 1945	1951	North America	CDFA 1954 43:170	
<i>Pristiphora abbreviata</i> (Hartig 1837)	1881	North America	Krombein & Hurd 1979, CDFA4:360	yes
<i>Tomostethus multicoloratus</i> (Rohwer 1909)	1950	North America	CDFA 1950 39:183	
Hymenoptera-Torymidae				
<i>Ditropinotus aureoviridis</i> Crawford 1907	<1915		CDFA 1915 4:370, Dowell & Gill 1989	
<i>Megastigmus pistaciae</i> Walker 1871	1967	Asia	Dowell & Gill 1989	yes
<i>Megastigmus transvaalensis</i> (Hussey 1956)	1960	Africa	Krombein & Hurd 1979, Dowell & Gill 1989	
Hymenoptera-Vespididae				
<i>Polistes dominulus</i> (Christ 1791)	1997	North America	CPPDR 1997 16:44	yes
<i>Polistes apachus</i> Saussure 1857	1921	North America	Bohart & Bechtel 1957	yes
<i>Vespula germanica</i> (Fabricius 1793)	1983	North America	Vetter et al. 1995	yes
Isopoda-Armadillidiidae				
<i>Armadillidium nasatum</i> Budde-Lund 1885		Europe	Jass & Klausmeier 2001	
<i>Armadillidium vulgare</i> (Latreille 1804)	<1925	Europe	Jass & Klausmeier 2000, Essig 1926a	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Isopoda-Trichoniscidae				
<i>Haplophthalmus danicus</i> Budde-Lund 1879		Europe	Jass & Klausmeier 2001	
Isopoda-Ligiidae				
<i>Ligia exotica</i> Roux 1828			Jass & Klausmeier 2001	
<i>Ligidium elrodii</i> (Packard 1873)		Europe	Jass & Klausmeier 2001	
Isopoda-Platyarthridae				
<i>Niambia capensis</i> (Dollfus 1895)		Africa	Jass & Klausmeier 2001, Brusca et al. 2001	
Isopoda-Oniscidae				
<i>Platyarthrus aiasensis</i> Legrand 1954		Europe	Jass & Klausmeier 2001,	
Isopoda-Porcellioniade				
<i>Porcellio dilatatus</i> Brandt & Ratzeburg 1831		Europe	Jass & Klausmeier 2001,	
<i>Porcellio laevis</i> Latreille 1804	<1915	Europe	Jass & Klausmeier 2001, Essig 1915	
<i>Porcellio scaber</i> Latreille 1804		Europe	Jass & Klausmeier 2001	
<i>Porcellionides pruinosus</i> (Brandt 1833)			Lindroth 1957, Richardson 1905	
Isoptera-Rhinotermitidae				
<i>Coptotermes formosanus</i> Shiraki 1909	1992	Hawaii	CPPDR 1992 11:4	yes
Lepidoptera-Argyresthiidae				
<i>Argyresthia conjugella</i> Zeller 1839			Zhang 1994, Carter 1984	
<i>Argyresthia pruniella</i> (Clerk 1759)			Carter 1984	
Lepidoptera-Arctiidae				
<i>Hyphantria cunea</i> (Drury 1773)	<1915	North America	Lindroth 1957, CDFA 1915 4:391, Carter 1984	yes
Lepidoptera-Bucculatrigridae				
<i>Bucculatrix thurberiella</i> Busck 1914		Mexico	Zhang 1994	yes
<i>Bucculatrix tridenticola</i> Braun 1963	1963	North America	Dowell & Gill 1989	
Lepidoptera-Choreutidae				
<i>Choreutis pariana</i> (Clerck 1759)	1944	North America	CDFA 1944 33:248	
Lepidoptera-Coleophoridae				
<i>Coleophora mayrella</i> (Hübner 1813)	1952	Europe	CDFA 1952 41:182	
<i>Homaledra sabalella</i> (Chambers 1880)	2000	North America	CPPDR 2000 19:29	yes
Lepidoptera-Cosmopterygidae				
<i>Periploca nigra</i> Hodges 1962	1962	North America	Powell & Opler 2009, Dowell & Gill 1989	
<i>Pyroderces badia</i> Hodges 1962	<1925	North America	Essig 1926a, Powell & Opler 2009	
Lepidoptera-Crambidae				
<i>Asciodes gordialis</i> Guenee 1854	2005	North America	CPPDR 2006 22: 21	
<i>Diaphania nitidalis</i> (Stoll 1781)	1992	North America	CPPDR 1992 11:71	
<i>Eoreuma loftini</i> (Dyar 1917)	1945	Asia	CDFA 1945 34:175	
<i>Glyphodes onychinalis</i> (Guenee 1854)	2000	Pacific Region	CPPDR 2000 19:30	
<i>Hellula rogatalis</i> (Hulst 1886)			Powell 2005	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Lineodes elcodes</i> Dyar 1910	2003	Tropical America	CPPDR 2006 22:20	
<i>Loxostege sticticalis</i> (Linnaeus, 1761)			Carter 1984	yes
<i>Ostrinia penitalis</i> (Grote 1796)	1952	North America	CDFA 1953 42:204	
<i>Parapidiasia teterrella</i> (Zincken 1821)	1954	North America	Powell 1992	
<i>Udea ferrugalis</i> (Hübner 1796)	1907	North America	Campbell 1927	
<i>Uresiphita reversalis</i> (Guenée 1854)	1929		CDFA 1933 22:410	yes
Lepidoptera-Ethmiidae				
<i>Pyramidobela angelarum</i> Keifer 1936	1934	Mexico	CDFA 1942 31:177	
Lepidoptera-Gelechiidae				
<i>Anarsia lineatella</i> Zeller 1839	1900	North America	Metcalf 1995, Carter 1984	yes
<i>Athrips rancidella</i> (Herrich-Schaffer 1854)	1983	Europe	Dowell & Gill 1989	
<i>Chrysoesthia lingulacella</i> (Clemens 1860)		North America	Powell & Opler 2009	
<i>Dichomeris marginella</i> (Fabricius 1781)	1922	Europe	CDFA 1928 17:17, 47	
<i>Euscrobipalpa artemisiella</i> (Treitschke 1833)			Powell & Hsu 2004	
<i>Euscrobipalpa artiplicella</i> (F. von Roslerstamm 1841)			Powell & Hsu 2004	
<i>Euscrobipalpa instabiliella</i> (Douglas 1846)			Powell & Hsu 2004	
<i>Euscrobipalpa obsoletella</i> (F. von Roslerstamm 1841)			Powell & Hsu 2004	
<i>Keiferia lycopersicella</i> (Walsingham 1897)	1922	Tropical America	CDFA 1934 23:301	yes
<i>Metzneria lappella</i> (Linnaeus 1758)	1958	North America	Powell & Opler 2009	
<i>Mirificarma eburnella</i> (Denis & Schiffermüller 1775)	1969		Powell & Hsu 2004, Powell & Opler 2009	
<i>Mirificarma formosella</i> (Hubner 1796)	1969	Europe	Dowell & Gill 1989	
<i>Pectinophora gossypiella</i> (Saunders 1844)	1965	Tropical America	Dowell & Gill 1989	yes
<i>Phthorimaea operculella</i> (Zeller 1873)	1854	Tropical America	Metcalf 1995, Carter 1984	yes
