

Computerized Data Base on Immigrant Arthropods

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ABSTRACT Immigrants make up a small (about 2%) portion of the arthropod fauna of North America, but are a very important component of the pest and beneficial fauna. Heretofore no generally accessible, computerized compendium has been available to provide access to the vast and dispersed body of knowledge on these organisms. The computerized North American Immigrant Arthropod Database (NAIAD) was developed to provide such a single source. This interactive data base contains 51 fields of core data on the 1,800 species of arthropods known to be immigrant to America north of Mexico. The COBOL program and data files reside on a Wang VS-100 minicomputer at Beltsville, Md., and the data files are accessible from remote locations via TTY (ADAS). Extensive hard copy, back-up files also are maintained. The NAIAD program and its use are described here, and the data fields included in the program are discussed. This data processing application will allow researchers worldwide access to a broad spectrum of information, will allow rapid publication of certain important subsets of information contained therein, and will help in accumulating, analyzing, and disseminating information about immigrant arthropods.

KEY WORDS Insecta, immigrant species, adventive species, automatic data processing

IMMIGRANT SPECIES, the exotic species accidentally or purposefully established in new areas, are significant from practical and theoretical points of view: as pests; as beneficials (especially as natural enemies of pest organisms and as pollinators); as "noneconomic" species that have an effect on native, noneconomic plants and animals; and as prime subjects for the study of microevolutionary, ecological, and biogeographical processes. The general nature of immigrant species is analyzed in the accompanying paper by Whitehead & Wheeler (1990).

The study of immigrant species should and can be carried out with reference to such broad objectives as the maintenance of species diversity. A body of knowledge and a framework of appropriate theory are beginning to be produced. The modern literature can be considered to start with Elton's classic, *The Ecology of Invasions by Animals and Plants* (Elton 1958), followed by *The Genetics of Colonizing Species* (Baker & Stebbins 1965). Over the past decade, numerous research papers and special reviews have appeared, along with such major works as those by Wilson & Graham (1983), Parsons (1983), Groves & Burdon (1986), and Mooney & Drake (1986).

Foreign species make up about 35% of the approximately 700 most important arthropod pests in the continental United States. Nearly 30% of all agricultural losses in the United States caused by arthropods are inflicted by immigrant species. In addition, about 800 species of beneficial arthropods—including pollinators and parasitic and predaceous natural enemies of arthropods and weeds—have been introduced intentionally or accidentally into the United States and Canada, primarily since the 1880s (Sailer 1983).

Thus, immigrant species are economically and scientifically important. There have been a few important publications on species of arthropods immigrant to major areas (e.g., Hoebeke & Wheeler 1983) and analyses of immigrants by major taxonomic group (e.g., Hamilton 1983), but there is no comprehensive listing of arthropods immigrant to the United States, to North America as a whole, or indeed to any major region of the world. A generally accessible, computerized master data base of key information on all immigrant organisms, for all parts of the world is critically needed. We are developing such a data base for immigrant arthropods, beginning with those known from the United States, but eventually including those known from the entire Western Hemisphere. A data base that includes information on immigrant species in the Hawaiian Islands is being developed at the B. P. Bishop Museum (S. Miller, personal communication) and exchange of information with this data base and similar ones is planned.

The Agricultural Research Service has the responsibility to provide plant quarantine interests

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with authoritative identifications of suspected new pests, and biological control units with authoritative identifications of new natural enemies being introduced. The availability of this kind of information depends, of course, directly on the results of systematics research and will be enhanced by this data base.

The late Reece I. Sailer (then Chief, Insect Identification and Parasite Introduction Research Branch, USDA-ARS) began about 1968 to develop a hard copy file of core data on species of insects and mites known to be immigrant to North America and Hawaii. Each species record included as many as 12 fields of essential data, such as scientific and common names, geographic origin, and time and place of entry or introduction. The initial data set was developed with the assistance of insect and mite systematists in the Systematic Entomology Laboratory (SEL), USDA, the Smithsonian Institution, and other organizations. Information on 1,660 species immigrant to North America had been accumulated by 1978 (Sailer 1978). In 1980, we began to develop a computerized data base for insects, mites, and related arthropods immigrant to North America. The objectives of the North American Immigrant Arthropod Data Base (NAIAD) program are to develop a computerized data base and hard copy file of essential information on these arthropods immigrant to or introduced into North America, with initial emphasis on taxa in the United States; to create a system for obtaining, maintaining, documenting, and analyzing such information; and to convey this information to a broad spectrum of users, especially regulatory agencies and research organizations such as biological control units and state extension agencies, as well as to agricultural businesses, international organizations, and individual scientists. Having transferred the data from a hard copy file to a computerized system, we can project a rapid increase in the number of taxa covered to about 3,000 species during the first two or three years of active development of NAIAD. Thereafter, 10-25 species are likely to be added each year and two or three deleted, as our knowledge of the establishment of certain species improves.

