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PEST-MAN™
Orchard Pest Forecasting System
Version 3.0 March 1995
(for use in UK)

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CONTENTS

1.	Hardware and software requirements	4
2.	Outline of PEST-MAN	4
3.	How to move about within PEST-MAN	6
4.	How to get help	6
5.	Demonstration run through PEST-MAN	7
6.	Inputting temperature data	11
7.	Historical temperature sets	12
8.	Plotting temperature records	12
9.	Saving tables of results	13
10.	Emergence model	13
11.	Interpreting the pest forecasts	14



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1. HARDWARE AND SOFTWARE REQUIREMENTS

PEST-MAN version 3.0 runs on IBM PC or 100% IBM-compatible computers. PEST-MAN requires a 386 processor or above, and 530K of base memory free. MS DOS 5.0 or higher is recommended.

Install PEST-MAN version 3.0 on the hard disk using the supplied 3½ inch high-density disk. 1 MB of free space is required on the hard disk.

2. OUTLINE OF PEST-MAN

Introduction

PEST-MAN is based on simulation models of the development of some orchard pests. It provides information on the times when particular stages of these pests are likely to be present in the orchard in the year in question. The timing of these events varies from year to year depending on temperature. This information is valuable because:-

- 1) it means that monitoring activity can be timed efficiently, and the results of sampling can be interpreted properly, so that rational decisions can be made about the need for pesticide treatment
- 2) if the decision is that pesticide treatment is necessary, then information about the timing of the susceptible stage of the pest allows the pesticide applications to be timed precisely. Thus the effect the treatment is optimised and the likelihood of another application being required later is reduced.

Outputs

Codling moth:

start of flight period (warning of date by which pheromone traps should be put out)

timing of peak flight activity (aids interpretation of pheromone trap catches). Cumulative egg hatch i.e. larval emergence (timing of the stage most susceptible to pesticides)

predicts the second generation that occurs in some years only

output displayed graphically and in table; table

	can be printed out
Summer fruit tortrix:	as for codling moth, but two generations every year
Pear sucker:	timing of egg, nymph, and adult stages of all three generations
	timing for optimal use of selective insecticides against nymphs
	timing for possible early season broad spectrum insecticide against adults and eggs
	output displayed graphically and in table; table can be printed out
Emergence model:	can enter single dates for trap catch of codling or summer fruit tortrix, and model will calculate resulting egg hatch date
Temperature record:	can be displayed graphically

Temperature Inputs

PEST-MAN requires an input of daily maximum and minimum temperatures (or more detailed temperature records), starting from 1st January. PEST-MAN is preloaded with a temperature data set for the previous five years; it defaults to the five-year-mean temperatures for any missing data i.e. any dates between 1st January and the current date for which temperature records for the current year have not been fed in, and all future dates for the rest of the year.

There are several alternative kinds of equipment that can provide the current temperature data that PEST-MAN needs:-

1. An Orion Tinytalk temperature logger. The logger can be connected to the PC by a cable, or the Tinytalk can be brought into the office and plugged into the PC via a short lead for downloading, or the Tinytalk can be downloaded into a Psion Series 3 Personal Organiser (a palmtop computer), which is in turn downloaded into the PC (extra software is required for this).
2. A Metos weather station or data logger. If a Metos is being used to provide inputs for a VENTEM scab warning system, then PEST-MAN can access the temperature data files set up in the PC from the Metos.
3. Other weather stations or temperature loggers (extra software may be necessary for this).
4. A maximum and minimum thermometer; it is possible to type in daily maximum and minimum temperatures.

3. HOW TO MOVE ABOUT WITHIN PEST-MAN

Screen layout

The MAIN MENU items are on the top line of the screen.

The current item is highlighted e.g. temperature.

The description of the current item is displayed on the bottom list.

Selecting an item will lead to a SUB-MENU or a form.