<i>Platyedra subcinerea</i> (Haworth 1828)	1990	Europe	Powell & Opler 2009	
<i>Recurvaria nanella</i> Denis and Schiffermuller 1775			Aukema et al. 2010,	
<i>Sitotroga cerealella</i> (Olivier 1789)	<1915		Arnett 1985	
<i>Stenolechia bathyrodys</i> Meyrick 1935	1980	Asia	Dowell & Gill 1989	
<i>Symmetrischema striatellum</i> (Murtfeldt 1900)	1930's		Powell & Hsu 2004, Powell & Opler 2009	
<i>Symmetrischema tangolias</i> (Geyen 1913)	1936	Tropical America	McDunnough 1939	
Lepidoptera-Geometridae				
<i>Alsophila pometaria</i> (Harris 1841)	<1915	North America	CDFA 1915 4:477	yes
<i>Disclisioprocta stellata</i> (Guenee 1857)	2006	North America	CPPDR 2007 23:12	yes
Lepidoptera-Gracillariidae				
<i>Caloptilia azaleella</i> (Brants 1913)	1960's	North America	Powell & Opler 2009	
<i>Caloptilia fraxinella</i> (Ely 1915)			Zhang 1994	
<i>Caloptilia negundella</i> (Chambers 1876)			Aukema et al. 2010	
<i>Caloptilia syringella</i> (Fabricius 1794)			Zhang 1994	
<i>Lithocolletis mespilella</i> (Hübner 1805)			Zhang 1994	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Phyllocnistis citrella</i> Stainton 1856	1999	North America	CPPDR 1999 18:79	yes
<i>Phyllonorycter crataegella</i> (Clemens 1859)	<1952	North America	C DFA 1952 41:181	
<i>Phyllocnistis</i> sp. Zeller 1848	1963	North America	Dowell & Gill 1989	
Lepidoptera-Helioidinidae				
<i>Aetole bella</i> Chambers 1875	1890	Europe	Powell & Opler 2009	
Lepidoptera-Limacodidae				
<i>Sibine stimulea</i> (Clemens 1860)	1965	North America	Dowell & Gill 1989	
Lepidoptera-Lymantriidae				
<i>Leucoma salicis</i> (Linnaeus 1758)	1960	North America	Dowell & Gill 1989	
^a <i>Lymantria dispar</i> (Linnaeus 1758)	1976	North America	Dowell & Gill 1989	yes
^a <i>Lymantria dispar asiatica</i> Vnukovskij 1926	2005	Asia	CPPDR 2006 22: 19-20	
<i>Orgyia antiqua</i> (Linnaeus 1758)	<1925	North America	Martineau 1984, Essig 1926a	
Lepidoptera-Lyonetiidae				
<i>Bedellia somnulentella</i> (Zeller 1847)			Powell & Hsu 2004, Powell 2005	
Lepidoptera-Noctuidae				
<i>Ascalapha odorata</i> (Linnaeus 1758)	<1925	Mexico	Powell & Hogue 1979, Essig 1926a	
<i>Agrotis malefida</i> Guenee 1852	1960	North America	Dowell & Gill 1989	
<i>Amphipyra tragopoginis</i> Clerk 1759			Aukema et al. 2010,	
<i>Apamea indocilis</i> Walker 1856	1970		Dowell & Gill 1989	
<i>Athetis mindara</i> (Barnes & McDunnough 1913)	1958		C DFA 1960 49:246	
<i>Discestra trifolii</i> (Hufnagel 1766)			Zhang 1994	
<i>Euxoa ochrogaster</i> (Guenee 1852)	1970		Dowell & Gill 1989	
<i>Feltia jaculifera</i> (Guenee 1852)			Powell 2005	
<i>Macronoctua onusta</i> Grote 1874	1963		Dowell & Gill 1989	
<i>Noctua pronuba</i> (Linnaeus 1758)	2001	North America	Powell 2002	
<i>Peridroma saucia</i> (Hubner 1808)			Aukema et al. 2010,	yes
<i>Pseudaletia unipunctata</i> (Haworth 1809)			C DFA 1959 48:20, Powell 2005	
<i>Sideridis rosa</i> Harvey 1874	1970	North America	Dowell & Gill 1989	
<i>Spodoptera exigua</i> (Hübner 1808)	1876	Tropical America	Davidson & Lyon 1987, Powell & Opler 2009	
<i>Spodoptera frugiperda</i> (J.E. Smith 1797)	1931		C DFA 1931 20:613	
<i>Trichoplusia ni</i> (Hubner 1803)		North America	Powell 2005	yes
Lepidoptera-Nymphalidae				
<i>Dione vanillae</i> (Linnaeus 1758)	1875	Mexico	Hogue 1974	
Lepidoptera-Oecophoridae				
<i>Agonopterix alstroemeriana</i> (Clerck 1759)	1983	North America	Powell 1991	
<i>Agonopterix nervosa</i> (Haworth 1811)	<1957	Europe	Hodges 1974, Powell & Opler 2009	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Batia lunaris</i> (Haworth 1828)	1956		Powell 1964b, Powell & Opler 2009	
<i>Borkhausenia nefrax</i> Hodges 1974	1936		Powell 1964a	
<i>Depressaria daucella</i> (Denis & Schiffermüller 1775)	1957		Hodges 1974, Powell & Opler 2009	
<i>Depressaria pastinacella</i> (Duponchel 1838)			Zhang 1994, Carter 1984	
<i>Endrosis sarcitrella</i> (Linnaeus 1758)	1902		Zhang 1994, Powell & Opler 2009	
<i>Esperia sulphurella</i> (Fabricius 1775)	1966	Europe	Powell 1968b	
<i>Hofmannophila pseudospretella</i> (Stainton 1849)	1871		Hodges 1974, Powell & Opler 2009	
Lepidoptera-Papilionidae				
<i>Papilio crespontes</i> Cramer 1777	1959	North America	CDFA 1959 48:127	
Lepidoptera-Pieridae				
<i>Pieris rapae</i> (Linnaeus 1758)	1882	North America	Metcalf 1995, Shapiro and Manolis 2007	yes
Lepidoptera-Plutellidae				
<i>Homadaula anisocentra</i> Meyrick 1922	1963		Dowell & Gill 1989	yes
<i>Plutella porrectella</i> (Linnaeus 1758)	<1871	North America	Powell 1967, Powell & Opler 2009	
<i>Plutella xylostella</i> (Linnaeus 1758)		North America	Powell & Hogue 1979	yes
Lepidoptera-Psychidae				
<i>Apterona helix</i> (Siebold 1850)	1940	Asia	CDFA 1944 33:250, Powell & Opler 2009	
<i>Oiketicus townsendi</i> (Townsend 1894)	1968	North America	Dowell & Gill 1989	
<i>Thyridopteryx ephemeraeformis</i> (Haworth 1803)	1953	North America	Zhang 1994	
Lepidoptera-Pterophoridae				
<i>Emmelina monodactylus</i> (Linnaeus 1758)			Powell & Hsu 2004	
<i>Gillmeria pallidactyla</i> (Haworth 1811)	1871		Powell & Hsu 2004, Powell & Opler 2009	
<i>Hellinsia longifrons</i> (Walsingham 1915)			Powell & Hsu 2004	