Determining which species are appropriate for inclusion in NAIAD presents a challenge, as does determination of what actually constitutes an immigrant (Whitehead & Wheeler, 1990). Information on immigrant arthropods is scattered through a large and disparate body of published and unpublished documents, including records in entomologists' informal files. Moreover, occurrences of some immigrant species are represented only by a few specimens in museum collections. As a basic step in obtaining data, we reviewed published and unpublished information found in articles, reports, memos, etc. Other major sources of information include the identification service and taxonomic research provided by systematists at SEL for plant quarantine and biological control. The paper by Henry (1990) is an example of the kind of infor-

mation on immigrant species that results from the identification service. Another source of information is the Release of Beneficial Organisms data base in the USDA-ARS National Biological Control Documentation Center, Beneficial Insects Laboratory, Beltsville, Md. (Coulson 1987).

Overview of NAIAD

After preliminary information has been obtained on an immigrant species to be added to NAIAD, a data sheet (covering 51 subject fields) or other documentation is prepared and submitted to the appropriate taxonomic specialist for review. The information is then entered into an interactive, expandable data base stored on a minicomputer (Wang VS-100, Wang Laboratories, Boston). All data files on the system can be manipulated or updated remotely from a Wang workstation through the WANGNET telecommunications program. Asynchronous communication software allows access to NAIAD data from any computer terminal equipped with a modem and Wang 2110 emulation software.

The data base currently includes 51 fields of core data (e.g., geographic origin, date of entry and distribution, hosts; Appendix I and II) on 1,800 species, with detailed information on about 550 species of Coleoptera, Diptera, Heteroptera, Homoptera, Lepidoptera, and Orthoptera. The capability to analyze data such as the origin, dates and modes of entry, sites of establishment, host and habitat preferences, vectored pathogens, and dynamics of geographic spread of immigrant arthropods is expected to be of considerable value in the exclusion, containment, and biological pest control activities of regulatory and research units. The knowledge should help develop appropriate methodology for excluding additional foreign arthropod pests (an estimated 10,000 species of which are considered capable of establishment but do not yet occur in North America [Knutson 1989]) and expediting the introduction and distribution of beneficial species in North America. In addition, this information will contribute to and should stimulate broader basic studies on biological phenomena that are important in understanding immigrant and native organisms.

An Immigrant Arthropod Voucher Specimen Collection of species immigrant to North America is being established to document the NAIAD program further. Specimens representing the earliest recognized establishments are obtained from various sources, uniquely numbered and labeled, and shared insofar as possible among the collector, the USDA-ARS National Biological Control Documentation Center, the U.S. National Museum of Natural History, and, where appropriate, with Agriculture Canada, and with the Instituto Nacional Investigaciones Agricola, and the Departamento Sanidad Vegetal in Mexico. These collections are to authenticate records of occurrence, provide ref-

erence material for subsequent identification, permit subsequent taxonomic study if error is suspected in the original identification, provide physical evidence to document morphological changes that may occur as the immigrant species become more widespread and entrenched, and provide visibility and draw attention to the importance of discovering and recording information on immigrant species of arthropods.

Description of the System

NAIAD has become a substantial data base with extensive programming and modification by Mary B. Goldenbaum (formerly with the Computer Data Services Division, USDA-ARS). Many fields of data were subdivided to improve data retrieval capabilities, and certain kinds of information came to be stored separately in supplementary files. There are now five such supplementary files in addition to NAIAD, the main file. File structure and contents are as follows:

- NAIAD—main data file; contains most of the information
- NAIADREF—supplemental file of literature references
- NAIADHAB—supplemental file of habitats
- NAIADHST—supplemental file of hosts
- NAIADVEC—supplemental file of disease vectors
- NAIADNTS—supplemental file of extra data and notes

The system also includes a file for checking synonymous names (SYNFILE) and a master bibliographic file (BIBFILE). All bibliographic records are first recorded in BIBFILE, the main NAIAD bibliography. Records in NAIADREF duplicate records in BIBFILE and add information to them from the main NAIAD file. This avoids the need for retyping a bibliographic citation pertaining to several NAIAD species while also making it convenient to produce a complete sorted printout of all NAIAD citations.