Cursor Keys

To move between MAIN MENU items use	<←> <→>
To move between SUB-MENU items use	<↓> <↑>
To select a highlighted item <i>press</i>	<Enter>
To move between form-fields <i>press</i>	<Tab>
To activate a list <i>press</i>	<Control> + <↓>
To obtain "help" on a highlighted item <i>press</i>	<F1>
To cancel current selection <i>press</i>	<Esc>

(Alternatively, most of these functions can be performed by using the mouse, or for options with a highlighted initial letter *press* <Ctrl> + the initial letter).

This information on Screen Layout and Cursor Keys is available within PEST-MAN.

To display it, move to **Help** in the MAIN MENU, and then *select* **Welcome** in the SUB-MENU

4. HOW TO GET HELP

The bottom line on every screen within PEST-MAN will prompt you to take the correct action. To obtain additional "Help" information, *press* <F1>

5. DEMONSTRATION RUN THROUGH PEST-MAN

From the DOS prompt,

type **PEST-MAN**

press **<Enter>**

The PEST-MAN title page appears

press **<Esc>** to continue

(On the first three occasions that PEST-MAN is used after installation, the "Welcome to PEST-MAN" page will appear, giving information on screen layout and use of cursor keys. On subsequent occasions this page can be selected under the "Help" menu. *press* **<Enter>** to continue)

In the MAIN MENU

Temperature is highlighted.

press **<→>** three times, so that **Help** is highlighted in MAIN MENU

In the SUB-MENU box **overview** is highlighted

press **<Enter>**

The "About PEST-MAN" page is displayed

press **<Esc>**

press **<↓>**

Sponsor is highlighted

press **<Enter>**

The "Sponsor" page is displayed

press **<Esc>**

press **<↓>**

Welcome is highlighted

press **<Enter>**

The "Welcome to PEST-MAN" page is displayed

press <Esc>

press <←> three times

Temperature is highlighted in the MAIN-MENU

In the "Temperature" SUB-MENU box **Update** is highlighted

press <Enter>

File is highlighted in the "Update" SUB-MENU box

press <Enter>

The "file update" form is displayed, with the "Site" FORM-FIELD highlighted

For new site, type in the site name (maximum 10 characters)

e.g. *type* **PADDOCK**

press <Tab>

The "File Path" FORM-FIELD is highlighted

press <Tab>

The "Filename" FORM-FIELD is highlighted

type **TEMP95.DAT**

press <Tab>

The "Year" FORM-FIELD is highlighted

type **1995**

press <Tab>

The "File Type" FORM-FIELD is highlighted

press <↓> three times, so that the **ASCII** file-type option is highlighted

press <Tab>

OK is highlighted

press <Enter>

press <→>

Pests is highlighted in the MAIN-MENU, and **Codling moth** in the "Pests" SUB-MENU

press <Enter>

The message "Forecasting codling moth" appears while the model is running, then the graphical display of "Forecasts for Codling moth" appears.

The upper graph shows the predicted pattern of moth flight i.e. the period during which pheromone trap catches can be expected, and the time of peak flight activity i.e. the time that peak trap catch can be expected. (The actual height of this peak does not reflect the size of the population in the orchard; it is an artefact resulting from the way the model functions).

The lower graph shows the timing of egg-hatch, with the curve running from 0% to 100%. On the "suitable spray periods" bar, the highlighted strip indicates the interval between 10% and 90% egg hatch i.e. the time when most of the newly-emerged larvae are present; this is the target period for insecticide application, if pheromone trap catches indicate that a treatment is necessary.

press <Tab>

A table summarising the graphical data is displayed

press <Esc> to return to the Pests SUB-MENU

press <↓> so that **Summer fruit tortrix** is highlighted

press <Enter>

The message "Forecasting Summer fruit tortrix" appears while the model is running, then the graphical display of "Forecast for Summer fruit tortrix" appears.

press <Tab> to display table summarising graphical data

press <Esc>

(The predictions for codling moth and summer fruit tortrix can be displayed simultaneously by selecting **Both codling and tortrix**)

press <↓> once or twice, as necessary to highlight **Pear psyllid**

press <Enter>

The message "Forecasting pear psyllid" appears while the model is running, then the graphical display of "Forecasts for pear psyllid" appears.