<i>Megalorhipida defectalis</i> (Walker 1864)			Powell & Hsu 2004	
<i>Platyptilia carduidactyla</i> (Riley 1869)	1922	North America	Metcalf 1995	
<i>Platyptilia pallidactyla</i> (Haworth 1811)			Powell 2005	
Lepidoptera-Pyralidae				
<i>Achroia grisella</i> (Fabricius 1794)	1908	Europe	Zhang 1994, Carter 1984	
<i>Acrobasis indigenella</i> (Zeller 1848)	1924	North America	CDFA 1959 48:206	
<i>Acrobasis nuxvorella</i> Neunzig 1970	1924	North America	Metcalf 1995	
<i>Aglossa caprealis</i> (Hubner 1809)	1936		Powell & Opler 2009,	
<i>Aglossa pinguinalis</i> (Linnaeus 1758)	1993		Solis 2008,	
<i>Amyelois transitella</i> (Walker 1863)	1947	North America	CDFA 1948 37:204	
<i>Cadra cautella</i> (Walker 1863)	1913		Neunzig 1990, Powell & Opler 2009	
<i>Cadra figulilella</i> (Gregson 1871)	1930	North America	CDFA 1931 20:64	
<i>Duponchelia fovealis</i> Zeller 1847	2004	Europe	CPPDR 2006 22: 20-21	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Ectomyelois ceratoniae</i> (Zeller 1839)	1983	North America	Dowell & Gill 1989	yes
<i>Ephestia ehutella</i> (Hübner 1796)	1911	Asia	Neunzig 1990	
<i>Ephestia kuehniella</i> (Zeller 1879)	1889		Zhang 1994, Powell & Opler 2009	
<i>Etiella zinckenella</i> (Treitschke 1832)	1885	Europe	CDFA 1915 4:433, Stone 1965	
<i>Euchromius ocellus</i> (Haworth 1811)	<1900	North America	Powell & Opler 2009	
<i>Eumysia mysiella</i> (Dyar 1905)	1975		Dowell & Gill 1989	
<i>Galleria mellonella</i> (Linnaeus 1758)	1875	North America	Zhang 1994	
<i>Hymenia perspectalis</i> (Hübner 1796)		North America	Zhang 1994	
<i>Hypsopygia costalis</i> (Fabricius 1775)	1968	North America	Pohl et al. 2005	
<i>Paralipsa gularis</i> (Zeller 1877)	<1921		CDFA 1921 10:142	
<i>Phycitodes albatella</i> (Ragonot 1887)			Zhang 1994	
<i>Plodia interpunctella</i> (Hübner 1813)	1881	Europe	Metcalf 1995	yes
<i>Pyralis farinalis</i> Linnaeus 1758	<1925		Zhang 1994, Essig 1926a	
<i>Pyrausta laticlavata</i> (Grote & Robinson 1867)	1880's	North America	Powell & Opler 2009	
<i>Pyrausta volupialis</i> (Grote 1877)	1991	North America	Powell & Opler 2009	
<i>Pyla fusca</i> (Haworth 1828)			Lafontaine & Wood 1997	
Lepidoptera-Sesiidae				
<i>Podosesia syringae</i> (Harris 1839)	1979	North America	Dowell & Gill 1989	yes
<i>Synanthedon saxifragae</i> (Edwards 1881)	1950		Smith 1950	
<i>Synanthedon tipuliformis</i> (Clerck 1759)	1880	North America	Zhang 1994	
<i>Synanthedon exitiosa</i> (Say 1823)	1914	North America	CDFA 1915 4:421	yes
Lepidoptera-Sphingidae				
<i>Manduca sexta</i> (Linnaeus 1763)	1871	North America	Metcalf 1995	yes
Lepidoptera-Symmocidae				
<i>Oegoconia quadripuncta</i> (Haworth 1828)		North America	Powell 1992	
<i>Symmoca signatella</i> Herrich-Schaeffer 1854		Europe	CDFA 1942 31:175	
Lepidoptera-Tineidae				
<i>Dryadula terpsichorella</i> (Busck 1910)	1963	Tropical America	CPPDR 1999 18:81, Powell & Opler 2009	
<i>Lindera tessellatella</i> (Blanchard 1854)			Powell & Hsu 2004	
<i>Monopis crocicapitella</i> (Clemens 1859)			Powell & Hsu 2004	
<i>Monopis rusticella</i> (Hubner 1796)			Powell & Hsu 2004	
<i>Nemapogon granellus</i> (Linnaeus 1758)	1963		Arnett 1985	
<i>Niditinea spretella</i> (Denis & Schiffermüller 1775)			CDFA 1943 32:258	
<i>Oinophila v-flava</i> (Haworth 1828)		Europe	Powell 1964b, Powell 1992, Powell & Opler 2009	
<i>Opogona omoscopia</i> (Meyrick 1892)		Hawaii	Powell 1992	yes
<i>Phereocera praecox</i> Gozmany & Vari 1973	1966	Africa	CPPDR 2000 19:29	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Setomorpha rutella</i> Zeller 1852			CDFA 1958 47:248, Powell & Hsu 2004	
<i>Tinea pallescentella</i> Stainton 1851			Powell & Hsu 2004, Powell & Opler 2009	
<i>Tinea pellionella</i> (Linnaeus 1758)			Arnett 1985, Essig 1926a	yes
<i>Tineola biselliella</i> Hummel 1823			Arnett 1985, Essig 1926a	yes
<i>Trichophaga tapetzella</i> (Linnaeus 1758)	<1940		Arnett 1985, Essig 1926a	
Lepidoptera-Tortricidae				
<i>Acleris variegana</i> (Denis & Schiffermuller 1775)			Powell 2005, Powell & Opler 2009	
<i>Ancylis comptana</i> (Frolich 1828)		North America	Essig 1926a, 1958, Powell & Opler 2009	
<i>Bactra priapeia</i> Heinrich 1923		North America	Powell 1997	
<i>Choristoneura confictana</i> (Walker 1863)		North America	Dowell & Gill 1989	
<i>Cnephasia longana</i> (Haworth 1811)		Europe	CDFA 1948 37:204	
<i>Crociosema plebejana</i> Zeller 1847		North America	Powell 1992	
<i>Cydia pomonella</i> (Linnaeus 1758)		North America	Metcalf 1995, Powell & Opler 2009	
<i>Cydia prunivora</i> Walsh 1868		North America	Essig 1926a	
<i>Ditula angustiorana</i> (Haworth 1811)		Europe	CDFA 1933 22:351	
<i>Endothenia albolineana</i> (Kearfoot 1907)		North America	Dowell & Gill 1989	
<i>Epinotia solandriana</i> (Linnaeus 1758)			Aukema et al. 2010,	
<i>Epiphyas postvittana</i> (Walker 1863)	2007	Australia	Powell & Opler 2009	
<i>Grapholita molesta</i> (Busck 1916)		North America	CDFA 1942 31:175	
^b <i>Lobesia botrana</i> (Denis & Schiffermuller 1775)		Europe	Gullian et al. 2011	yes
<i>Lorita scarificata</i> (Meyrick 1917)			Zhang 1994	
<i>Platynota stultana</i> Walsingham 1884		North America	Powell 1980	yes
<i>Rhyacionia frustrana</i> (Scudder, in Comstock 1880)		North America	Dowell & Gill 1989	