The computer program automatically places the data in the appropriate files as records are entered. The user must be aware of the existence of the supplemental files, however, when modifying and deleting records.

The NAIAD data can now be accessed via TTY (ADAS), although the NAIAD program software itself cannot be run via TTY. The Wang Report Utility can be used to design reports that meet the requirements of a user or group of users, and this report can generate output to ADAS when it is requested through a procedure (analogous to an MS-DOS batch file) that is set up as a command option for ADAS users.

To work directly with NAIAD via a modem, users must have a microcomputer running VT100 or Wang 2110 terminal emulation. Most popular microcomputer communications packages support

VT100 emulation, and specialized Wang 2110 emulation packages can be purchased from several software vendors.

Records are organized as follows. Species records are organized by the record "key" called "REF-NUM" (labeled "REF NO:" on the data entry screen). The REF-NUM identifies each record uniquely and cannot be changed once the record has been entered.

The REF-NUMs for the main file and the habitat file are 4-digit numbers, e.g. REF NO: ____-____; for the reference, vector, and notes files, 6-digit numbers (4-digit numbers plus 2-digit secondary number), e.g. REF NO: ____-____-____; and for the host file, a 7-digit number (4-digit number plus 3-digit secondary number), e.g. REF NO: ____-____-____-____.

Records for a single taxon in different files are tied together by the 4-digit number. The secondary number permits more than one literature reference, host, vector, or notes record to be tied to the same taxon.

A species record in the main file is referenced in three ways: (1) with the 4-digit reference number (REF NO), (2) with the genus-species name (such as *Musca autumnalis* De Geer), or (3) with the first six letters of the "EPA code." The EPA coding system, developed by the Environmental Protection Agency, Scientific Support Branch, Benefits and Use Division, Office of Pesticide Programs (Sutherland & Brassard 1987), consists of seven positions (upper case letters), broken down into vocabulary (e.g., insect, weed), higher taxonomic category, scientific name, and stage of development. REF NO is the primary "key" in the NAIAD data base; the genus-species name and the first six letters of the EPA code are called "alternate keys." Currently, the EPA code is usable only internally, but to find records in the supplementary files, the reference number must be known.

Recommendation

For more effective documentation of immigrant species, it would be useful to establish regular publication procedures to provide detailed records of the occurrence or establishment of species in new areas. Some advantages of such a procedure would be to elicit timely and broad dissemination of the essential information in a consistent format and to ensure appropriate recognition for the discoverer of the new record. An example of the kind of publication visualized is the paper in this issue by T. J. Henry.