The curves show the predicted timing of egg, nymph, and adult stages for all three generations. On the "suitable spray periods" bar, optimal timing for selective insecticide application is highlighted, i.e. the intervals during which most of the population is in the nymphal stages, which are susceptible to the currently-available selective insecticides. Also highlighted early in the season is the interval just before egg-laying by overwintered adults, when it is possible to use a broad spectrum insecticide against the adults in orchards with severe infestations. Most of the predatory anthocorids important in the biocontrol of pear psyllid move into the orchard later in the year, so the use of a broad spectrum insecticide at this time is less damaging to biocontrol than a later application would be.

press <Tab> to display table summarising graphical data.

To print out the table,

press <→> so that **Output** is highlighted on the MAIN-MENU and **Printer** is highlighted in the SUB-MENU

press <Enter>

The "Printer" form is displayed. If the printer is attached to port LPT1,

press <Tab>

(If printer is attached to a different port, *press* <↓> to select port, and *press* <Tab>)

The next field asks if your printer uses an IBM character set. If it does,

press <Tab>

if it does not,

press <↓>

press <Tab>

(If in doubt, choose **YES**)

The table should be printed out (if not, check printer connections).

press <→> twice, so that **Exit** is highlighted on the MAIN-MENU, and **Yes** on the SUB-MENU

press <Enter> to exit PEST-MAN

6. INPUTTING TEMPERATURE DATA

Tinytalk Temperature Logger

Downloading

select Temperature, Update, Tinytalk, Download

"Tinytalk download" form is displayed

select correct site

select the Com port to which Tinytalk is attached (probably COM 1)

select OK

Tinytalk downloads and re-initialises

(PEST-MAN automatically creates a text file named PEST-MAN.TXT containing the downloaded data. This can be viewed in a text editor)

When set up for use with PEST-MAN, a Tinytalk temperature logger will store up to 60 days of data. If not downloaded within this time, then the data "wrap around", i.e. the oldest records are over-written.

Initialising

Before a Tinytalk first starts recording temperature, it must be initialised.

select Temperature, Update, Tinytalk, Initialise

"Tinytalk initialisation" form is displayed

type or select Site name (the Site name identifies the location where the logger is sited. If you are running more than one logger, then each must be given a separate site name)

type or select correct, Date, Time, and Com Port to which Tinytalk is attached

select OK

NB. When a Tinytalk is downloaded into PEST-MAN, it is automatically re-initialised.

Metos or other weather stations/data loggers

Follow **Temperature, Update, File**, procedures, selecting appropriate file type

Inputting data manually (from maximum/minimum thermometer)

select **Temperature, Update, Manual**

"Manual input" form is displayed

select site

select the first date for which temperature data are to be entered

use <↑> and <↓> to scroll for days

use <Pg Up> and <Pg Dn> to scroll for months (or type date in)

type - max temperature to one decimal place e.g. **8.7**, or **10.7**

type - min temperature to one decimal place e.g. **-1.5**, or **7.4**

To move to next day, *press* <↓>

press <Shift> and <Tab> to return to max temperature FORM-FIELD

7. HISTORICAL TEMPERATURE SETS

This allows previous years' predictions to be run.

select **temperature, historical**, so that historical form is displayed.

select site and year

select **OK** to accept

Then *select* appropriate pest model

To return to current year, *select* historical form again, and *select* current year.