<i>Spilonota ocellana</i> (Denis & Schiffermüller 1775)		North America	CDFA 1939 28:539, Powell & Opler 2009	
<i>Zeiraphera canadensis</i> Mutura & Freeman 1967			Martineau 1984, Ferguson 1978	
<i>Zeiraphera hesperiana</i> Mutura & Freeman 1967	1968	North America	Powell 1968a	
<i>Zeiraphera vancouverana</i> McDunnough, 1925		North America	Dowell & Gill 1989	
Lepidoptera-Yponomeutidae				
<i>Zelleria</i> cf. <i>hepariella</i> Stainton 1849	1977	Europe	CPPDR 2000 19:31	
Lepidoptera-Zygaenidae				
<i>Harrisina metallica</i> Stretch 1885	1966	Mexico	CDFA 1943 32:98	
Mollusca-Agrilolimacidae				
<i>Deroceras panormitanum</i> (Lesson & Pollonera 1882)		Europe	McDonnel et al. 2009	
<i>Deroceras reticulatum</i> (Müller 1774)	2002		Ebeling 1975	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Mollusca-Arionidae				
<i>Arion ater</i> Linnaeus 1758	1912	North America	Dowell & Gill 1989	
<i>Arion distinctus</i> Mabilie 1868			Roth & Sadeghian 2003	
<i>Arion hortensis</i> Ferussac 1819		Europe	Lindroth 1957, McDonnel et al. 2009	yes
<i>Arion intermedius</i> Normand 1852	<1925		Lindroth 1957, McDonnel et al. 2009	
<i>Arion rufus</i> (Linnaeus 1758)	<1925		Roth & Sadeghian 2003	
<i>Arion silvaticus</i> Lohmander 1937			Roth & Sadeghian 2003	
Mollusca-Carychiidae				
<i>Carychium minimum</i> Muller 1774	<1925	Europe	Roth & Sadeghian 2003	
Mollusca-Daudebardiidae				
<1925				
<i>Oxychilus alliarius</i> Miller 1822		Europe	Lindroth 1957, Hanna 1939	
<i>Oxychilus cellarius</i> Müller 1774		Europe	Lindroth 1957, Hanna 1939	
<i>Oxychilus draparnaldi</i> (Beck 1837)		Europe	Lindroth 1957, Hanna 1939	
<i>Oxychilus helveticus</i> (Blum 1881)			Lindroth 1957	
Mollusca-Ferrussaciidae				
<i>Ceciloides acicula</i> (Muller 1774)	<1925	Europe	Roth & Sadeghian 2003	
Mollusca-Helicellidae				
<1925				
<i>Cerneuella virgata</i> (Mendes de Costa 1778)	<1925	Europe	Roth & Sadeghian 2003	
<i>Cochlicella barbara</i> (Linnaeus 1758)		Europe	Roth & Sadeghian 2003	
<i>Cochlicella ventrosa</i> (Ferrussac 1821)	<1925		Dowell & Gill 1989	
Mollusca-Helicidae				
<1925				
<i>Cepaea nemoralis</i> (Linnaeus 1758)		Europe	C DFA 1940 29:241	
<i>Eobania vermiculata</i> (Muller 1774)	<1900		Roth & Sadeghian 2003	
<i>Cantareus aspertus</i> (Born 1778)		Europe	C DFA 1941 30:352	yes
<i>Cornu awspersum</i> (Müller 1774)	<1925	Europe	C DFA 1939 28:302, Hanna 1939	yes
<i>Otala lactea</i> (Müller 1774)		Europe	C DFA 1940 29:241	
<i>Theba pisana</i> (Müller 1774)		Europe	C DFA 1919 8:7, Hanna 1939	yes
Mollusca-Helicodiscidae				
<1925				
<i>Lucilla singleyana</i> (Pilsbry 1889)		North America	Roth & Sadeghian 2003	
Mollusca-Hygromiidae				
<i>Helicella maritima</i> (Draparnaud 1805)		Africa	Dowell & Gill 1989	
<i>Xerotracha conspurcata</i> (Draparnaud 1801)		Europe	CPPDR 1996 15:8	
Mollusca-Limacidae				
<1925				
<i>Lehmannia valentiana</i> (Ferussac 1822)		Europe	Roth & Sadeghian 2003	yes
<i>Limax flavus</i> Linnaeus 1758		Europe	Lindroth 1957, McDonnel et al. 2009	yes
<i>Limax maximus</i> Linnaeus 1758		Europe	Lindroth 1957, McDonnel et al. 2009	yes
Mollusca-Milacidae				
<i>Milax gagates</i> (Draparnaud 1801)	<1900	Europe	Lindroth 1957, McDonnel et al. 2009	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Mollusca-Patulidae				
<i>Discus rotundatus</i> (Muller 1774)	<1925	Europe	Roth & Sadeghian 2003	
Mollusca-Pristilomatidae				
<i>Hawaiiia minuscula</i> (Binney 1841)	<1925	Hawaii	Dowell & Gill 1989	
<i>Vitrea contracta</i> Lowe (Westerlund 1871)	<1925	Europe	Roth & Sadeghian 2003	
Mollusca-Punctidae				
<i>Paralaoma servilis</i> (Shuttleworth 1852)	<1925		Roth & Sadeghian 2003	
Mollusca-Pupillidae				
<i>Pupoides albilabris</i> (C. B. Adams 1841)		North America	Roth & Sadeghian 2003	
Mollusca-Spiraxidae				
<i>Euglandina rosea</i> (Ferussac 1818)		North America	Roth & Sadeghian 2003	
Mollusca-Subulinidae				
<i>Rumina decollata</i> (Linnaeus 1758)		North America	Dowell & Gill 1989	
Mollusca-Succineidae				
<i>Novisuccinea ovalis</i> (Say 1817)		North America	Roth & Sadeghian 2003	
<i>Succinea luteola</i> Gould 1848		North America	Roth & Sadeghian 2003	yes
Mollusca-Testacellidae				
<i>Testacella haliotidea</i> Draparnaud 1801		Europe	McDonnel et al. 2009	
Mollusca-Valloniidae				
<i>Vallonia costata</i> (Müller 1774)		North America	Roth & Sadeghian 2003	
<i>Vallonia excentrica</i> Sterki 1893		North America	Roth & Sadeghian 2003	
<i>Vallonia pulchella</i> (Müller 1774)		North America	Lindroth 1957, Hanna 1939	
Opisthophora-Lumbricidae				
<i>Allolophora chlorotica</i> (Savigny 1826)			Wood & James 1993	
<i>Aporrectodea caliginosa</i> (Savigny 1826)			Wood & James 1993	
<i>Aporrectodea trapezoides</i> (Duges 1828)			Wood & James 1993	
<i>Aporrectodea tuberculata</i> (Eisen 1874)			Wood & James 1993	
<i>Aporrectodea</i> sp.			Wood & James 1993	
<i>Dendrobaena rubida</i> (Savigny 1826)			Wood & James 1993	
<i>Eisenia foetida</i> Savigny 1826			Wetzel & Reynolds 2014, Bugg 2014	
<i>Eisenia rosea</i> (Savigny 1826)			Wood & James 1993	
<i>Eiseniella tetraedra</i> (Savigny 1826)	1942		Wood & James 1993	