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Appendix 1. NAIAD Fields

| Field name | No. characters | Description |
|--------------|----------------|--|
| 1. REF NO | 4 | Primary key for main file records—NAIAD reference number |
| 2. CLASS | 20 | Class |
| 3. ORDER | 20 | Order |
| 4. FAMILY | 20 | Family |
| 5. GENUS | 20 | Genus |
| 6. SPECIES | 22 | Species |
| GEN-SPEC | 42 | Alternate key for main file records (genus and species fields combined) |
| SUBSP | 22 | Subspecies |
| 7. AUTH | 20 | Author |
| EPA-CODE | 7 | 7-letter EPA code |
| EPA1-6+ | 6 | First 6 letters of the EPA code—alternate record key |
| EPA7+ | 1 | Seventh letter of the EPA code |
| 8. BIOTYPE | 36 | Biotype/population—locality |
| 9. TAXST | 40 | Taxonomic status uncertain because of unresolved origin, relationships, and/or nomenclature |
| 10. N-ENG | 50 | English common name or names |
| N-SPAN | 20 | Spanish common name or names |
| N-FREN | 20 | French common name or names |
| N-PORT | 20 | Portuguese common name or names |
| 11-15. | | Associated literature reference data from separate file |
| 16. EP | 2 | EP—Eastern Palearctic |
| WP | 2 | WP—Western Palearctic |
| SP | 2 | SP—Southern Palearctic |
| AF | 2 | Af—Afrotropical |
| NT | 2 | Nt—Neotropical |
| NA | 2 | Na—Nearctic |
| AU | 2 | Au—Australian |
| OC | 2 | Oc—Oceanic-Pacific |
| OR-X | 2 | Or—Oriental |
| 17. EASTH1 | 57 | Geographic distribution in Eastern Hemisphere—use geopolitical codes or "Cosmopolitan" |
| EASTH2 | 72 | Geographic distribution in Eastern Hemisphere—use geopolitical codes or "Cosmopolitan" |
| EASTH3 | 72 | Geographic distribution in Eastern Hemisphere—use geopolitical codes or "Cosmopolitan" |
| 18. WESTH1 | 57 | Geographic distribution in Western Hemisphere—use geopolitical codes or "Cosmopolitan" |
| WESTH2 | 72 | Geographic distribution in Western Hemisphere—use geopolitical codes or "Cosmopolitan" |
| WESTH3 | 72 | Geographic distribution in Western Hemisphere—use geopolitical codes or "Cosmopolitan" |
| 19. ESTSTAT | 20 | Establishment status: "Permanent," "Apparently temporary," "Eradicated," "Questionable," "Few specimens," or spaces ("P," "T," "E," "Q," "F"). |
| ERAD-YR | 16 | If species eradicated, indicate the years (example, "45, 64"), after "19:" on screen. |
| 20. OR-ENT-C | 2 | Country of original entry (geopolitical code) |
| OR-ENT-S | 4 | State or area of original entry (geopolitical code) |
| OR-ENT-I | 70 | May contain year, specific locality, identifier/organization, date of identification |
| ENT-D | 2 | Day of original entry |
| ENT-M | 4 | Month of original entry, Roman numeral, which displays in upper case |
| ENT-CY | 1 | Contains "" (before), "?" or spaces only, as a qualification for the year field |
| ENT-Y | 4 | Year of original entry |
| REV-DATA | 1 | If there is revised information about the original entry in the notes, enter "X." Field displays in upper case |
| 21. | | Unused area not displayed on screen |
| 22. RE-ENT1 | 51 | First reentry of species may include country, state/area (in geopolitical codes). May also include year, specific locality, identifier/organization, date of identification. |
| RE-ENT2 | 51 | |
| RE-ENT3 | 51 | |
| RE-ENT4 | 51 | |
| RE-ENT5 | 51 | |
| RE-ENT6 | 51 | |
| RE-ENT7 | 51 | |
| RE-ENT8 | 51 | |
| RE-ENT9 | 51 | |
| REENTX | 1 | If there is more reentry information enter "X." Field displays in upper case |
| FILL-SPACE | 1 | Unused area not displayed on screen |
| 23-24. | | Unused area not displayed on screen |
| 25. REENT-DA | 50 | Years of reentries |
| 26. US-CYR | 1 | Contains "" (before), "?" or spaces |
| US-YR | 4 | Year species new to conterminous 48 U.S. states |
| US-ST | 4 | State (geopolitical code) |