8. PLOTTING TEMPERATURE RECORDS

This gives a graphical display of temperature records

select Temperature, Plot, so that "plot" form is displayed

select site and year

press OK to accept

9. SAVING TABLES OF RESULTS

If you wish to save a table of results

select Output File, so that "file" form is displayed

The "Path" FORM-FIELD shows the destination, and the "Filename" FORM-FIELD shows the output filename; accept the defaults or enter your own

10. EMERGENCE MODEL

There are circumstances in which the pattern of trap catches of codling moth or summer fruit tortrix may differ from the PEST-MAN predictions, e.g. if the siting of a temperature logger produces temperatures different from those in the orchard. In this situation the date of the observed maximum trap catch can be entered into the "Emergence model", and it predicts the egg hatch date that would result from this timing of adult activity.

press <F4> to display emergence model form

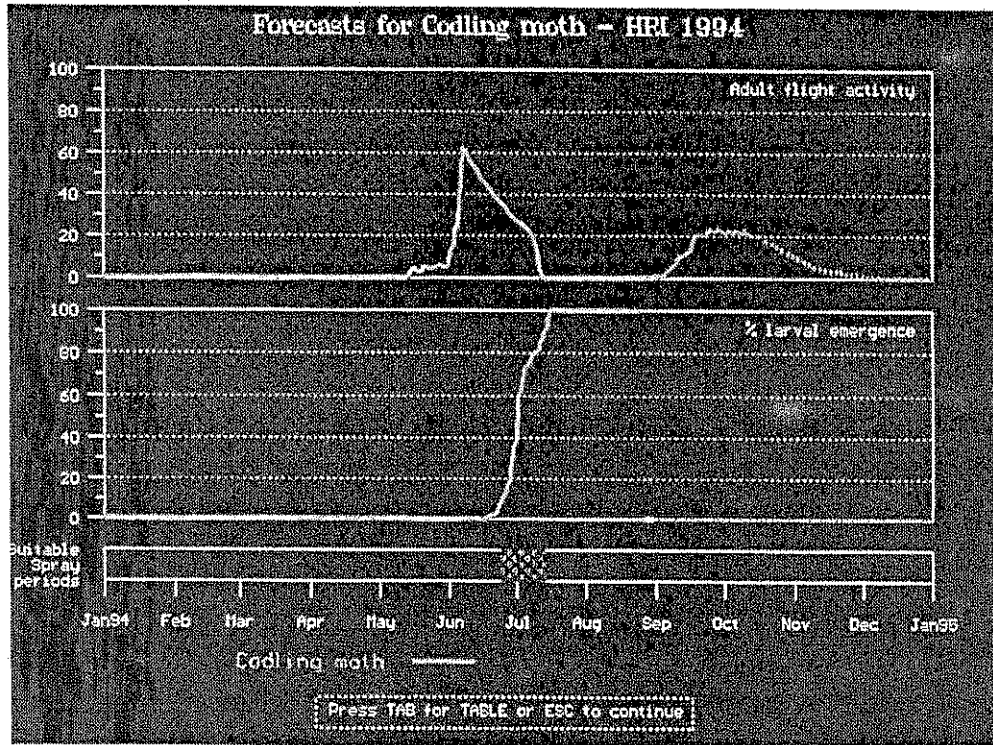
select or *type in* "Site" name

type in date of trap catch for summer fruit tortrix, and/or for codling moth.

select OK, and calculated emergence dates are displayed.

11. INTERPRETING THE PEST FORECASTS

Codling Moth (*Cydia pomonella*)



The upper graph shows the predicted pattern of moth flight activity, i.e. the period during which pheromone trap catches can be expected. The actual height of the peak is an artefact resulting from the way the model functions; it does not reflect the size of the populations in the orchard. The important thing is the position and shape of the curve. It predicts the time of the beginning of flight activity (i.e. the date by which pheromone traps should have been put out in the orchard), and the timing of peak flight activity (i.e. the time when peak trap catches can be expected). This information is valuable when interpreting pheromone trap catches, providing a framework within which well-informed decisions can be made on whether treatment thresholds have been exceeded.