<i>Lumbricus rubellus</i> Hoffmeister 1843			Wetzel and Reynolds 2014, Bugg 2014	
<i>Lumbricus terrestris</i> Linnaeus 1758			Wetzel & Reynolds 2014, Bugg 2014	
<i>Octolasion cyaneum</i> (Savigny 1826)	<1925		Wood & James 1993	
Opisthophora-Megascolecidae				
<i>Amyntas corticis</i> (Kinberg 1867)			Hendrix & Bohlen 2002, Bugg 2014	
<i>Amyntas gracilis</i> (Kinberg 1867)	<1925		Hendrix & Bohlen 2002, Bugg 2014	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
<i>Microscolex dubius</i> (Fletcher 1887)			Wood & James 1993	
<i>Microscolex</i> sp Rosa 1887	<1925		Wood & James 1993	
Orthoptera-Gryllidae	<1925			
<i>Acheta domestica</i> (Linnaeus 1758)	<1925	North America	Arnett 1985, Weissman & Rentz 1977	
<i>Allonemobius fasciatus</i> (De Geer 1773)	<1925		Dowell & Gill 1989	
<i>Gryllobates supplicans</i> (Walker 1859)	<1900	North America	Dowell & Gill 1989	
Orthoptera-Gryllotalpidae				
<i>Scapteriscus borellii</i> Giglio-Tos 1894	<1931	North America	CPPDR 2011 24: 14-16	
Orthoptera-Tettigoniidae				
<i>Anabrus simplex</i> Haldeman 1852	1943	North America	CDFA 1943 32:201	
<i>Neoconocephalus robustus</i> (Scudder 1862)	1995	North America	Dowell & Gill 1989	
<i>Phaneroptera nana</i> Fieber 1853	<1925	Europe	Strohecker 1952	
<i>Phaneroptera quadripunctata</i> Brunner 1878	1949	Europe	Strohecker 1952, Cantrall 1972	
<i>Platycoleis tessellata</i> (Charpentier 1825)	1926	Europe	CDFA 1960 49:143, Rentz 1963	
Phasmida-Phasmatidae				
<i>Carausius morosus</i> (Sinetzky 1901)		North America	CPPDR 2001 20:11	yes
Phthiraptera-Boopidae				
<i>Heterodoxus longitarsus</i> (Piaget 1880)	1894	Australia	Essig 1926a, 1958	
<i>Heterodoxus spiniger</i> (Enderlein 1909)	1945		Arnett 1985	
Phthiraptera-Gyropidae				
<i>Gyropus ovalis</i> Burmeister 1838	1976		Emerson 1972, Essig 1926a	
<i>Gliricola porcelli</i> (Schrank 1781)			Emerson 1972, Essig 1926a	
Phthiraptera-Haematopinidae	1973			
<i>Haematopinus asini</i> (Linnaeus 1758)	1959		Kim et al. 1986, Essig 1926a	yes
<i>Haematopinus eurysternus</i> Nitzsch 1818	<1925		Kim et al. 1986, Essig 1926a	yes
<i>Haematopinus suis</i> (Linnaeus 1758)	1959		Kim et al. 1986, Essig 1926a	yes
Phthiraptera-Hoplopleuridae				
<i>Hoplopleura captiosa</i> Johnson 1960	2005		Kim et al. 1986	
<i>Hoplopleura pacifica</i> Ewing 1924	1924		Kim et al. 1986	
Phthiraptera-Linognathidae	1940			
<i>Linognathus africanus</i> Kellogg & Paine 1911			Kim et al. 1986	
<i>Linognathus setosus</i> (Olfers 1816)			Kim et al. 1986, Essig 1926a	
<i>Linognathus stenopsis</i> (Burmeister 1838)			Kim et al. 1986, Essig 1926a	
<i>Linognathus vituli</i> (Linnaeus 1758)			Kim et al. 1986, Essig 1926a	
Phthiraptera-Menoponidae	<1925			
<i>Menacanthus stramineus</i> (Nitzsch 1818)			Essig 1926a	
<i>Menopon gallinae</i> Linnaeus 1758			Emerson 1972, Essig 1926a	
Phthiraptera-Pediculidae				
<i>Pediculus humanus</i> Linnaeus 1758			Kim et al. 1986	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Phthiraptera-Phloptoridae	1996			
<i>Campanulotes bidentatus</i> Scopoli 1763	1968		Essig 1926a, 1958	
<i>Goniocotes chryocephalus</i> Giebel 1874	1925		Emerson 1972	
<i>Goniocotes creber</i> Kellogg 1896	1909		Essig 1958	
<i>Goniocotes gigas</i> Taschenberg 1879	<1915		Essig 1926a, 1958	
<i>Goniocotes gallinae</i> (De Geer 1778)	1997		Emerson 1972	
<i>Goniocotes maculatus</i> Taschenberg 1882	<1915		Emerson 1972	
<i>Goniocotes parviceps</i> (Piaget 1880)	<1925		Emerson 1972	
<i>Goniocotes rectangulatus</i> Nitzsch 1866	1995		Emerson 1972	
<i>Lipeurus caponis</i> (Linnaeus 1758)	2004		Emerson 1972, Essig 1926a	
<i>Lipeurus maculosus</i> Clay 1938			Emerson 1972	
<i>Lipeurus numidae</i> (Denny 1842)	1943		Emerson 1972	
<i>Lipeurus pavo</i> Clay 1938			Emerson 1972	
Phthiraptera-Pthiridae	1946			
<i>Pthirus pubis</i> (Linnaeus 1758)			Kim et al. 1986	
Phthiraptera-Polyplacidae				
<i>Polyplax spinulosa</i> (Burmeister 1839)	<1925		Kim et al. 1986, Essig 1926a	
Phthiraptera-Trichodectidae	1999			
<i>Bovicola bovis</i> (Linnaeus 1758)	1907		Emerson 1972, Essig 1926a	yes
<i>Trichodectes equi</i> (Denny 1842)	1972		Emerson 1972, Essig 1926a	yes
<i>Trichodectes canis</i> (De Geer 1778)	1931		Essig 1926a, 1958	
Phthiraptera-Trimenoponidae	1996			
<i>Trimenopon hispidum</i> (Burmister 1838)	1904		Arnett 1985	
Pscoptera-Ectopsocidae				
<i>Ctopsocus strauschi</i> Enderlein 1906	1949		BugGuide 2011	
Pscoptera-Elipsocidae	1985			
<i>Cuneopalpus cyanops</i> (Rostock 1876)		Europe	Mockford 1993	
<i>Propocus pulchripennis</i> Perkins 1899	<1915		Mockford 1993	
Psocoptera-Lachesillidae				
<i>Lachesilla pedicularia</i> (Linnaeus 1758)			Mockford 1993	
Psocoptera-Liposcelididae				
<i>Liposcelis corrodens</i> Heymons 1909			Mockford 1993	
<i>Liposcelis decolor</i> (Pearman 1925)			Mockford 1993	
<i>Liposcelis bostrychophilus</i> Badonnel 1931			Powell & Hogue 1979	
<i>Liposcelis rufa</i> Broadhead 1950		Europe	Mockford 1993	
Psocoptera-Peripsocidae				
<i>Peripsocus reductus</i> Badonnel 1943	<1925		Mockford 1993	
Psocoptera-Psyllipsocidae	<1925			
<i>Psyllipsocus ramburii</i> Selys-Longchamps 1872			Mockford 1993	

APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2010.