Appendix 1. Continued

| Field name | No. characters | Description |
|--------------|----------------|--|
| 27. HA-CYR | 1 | Contains " ", "?" or spaces |
| HA-YR | 4 | Year species new to Hawaii |
| 28. PR-CYR | 1 | Contains " ", "?" or spaces |
| PR-YR | 4 | Year species new to Puerto Rico |
| 29. VI-CYR | 1 | Contains " ", "?" or spaces |
| VI-YR | 4 | Year species new to U.S. and U.K. Virgin Islands |
| 30. AL-CYR | 1 | Contains " ", "?" or spaces |
| AL-YR | 4 | Year species new to Alaska |
| 31. CAN-CYR | 1 | Contains " ", "?" or spaces |
| CAN-YR | 4 | Year species new to Canada |
| CAN-PR | 4 | Province (geopolitical code) |
| 32. TEMS-CYR | 1 | Contains " ", "?" or spaces |
| TEMS-YR | 4 | Year species new to temperate South America |
| TEMS-CTY | 2 | Country (geopolitical code) |
| TEMS-ST | 4 | State (geopolitical code) |
| 33. MEX-CYR | 1 | Contains " ", "?" or spaces |
| MEX-YR | 4 | Year species new to Mexico |
| MEX-ST | 4 | State |
| 34. CAT-CYR | 1 | Contains " ", "?" or spaces |
| CAT-YR | 4 | Year species new to Central America and tropical South America (including West Indies) |
| CAT-CTRY | 2 | Country (geopolitical code) |
| CAT-STA | 4 | State (geopolitical code) |
| 35. | | Associated habitat data from separate file |
| 36. | | Associated host or prey data from separate file |
| 37. | | Associated vector data from separate file |
| 38. STATUS-X | 22 | Contains status of species in immigrant area: "Minor pest," "Major pest," "Beneficial," "Undetermined," "No economic importance" or spaces ("M", "MA", "B", "U", "N") |
| 39. BEN-CONT | 72 | Beneficial introduced to control: family, genus, species, author |
| 40. BEN-ORG | 50 | Beneficial introduced by: organization, specialist |
| 41. BEN-YEAR | 4 | Year(s) beneficial introduced |
| 42. BEN-CTRY | 2 | Country where beneficial released (geopolitical code) |
| BEN-STA | 4 | State(s)/province(s) (geopolitical code) |
| 43. TYPE-ENT | 23 | Type of entry: "Accidental introduction," "Natural range extension," "R. ext-cult.host-new ar." (Range extension-cultured host-new arrival), "Purposeful introduction," "Undetermined" or spaces ("A", "N", "R", "P", "U") |
| ENTR-CYR | 1 | Contains " " (before), "?" or spaces |
| ENTR-YR | 4 | If entry "A", "P", or "U," field contains year in which species entered |
| 44. ACTION | 62 | Action taken as result of establishment of species |
| 45. COM-PAT1 | 2 | 2-character code for type of commerce pattern involved in entry |
| COM-PAT2 | 2 | 2-character code for type of commerce pattern involved in entry |
| COM-PAT3 | 2 | 2-character code for type of commerce pattern involved in entry |
| 46. | | Unused area not displayed on screen |
| 47. ICOL-NO | 20 | BIL Introduced Beneficial Arthropod Collection number |
| 48. COLL1 | 71 | } Collections containing voucher specimens |
| COLL2 | 55 | |
| 49. | | General notes from separate file |
| 50. DATE1 | 4 | Date of preparation of original document (MMYY) |
| PREP1 | 15 | Preparer of original document |
| 51. DATE2 | 4 | } Dates (MMYY) and preparers of major revisions |
| PREP2 | 15 | |
| DATE3 | 4 | |
| PREP3 | 15 | |
| DATE4 | 4 | |
| PREP4 | 15 | |
| DATE5 | 4 | |
| PREP5 | 15 | |
| DATE6 | 4 | |
| PREP6 | 15 | |