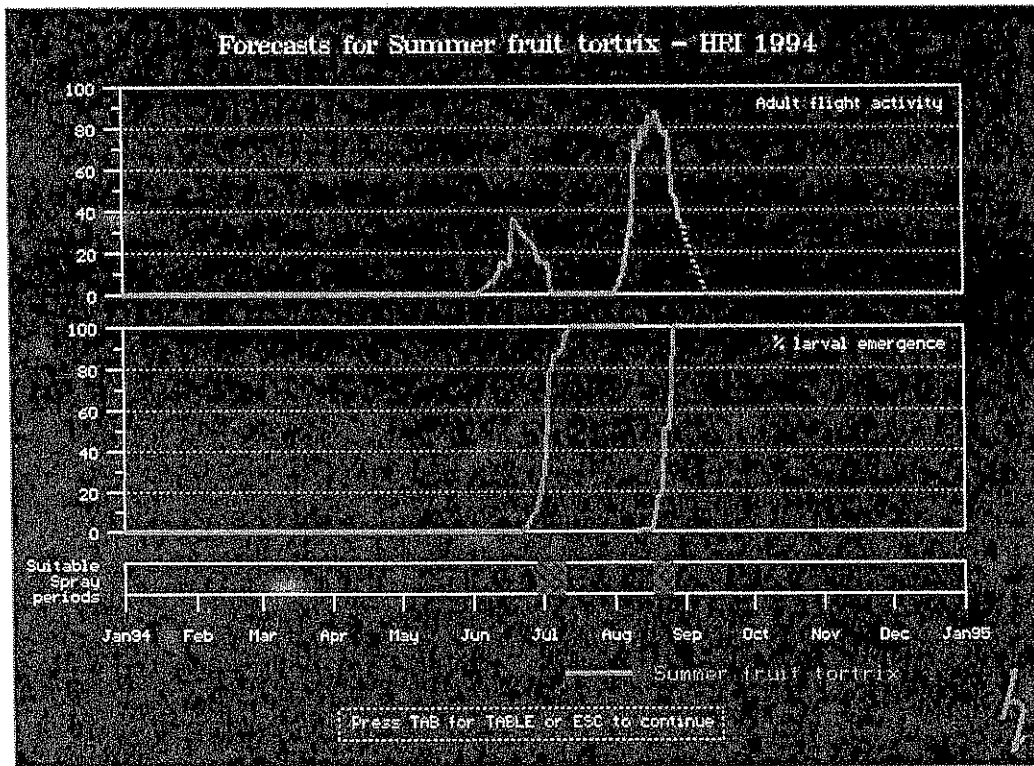
The lower graph shows the cumulative egg hatch curve, running from 0% to 100%. On the "suitable spray periods" bar below this, the highlighted strip indicates the interval between 10% and 90% egg hatch, i.e. the time when most of the newly-emerged larvae are present; this is the target period for insecticide application, if the pheromone trap catches indicate that a treatment is necessary.

Codling moth usually completes only one generation per year in the UK, but in exceptionally hot years it may pass through a partial or complete second generation. PEST-MAN predicts this second generation in years when it is likely, giving warning of the need to continue to monitor pheromone trap catches, or to put out new traps. The timing of any egg hatch of a second generation is important in relation to harvest date.

The timing of these events is including in the table of results, which can be printed out.

There are circumstances in which the pattern of pheromone trap catches of codling moth may differ from the PEST-MAN predictions, e.g. if the siting of a temperature logger produces temperatures different from those in the orchard. In this situation, the "Emergence Model" can be run. The date of the observed maximum trap catch can be entered into the model, and it predicts the egg hatch date that would result from this timing of adult activity.