Taxon	Year detected	Probable origin	Reference	Listed as a pest ^b
Psocoptera-Stenopsocidae				
<i>Graphopsocus cruciatus</i> (Linnaeus 1768)			Mockford 1993	
Psocoptera-Trichopsocidae				
<i>Trichopsocus clarus</i> (Banks 1908)			BugGuide 2011	
Psocoptera-Trogiidae				
<i>Cerobasis annulata</i> (Hagen 1865)		Europe	Mockford 1993	
<i>Lepinotus inquilinus</i> Heyden 1850			Mockford 1993	
<i>Lepinotus patruelis</i> Pearman 1931		Europe	CDFA 1942 31:176	
<i>Lepinotus reticulatus</i> Enderlein 1905			Mockford 1993	
Siphonaptera-Ceratophyllidae				
<i>Nosopsyllus fasciatus</i> (Bosc 1800)			Hubbard 1968, Lewis et al. 1988, Essig 1926a	
<i>Nosopsyllus londiniensis</i> (Rothschild 1903)			Lewis et al. 1988	
Siphonaptera-Leptopsyllidae				
<i>Leptopsylla segnis</i> (Schönherr 1811)			Hubbard 1968, Lewis et al. 1988, Essig 1926a	
Siphonaptera-Pulicidae				
<i>Ctenocephalides canis</i> (Curtis 1826)			Hubbard 1968, Essig 1926a	yes
<i>Ctenocephalides felis</i> (Bouché 1835)			Hubbard 1968, Lewis et al. 1988, Essig 1926a	yes
<i>Echidnophaga gallinacea</i> (Westwood 1875)			Lewis et al. 1988, Essig 1926a	yes
<i>Pulex irritans</i> Linnaeus 1758		Tropical America	Lewis et al. 1988, Essig 1926a	
<i>Xenopsylla cheopis</i> Rothschild 1903		Europe	Hubbard 1968, Lewis et al. 1988	
Symphyla-Scolopendrellidae				
<i>Symphylella isabellae</i> (Grassi 1886)		Europe	Hilton 1931	
Thysanura-Lepismatidae				
<i>Ctenolepisma ciliata</i> (Dufour 1831)			Wygodzinsky 1972	
<i>Ctenolepisma lineata</i> (Fabricius 1775)			Wygodzinsky 1972	
<i>Ctenolepisma longicaudata</i> Escherich 1905			Wygodzinsky 1972	
<i>Lepisma saccharina</i> Linnaeus 1758			Wygodzinsky 1972, Essig 1926a	yes
<i>Thermobia domestica</i> (Packard 1873)			Wygodzinsky 1972, Essig 1926a	yes

ADDENDUM TO APPENDIX. Exotic terrestrial macro-invertebrates found breeding in California 1700-2016

Taxon	Year detected	Probable origin	Reference	Listed as a pest
Araneae-Corinnidae				
<i>Falconina gracilis</i> (Keyserling 1891)	2013	Tropical America	Valle et al. 2013	
Araneae-Theridiidae				
<i>Steatoda nobilis</i> (Thorell 1875)	2012	Europe	Vetter and Rust 2012	
Coleoptera-Anthricidae				
<i>Omonadus formicarius</i> (Goeze 1777)		North America	Majka 2011, California beetle project 2016	
Coleoptera-Buprestidae				
<i>Chrysobothris analis</i> LeConte 1860	2012	North America	Westcott et al. 2015	
Coleoptera-Carabidae				
<i>Amara apricaria</i> (Paykull 1790)		Europe	Sokolov and Kavanaugh 2014	
<i>Amara familiaris</i> (Duftschmid 1812)		North America	Bosquet 2012	
<i>Harpalus affinis</i> (Schrank 1781)		Europe	Sokolov and Kavanaugh 2014	
<i>Pterostichus melanarius</i> (Illiger 1798)		North America	Bosquet 2012	
Coleoptera-Chrysomelidae				
<i>Microtheca ochrolma</i> Stal 1860	2011	North America	Gilbert et al. 2011	
<i>Oulema melanopus</i> (Linnaeus 1758)	2015	North America	Dowell and Pickett (in prep)	yes
Coleoptera-Curculionidae				
<i>Euwallacea</i> n. sp. #2	2013		Anon. 2016	
Coleoptera-Dermestidae				
<i>Thylodrias contractus</i> Motshulsky 1839			California beetle project 2016	
Coleoptera-Erotylidae				
<i>Dacne picta</i> Crotch 1873	1990	Asia	Savary 1995	
Coleoptera-Hyborosoridae				
<i>Hybosorus illigeri</i> Reiche 1853			California beetle project 2016, Ocampo 2002.	
Coleoptera-Hydrophilidae				
<i>Cercyon atricapillus</i> (Marsham 1802)			Smetana 1988, California beetle project 2016	
<i>Cercyon haemorrhoidales</i> (Fabricius 1775)			Smetana 1988, California beetle project 2016	
<i>Cercyon lateralis</i> (Marsham 1802)			Smetana 1988, California beetle project 2016	
<i>Cercyon pygmaeus</i> (Illiger 1801)			Smetana 1988, California beetle project 2016	
<i>Cercyon quisquilius</i> (Linnaeus 1761)			Smetana 1988, California beetle project 2016	
<i>Cercyon terminalis</i> (Marsham 1802)			Smetana 1988, California beetle project 2016	
Coleoptera-Latridiidae				
<i>Adistema watsoni</i> (Wollaston 1871)			California beetle project 2016	
<i>Cartodere notifer</i> (Westwood 1839)			Majka et al. 2009a	
<i>Corticaria ferruginea</i> Marsham 1802			Majka et al. 2009a	

ADDENDUM TO APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2016

Taxon	Year detected	Probable origin	Reference	Listed as a pest
Coleoptera-Staphylinidae				
<i>Anotylustetra carinatus</i> (Block 1799)			California beetle project 2016, Klimaszewski et al. 2012.	
<i>Bisnius cephalotes</i> (Gravenhorst 1802)			California beetle project 2016, Majka et al. 2006	
<i>Crataraea suturalis</i> (Mannerheim 1830)			California beetle project 2016, Klimaszewski et al.2012	
<i>Lithocharis ochracea</i> (Gravenhorst 1802)			California beetle project 2016, Hamilton 1889	
<i>Myrmecocephalus concinnus</i> (Erichson 1840)			California beetle project 2016, Klimsezewski et al. 2012	
<i>Nehemitropia lividipennis</i> (Mannerheim 1831)			California beetle project 2016, Klimsezewski et al. 2012	
<i>Philonthus carbonarius</i> (Gravenhorst 1802)			California beetle project 2016. Majka et al. 2006.	