Appendix 2. Example of Completed Fields

NORTH AMERICAN IMMIGRANT ARTHROPOD DATABASE

1. REF NO: 0118
 2. CLASS: Insecta
 3. ORDER: Coleoptera
 4. FAMILY: Curculionidae
 5. GENUS: Anthonomus
 6. SPECIES AND SUBSPECIES: grandis
 7. AUTHOR: Boheman
 EPA CODE: INASAHA
 8. BIOTYPE/POPULATION—LOCALITY:
 9. TAXONOMIC STATUS CERTAIN/UNCERTAIN (BECAUSE OF UNRESOLVED ORIGIN, RELATIONSHIPS, AND/OR NOMENCLATURE):
 10. COMMON NAME(S)—(ESA NAMES ASTERISKED)
 A. ENGLISH: boll weevil*, cotton boll weevil, Mex. boll weevil
 B. SPANISH: el picudo
 C. FRENCH:
 D. PORTUGUESE:
 LITERATURE REF NO: 0118-01 (Indicate topics covered with "X" in fields 11-15)
 (11) DISTRIBUTION IN INTRODUCED AREA: X (12) ESTABLISHMENT AS IMMIGRANT: X (13) TAXONOMY:
 (14) BIOLOGY: X (15) MISC:
 AUTHOR(S): Hunter, W. D. and W. E. Hinds.
 TITLE: The Mexican cotton boll weevil.
 PUBLICATION DATA: USDA Bur. Entomol. Bull. 51:1-181
 YEAR: 1905
 LITERATURE REF NO: 0118-02 (Indicate topics covered with "X" in fields 11-15)
 (11) DISTRIBUTION IN INTRODUCED AREA: X (12) ESTABLISHMENT AS IMMIGRANT: X (13) TAXONOMY:
 (14) BIOLOGY: X (15) MISC:
 AUTHOR(S): Hunter, W. D. and W. D. Pierce.
 TITLE: The Mexican cotton boll weevil. A summary of the investigation of this insect up to Dec. 31, 1911.
 PUBLICATION DATA: USDA Bur. Entomol. Bull. 114:1-188.
 YEAR: 1912
 LITERATURE REF NO: 0118-03 (Indicate topics covered with "X" in fields 11-15)
 (11) DISTRIBUTION IN INTRODUCED AREA: (12) ESTABLISHMENT AS IMMIGRANT: (13) TAXONOMY: X
 (14) BIOLOGY: (15) MISC:
 AUTHOR(S): Blatchley, W. S. and C. W. Leng.
 TITLE: Rhynchophora or weevils of northeastern America.
 PUBLICATION DATA: Nature Publ., Indianapolis. 682 pp.
 YEAR: 1916
 LITERATURE REF NO: 0118-04 (Indicate topics covered with "X" in fields 11-15)
 (11) DISTRIBUTION IN INTRODUCED AREA: X (12) ESTABLISHMENT AS IMMIGRANT: (13) TAXONOMY:
 (14) BIOLOGY: (15) MISC:
 AUTHOR(S): Commonwealth Institute of Entomology.
 TITLE: *Anthonomus grandis* (Boh.) Map 12 (Rev.) IN Distribution Maps of Pests.
 PUBLICATION DATA: Commonwealth Agricultural Bureau. London.
 YEAR: 1972
 16. ORIGIN—ABBREVIATION OR ZERO IN EACH SPACE
 EP: WP: SP: Af: Nt: Nt: Na: Au: Oc: Or:
 GEOGRAPHICAL DISTRIBUTION—GEOPOLITICAL DATA CODES OR "Cosmopolitan"
 17. E. HEMISPHERE:
 18. W. HEMISPHERE: CO, VE, MX, CS, ES, GT, HO, NU, CU, HA, US-TX, AZ, LS, MSAL, AR, TE, MO, GA, FL, OK, SC, NC
 19. ESTABLISHMENT STATUS (Permanent, Apparently temporary, Eradicated, Questionable, Few specimens): Permanent
 IF ERADICATED, YEAR(S)—19:
 20. ORIGINAL ENTRY—COUNTRY: US STATE/AREA: TX
 YEAR, SPECIFIC LOCALITY, IDENTIFIER/ORGANIZATION, DATE OF IDENTIFICATION:
 Brownsville, TX
 DATE OF ENTRY (OR EARLIEST DATE OF RECORD)—DAY: MONTH (ROMAN NUMERAL):
 YEAR: 1892
 FOR REVISED INFORMATION IN NOTES (ITEM 49) ENTER 'X':
 22. RE-ENTRIES—GEOPOLITICAL DATA CODES
 COUNTRY, STATE/AREA, (YEAR, SPECIFIC LOCALITY, IDENTIFIER/ORGANIZATION, DATE OF IDENTIFICATION):
 A. B.
 C. D.
 E. F.
 G. H.
 I. IF MORE RE-ENTRIES IN NOTES (ITEM 49)
 ENTER 'X':
 25. YEARS OF RE-ENTRIES:
 NEW TO—GEOPOLITICAL CODES
 26. U.S. (48 CONTIGUOUS STATES)—YEAR: 1892 STATE: TX
 27. HAWAII—YEAR:
 28. PUERTO RICO—YEAR:
 29. VIRGIN ISLANDS—YEAR:
 30. ALASKA—YEAR:
 31. CANADA—YEAR: PROVINCE
 32. TEMPERATE S. AMERICA—YEAR: COUNTRY: STATE: NAT.
 33. MEXICO—YEAR: STATE: NAT.
 34. C. AMERICA AND TROPICAL S. AMERICA—YEAR: COUNTRY: STATE: NAT.
 35. HABITAT(S)—INITIALS REPEATED WHEN HABITAT APPROPRIATE
 HABITATS ASSOCIATED WITH MAN OR DISTURBED AREAS—Greenhse-MG: Hsehled-MH: Strd.prod-MS: Waste ar.:
 rr.emb.weedy L+ -M Ornamentals-MO: Turf-MT: Bees' nests-MB: Refuse-MR: Food prod.proc-MF: Urban
 roadsides, parks-MU:
 NATURAL TERRESTRIAL HABITATS—Conif.for-TC: Mixed for-TM: Dec.for-TD: Rain for-TR: Cloud for-TL: Scrub,chnp-
 T: Grsl-d-TG: Wet meadow-TW: Desert-TE: Sandy beach-TB: Mudflat-TU: Riparian-TI: Fld.croplnd-TF: TF