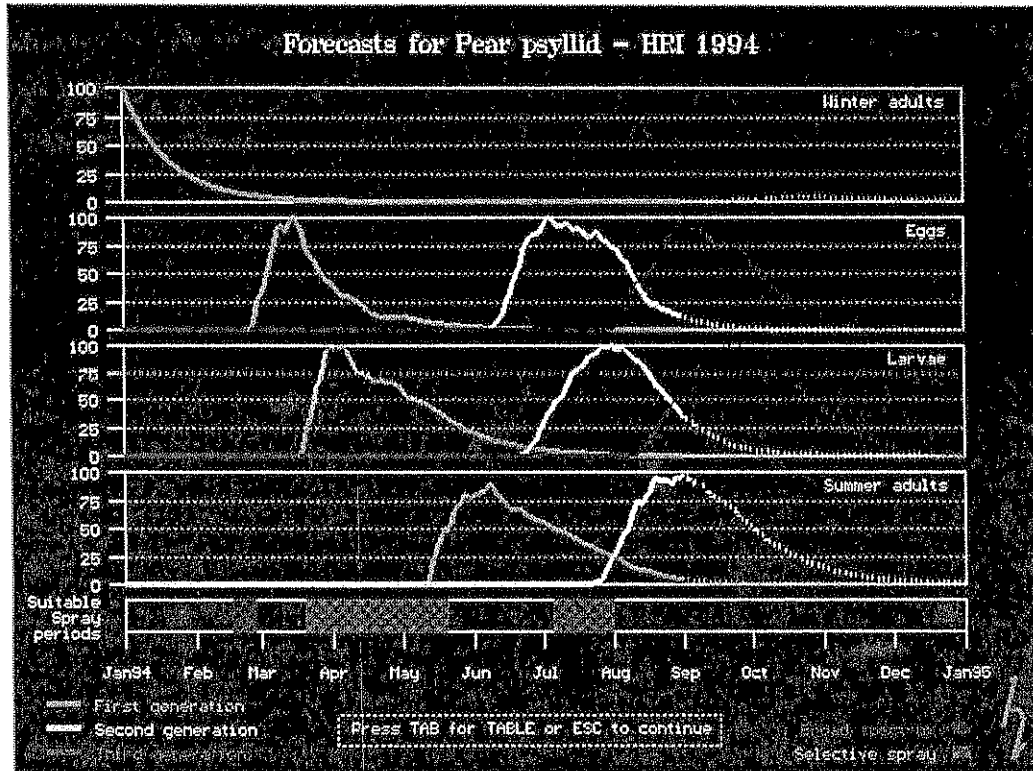
Summer fruit tortrix (*Adoxophyes orana*)



The summer fruit tortrix moth normally passes through two generations per year in the UK. As for codling moth, the upper graph shows the predicted pattern of flight activity, and the lower graph shows cumulative egg hatch.

As for codling moth, if the timing of peak trap catch differs from the PEST-MAN predictions, then the date of maximum trap catch can be entered into the summer fruit tortrix emergence model for a prediction of the egg hatch date that would result from this timing of adult activity.

Pear Psyllid (*Cacopsylla pyricola*)



Integrated pest management of pear psyllid populations is based on the exploitation of the biocontrol potential of the anthocorid bugs that prey on pear psyllids. When monitoring indicates that it is necessary to intervene with an insecticide application, then the chosen chemical should be one that does not damage anthocorids. The currently-available insecticides with these selective properties are effective against pear psyllid nymphs, but not adults. For maximum effect, the application of such selective material should be timed so that most of the pear psyllids in the orchard are in nymphal stages. This is the background against which PEST-MAN can provide valuable information on the timing of development of pear psyllid.

Pear psyllid normally passes through three generations per year in the UK. The graphical display shows the overwintering generations and the two summer generations. The curves show the predicted timing of adults, eggs, and nymphs (larvae) of each of these generations. The curves are all scaled to a standard height, and do not reflect the size of the populations in the orchard. The position and shape of the curves indicates the times when most of the psyllids in the orchard are in a particular stage. This means that monitoring operations involving sampling for adults or nymphs can be timed efficiently, and if pesticide application is necessary, it can be timed for greatest effect. On the "suitable spray periods"

bar at the bottom of the display, highlighted strips indicate suitable timings for selective insecticide applications, i.e. intervals during which the majority of the psyllids are in nymphal stages. Also highlighted early in the season is the interval just before egg-laying by overwintered adults, when it is possible to consider using a broad spectrum insecticide against the adults in orchards with severe infestations. Most of the predatory anthocorids move into the orchard later in the spring, so the use of a broad spectrum insecticide at this time is less damaging to biocontrol than a later application would be.

The timing of these "suitable spray periods" is included in the table of results, which can be printed out.