<i>Philonthus varians</i> (Paykull 1789)			California beetle project 2016, Staniec 2002	
<i>Quedius fulgidus</i> (Fabricius 1792)			Majka et al. 2009b	
<i>Tasgius ater</i> (Gravenhorst 1802)			California beetle project 2016, Brunke et al. 2011	
Coleoptera-Tenebrionidae				
<i>Alphitobius laevigatus</i> (Fabricius 1781)			California beetle project 2016, Bosquet 1990.	
<i>Latheticus oryzae</i> (Waterhouse 1880)			California beetle project 2016, Wittenberg et al. 2005	
Diptera-Agromyzidae				
<i>Liriomyza huidobrensis</i> (Blanchard 1926)		Tropical America	Steck 2006	
<i>Napomyza vanescens</i> (Walker 1853)			Spencer 1981	
<i>Phytomyza vomitoriae</i> Kulp 1968			Lonsdale and Scheffer 2011	
Diptera-Cecidomyiidae				
<i>Monarthropalpus buxi</i> , (Geoffroy 1764)			Anon. 1985, 2014	
Diptera-Culicidae				
<i>Aedes albopictus</i> (Skuse 1849)			Anon. 2015	yes
<i>Aedes quinquefasciatus</i> Say 1823			Juliano and Lounibos 2005, Cornell et al. 2003	
Diptera-Dolichopodidae				
<i>Medetera johnthomasi</i> Bickel & Arnaud 2011	2011		Bickel and Arnaud 2011	
Diptera-Muscidae				
<i>Athergonia orientalis</i> (Schiner 1868)			Cole 1969, Hancock et al. 2014	
<i>Athergonia reversura</i> Villeneuve 1963			Bryant 2016, Hancock et al. 2014	
Diptera-Drosophilidae				
<i>Drosophila gentica</i> Wheeler & Takada 1962.	2014	TropicalAmerica	Grimaldi et al. 2015	
<i>Drosophila flavohirta</i> Malloch 1924	2014	Australia	Grimaldi et al. 2015	
<i>Drosophila melanogaster</i> Meigen 1830			Baudy et al. 2004, Varela et al. 2015	
Diptera-Tephritidae				
<i>Euaresta bullans</i> Weidemann 1830			Foote and Blanc 1963	

ADDENDUM TO APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California
1700-2016

Taxon	Year detected	Probable origin	Reference	Listed as a pest
Hemiptera-Adgelidae				
<i>Pineus boeneri</i> Annand, 1928			Lazzari and Cardoso 2011	
Hemiptera-Aleyrodidae				
<i>Aleurotulus nephrolepidis</i> (Quiantance, 1900)			Anon. 2006	
Hemiptera-Aphididae				
<i>Anoecia corni</i> (Fabricius, 1775)			Footitt et al. 2006, Swain 1919	
<i>Aphis eurphorbiae</i> Kaltenbach, 1933	1933		Footitt et al. 2006	
<i>Aphis polygonata</i> (Nevsky, 1929)			Footitt et al. 2006, Blackman and Eastop 2007	
<i>Aphis spiraecola</i> Patch, 1914			Footitt et al. 2006, Reuther et al. 1978	
<i>Aphis thalictri</i> Koch, 1854			Footitt et al. 2006, Swain 1919	
<i>Asiphonella dactylonii</i> Theobald 1923			Footitt et al. 2006, Anon. 1969	
<i>Atarsaphis agrifoliae</i> (Ferris, 1921)	1921		Footitt et al. 2006	
<i>Brachycaudus helichrysi</i> (Kaltenbach, 1843)			Footitt et al. 2006, Bentley et al. 2009	
<i>Capitophorus elaeagni</i> (Del Guercio, 1894)			Footitt et al. 2006, Bari and Natwick 2015	
<i>Ctenocallis zelkowae</i> (Shinji, 1924)	1983		Footitt et al. 2006	
<i>Greenidea psidii</i> van der Goot, 1916	1998		Footitt et al. 2006	
<i>Liosomaphis berberidis</i> (Kaltenbach, 1843)			Footitt et al. 2006, Swain 1919	
<i>Metolophium dirhodum</i> (Walker, 1849)			Footitt et al. 2006, Glidow and Rochow 1983	
<i>Monaphis antennata</i> (Kaltenbach, 1843)			Footitt et al. 2006, Essig 1911	
<i>Panaphis juglandis</i> (Geoze, 1778)	1952		Footitt et al. 2006, Olson 1974	
<i>Sitobion avenae</i> (Fabricius, 1775)			Footitt et al. 2006, Summers and Godfrey 2009	
<i>Therioaphis maculata</i> (Buckton, 1899)			Footitt et al. 2006, Smith 1959	
<i>Tuberolachnus salignus</i> (Gmelin, 1790)			Stary and Schlinger 1967	
Hemiptera-Cicadellidae				
<i>Alebra wahlbergi</i> Boheman, 1845	1945		Hamilton 2010, 2011	
<i>Aphrodes bicinctus</i> (Schrank, 1776)			Hamilton 2011, Sherf and MacNab 1986	
<i>Dalbulus maidis</i> DeLong, 1923			Hamilton 2011, Summers et al. 2004	
<i>Empoasca maragdula</i> Fallen, 1806	1916		Hamilton 2011, van Duzee 1917	
<i>Kyboasca bipunctata</i> (Oshanin 1871)			Flock 1950	
<i>Sophonia orientalis</i> (Matsumura, 1912)			Hamilton 2011, Bryant et al. 2016	
Hemiptera-Miridae				
<i>Brachynotocoris puncticornis</i> Reuter, 1880	2013	Europe	Dowell (in prep)	
<i>Closterotomus norwegicus</i> (Gmelin, 1790)	1966		Scudder and Footitt 2006	
<i>Coridromius chenopoderis</i> Tatarnic and Cassis 2008		Australia	Tatarnic and Cassis 2008.	

ADDENDUM TO APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California 1700-2016

Taxon	Year detected	Probable origin	Reference	Listed as a pest
<i>Heteropsallus planicornis</i> (Pallas 1772)			Wheeler and Henry 1992	
<i>Lepidargyrus ancorifer</i> (Fieber 1858)	1912		Scudder and Footitt 2006	
<i>Megalonotus sabulicola</i> (Thompson 1870)	1921		Scudder and Footitt 2006	
Hemiptera-Psyllidae				
<i>Psylla buxi</i> Linnaeus, 1758			Tuthill 1943	
<i>Psyllopsis fraxinicola</i> Foerster 1848			Tuthill 1943	
Hymenoptera-Agaonidae				
<i>Eupristina altissima</i> Saunders 1882			Boucek 1997	
Hymenoptera-Apidae				
<i>Xylocopa appendiculata</i> Smith 1852	2012	Asia	Dahlberg et al. 2013	
Hymenoptera-Formicidae				
<i>Phiedole megacephala</i> (Fabricius 1793)	2014		Leathers 2014	
Lepidoptera-Crambidae				
<i>Terastia meticulosalis</i> Guenee & Agathodes 1854	2015	North America	Hodel et al. 2016	
Lepidoptera-Gracillariidae				
<i>Phyllonorycter mespilella</i> (Hubner 1805)	1936	Europe	Maier 2001	
Lepidoptera: Pyralidae				
<i>Diaphania hyalinata</i> Linnaeus 1767			Capinera 2014, California moth database 2016	
Lepidoptera-Yponomeutidae				
<i>Ocnerostoma piniariella</i> Zeller 1847			California moth database 2016, Felt 1922.	