Appendix 2. Continued

- NATURAL AQUATIC AND SEMIAQUATIC HABITATS—General aquat-WG· Wetland-WW· Estuarine,tidal,Intertidal-WE·
Lake,pond,reservr-WL· River,stream-WR· Subsurf,spr-WS· Ephemeral·pool,stream-WP· Container hab-WC·
PLANT HABITATS—Tree-VT· Shrub-VS· VS herb,forb,grass-VH· Aqua.macrophyte-VA· Fungus,mushroom-VF· Leaf-VL·
Stem-VM· Root-VR· Pollen,nectar-VP· Fruit-VU· VU Seed,spore-VD· Econ.plant-VE· Weed-VW·
ANIMAL HABITATS—Human host-AH· Domes,animal-AD· Other vertebrate-AV· Invert.(excl.Insect)-AI· Insect egg-AE·
I.larva,nymph-AL· I.pupa-AP· L.adult-AA· Microorganism-AM· Dung-AU· Carrion-AC·
DETAILS· Floral buds (squares)
36. HOST OR PREY REF NO· 0118-001
CLASS· Magnoliopsida ORDER· Malvales FAMILY· Malvaceae
GENUS· *Gossypium* SPECIES AND SUBSPECIES·
AUTHOR· OLD OR NEW WORLD—O/N· N
COMMON NAME(S)· Cotton
36. HOST OR PREY REF NO· 0118-002
CLASS· Magnoliopsida ORDER· Malvales FAMILY· Malvaceae
GENUS· *Hibiscus* SPECIES AND SUBSPECIES·
AUTHOR· OLD OR NEW WORLD—O/N· N
COMMON NAME(S)· *Hibiscus*
37. VECTOR OF PLANT AND ANIMAL DISEASES REF NO· 0118-00
CLASS· ORDER· FAMILY·
GENUS· SPECIES AND SUBSPECIES·
AUTHOR·
COMMON NAME OF DISEASE· PLANT OR ANIMAL DISEASE? (P or A)
38. STATUS IN IMMIGRANT AREA (Minor pest, Beneficial, Undetermined, No economic importance)· Major pest
BENEFICIAL INTRODUCED—
39. TO CONTROL (FAMILY, GENUS, SPECIES, AUTHOR)·
40. BY ORGANIZATION, SPECIALIST· 41. YEAR·
42. PLACE RELEASED—COUNTRY· STATE/PROVINCE·
43. TYPE OF ENTRY (Accidental Introduction-A, Natural range extension-N, R.ext.cult.host-new ar.-R, Purposeful Introduction-I,
Undetermined-U)· Natural range extension IF A, P OR U ENTER YEAR·
44. ACTION TAKEN AS RESULT OF ESTABLISHMENT OF PEST Legal, cultural and chemical control
45. COMMERCE PATTERNS INVOLVED IN ENTRY· (2-CHARACTER CODE)
A-Commercial cargo B-Passenger baggage C-Mail D-Hitchhiker
1-Fruits & veg. 2-Plants 3-Seeds 4-Cut flowers 5-Wood products 6-Soil 7-Ballast
47. BIL INTRODUCED BENEFICIAL ARTHROPOD COLLECTION NO·
48. VOUCHER SPECIMENS IN COLLECTION(S) OF· Up to 2 80-character lines
49. NOTES FILE REF NO· 0118-00
APHIS-PPQ LOT NUMBER(S)· A. B. C. D. E.
F. G. H. I. J.
BBII^a LOT NUMBER(S)· A. B. C. D. E.
F. G. H. I. J.
NOTES· Up to 10 80-character lines
50. DATE OF PREPARATION OF ORIGINAL DOCUMENT AND PREPARER· 0183 (MMYY) P. Wales
51. DATES OF MAJOR REVISIONS AND PREPARERS·
0185 D. Green 0385 J. Dogger

^a BBII, Biosystematics and Beneficial Insects Institute, now Taxonomic Services Unit, Systematic Entomology Laboratory.