Siphonaptera-Pulicidae				
<i>Hectopsylla psittaci</i> Von Frauenfeld 1860		TropicalAmerica	Schwann et al. 1983	
Thysanoptera-Aeolothripidae				
<i>Aeolothrips collaris</i> Priesner 1919		Europe	CPPDR 16:44	
<i>Aeolothrips ericae</i> Bagnall 1920		Europe	CPPDR 14:6	
<i>Aeolothrips melaleucus</i> (Haliday 1852)			Bailey 1957	
<i>Anaphothrips obscurus</i> Comstock 1875			Hoddle & Mound 2012	
<i>Aptinothrips rufus</i> Haliday 1836			Hoddle & Mound 2012	
<i>Rhipidothrips gratiosus</i> Uzel 1895		Europe	Bailey 1957	
Thysanoptera-Phlaeothripidae				
<i>Amynothrips andersoni</i> O'Neill 1968			Hoddle & Mound 2012	
<i>Androthrips ramachandrai</i> Karny 1926			Hoddle & Mound 2012	
<i>Cartomothrips browni</i> Stannard 1962			Hoddle & Mound 2012	
<i>Cephalothrips monilicornis</i> O.M. Reuter 1880		Europe	Cott 1956	
<i>Gynaikothrips ficorum</i> (Marchal 1908)		Mexico	Clausen 1978	yes
<i>Gyaikothrips uzeli</i> Zimmerman 1900			Hoddle & Mound 2012	
<i>Haplothrips leucanthemi</i> (Schränk 1781)			Cott 1956, Essig 1926a	
<i>Haplothrips robustus</i> Bagnall 1918			Hoddle & Mound 2012	
<i>Haplothrips verbasci</i> (Osborn 1897)			Keifer et al. 1982	
<i>Liothrips floridensis</i> Watson 1913			Hoddle & Mound 2012	

ADDENDUM TO APPENDIX (continued). Exotic terrestrial macro-invertebrates found breeding in California
1700-2016

<i>Liothrips vaneeckei</i> Priesner 1920		Europe	CDFA 28:479	
<i>Macrophthalthrips argus</i> (Karny, 1920)			Hoddle & Mound 2012	
<i>Nesothrips propinquus</i> (Bagnall, 1916)			Hoddle & Mound 2012	
<i>Neurothrips magnafemoralis</i> (Hinds 1902)			CDFA 28:538	
Thysanoptera-Thripidae				
<i>Anaphothrips obscurus</i> (Muller 1776)			Hoddle et al. 2004	
<i>Aptinothrips rufus</i> (Haliday) 1836		Europe	Essig 1926a	
<i>Aptinothrips stylifer</i> Trybom, 1894			Hoddle & Mound 2012	
<i>Asprothrips seminigricornis</i> (Girault 1926)			Hoddle et al. 2004	
<i>Chaetanaphothrips orchidii</i> (Moulton 1907)			Hoddle et al. 2004	
<i>Chirothrips aculeatus</i> Bagnell 1927			Bailey 1957	
<i>Chirothrips manicatus</i> (Haliday 1836)			Hoddle et al. 2004	
<i>Danothrips trifasciatus</i> Sakimura 1975		Pacific Region	CPPDR 15:73	
<i>Dendrothrips howei</i> Mound 1999	2011	North America	Hoddle & Mound 2012	
<i>Dendrothrips ornatus</i> (Jablonowski 1894)		North America	Dowell & Gill 1989	
<i>Drepanothrips reuteri</i> Uzel 1895		Europe	CDFA 17:455	
<i>Frankliniella hemerocallis</i> Crawford 1948		North America	CPPDR 16:44	
<i>Frankliniella schultzei</i> (Trybom 1910)			Hoddle & Mound 2012	
<i>Frankliniella tenuicornis</i> (Uzel 1895)			Hoddle & Mound 2012	
<i>Heliothrips haemorrhoidalis</i> (Bouché 1833)		Tropical America	CDFA 17:366	yes
<i>Hercinothrips bicinctus</i> (Bagnall 1919)			Hoddle & Mound 2012	
<i>Hercinothrips femoralis</i> (Reuter 1891)			Bailey 1957, Essig 1926a	
<i>Limothrips angulicornis</i> Jablonowski 1894		Europe	Bailey 1957	
<i>Limothrips cerealium</i> (Haliday 1836)			Bailey 1957	
<i>Leucothrips nigripennis</i> Reuter 1904			Hoddle & Mound 2012	
<i>Microcephalothrips abdominalis</i> (Crawford 1910)			Hoddle et al. 2004	
<i>Monilothrips kempfi</i> Moulton 1929			Bailey 1957	
<i>Neohydatothrips burungae</i> (Hood 1935)		Tropical America	CPPDR 22:21-22	
<i>Neohydatothrips samayunkur</i> (Kudo 1995)		North America	CPPDR 14:28	
<i>Odontothrips loti</i> (Haliday 1852)			Hoddle et al. 2004	
<i>Parthenothrips dracaenae</i> (Heeger 1854)			Bailey 1957, Essig 1926a	
<i>Pseudanaphothrips achaetus</i> (Bagnall) 1916		Australia	CPPDR 19:25	
<i>Pseudodendrothrips mori</i> (Niwa, 1908)			Hoddle & Mound 2012	
<i>Scirtothrips citri</i> (Moulton 1909)		Asia	CDFA 7:465	yes
<i>Scirtothrips inermis</i> Priesner 1933		Europe	Dowell & Gill 1989	
<i>Scirtothrips longipennis</i> (Bagnall 1909)			CDFA 20:345	
<i>Scirtothrips perseae</i> Nakahara 1997	1996	Tropical America	CPPDR 15:4	yes
<i>Taeniothrips inconsequens</i> (Uzel 1895)		Asia	Davidson & Lyon 1987, Bailey 1957	yes
<i>Tenothrips frici</i> (Uzel 1895)			Hoddle et al. 2004	
<i>Thrips australis</i> (Bagnall 1915)		Australia	Bailey 1957	
<i>Thrips hawaiiensis</i> (Morgan 1913)		Hawaii	Dowell & Gill 1989	
<i>Thrips nigropilosus</i> Uzel 1895			Gentile & Bailey 1968	
<i>Thrips tabaci</i> Lindeman 1888		North America	CDFA 4:56,	
<i>Thrips trehernei</i> Priesner 1927			Hoddle et al. 2004	
<i>Thrips simplex</i> (Morison 1930)			Hoddle & Mound 2012	
<i>Thrips vulgatissimus</i> Haliday 1836			Hoddle et al. 2004	
<i>Trichomothrips cyperaceae</i> (Bianchi 1945)		Asia	Hoddle et al. 2004	
<i>Trichomothrips xanthius</i> (Williams 1917)			Hoddle et al. 2004	

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