***BENHA UNIVERSITY, FACULTY OF SCIENCE***



***ENTOMOLOGY DEPARTMENT***



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| ***تمهيدي دكتورة حشرات طبية*** | ***Academic Year 2016/2017*** |
| ***الحشرات في الطب الشرعي (704 ش)***  ***Forensic Entomology (704E)*** | ***80 Marks*** |
| ***Tuesday, 22/8/2017*** | ***Time Allowed: 2 Hours*** |

1. **Write on four only from the following (20 marks):**
2. Information necessary for making an accurate prediction of time of death

* Microclimate data as temperature and humidity
* Position (Submerged, indoor, outdoor, in shade or in sun)
* Reduction in the body & Cause of Death
* Age, sex and fat contents
* Clothing, season and Geographical region
* Pesticides, Drugs & chemicals
* Insect fauna and stage of decomposition

1. Facts about insects can help determine if a corpse has been moved after death (postmortem movement)

* The body may have been moved after death, from the scene of the killing to a hiding place. Some of the insects on the body may be native to the first habitat and not the second. This will show that not only was the body moved, but it will also give an indication of the type of area where the murder actually took place. The body may have been disturbed after death, by the killer returning to the scene of the crime. This may disturb the lifecycle or successional cycle of insects on and around the body.

1. Effect of Sun exposure on corpse decomposition.

* Bodies found in direct sunlight will be warmer heating up more rapidly and decomposing faster, they will lose biomass more rapidly than bodies in shade and progress through decomposition stages faster.

1. Importance of Species identification in forensic cases

* Because Different species grow at different rates, for example 7-mm maggot may be anywhere from 3 days old to 10 days old, depending on species

1. Methods usually used by Forensic Entomology in PMI determination

Forensic Entomologists use different ways in PMI determination as:

* + - Growth diagrams of flies
    - Controlled rearing
    - Degree-Day Accumulation
    - Arthropod succession patterns

Situation dictates which is best solution

1. **Write the scientific term for each of the following (20 marks):**

|  |  |  |
| --- | --- | --- |
|  | The Statements | Scientific term |
| 1 | A Stage of decomposition where abdominal wall breaks allowing gasses to escape. Carcass deflates. | Decay Stage |
| 2 | One of the first insects to arrive at a cadaver – they prefer fresh, moist flesh. | Blow flies |
| 3 | They generally hide under a corpse during the daylight, and only become active at night when they enter the maggot-infested part of the corpse to capture and devour maggots. | Hister (clown) beetles |
| 4 | Late-arriving species tend to be specialist scavengers which feed on tougher parts like skin and tendons as the body dries out. | Hide Beetles |
| 5 | The most obvious stage and tends to be the point at which a body is noticed and recovered from the water. | Floating decay stage |
| 6 | Organisms that use the corpse as an extension of their normal habitat | Incidentals |
| 7 | A university research facility to investigate human decomposition under various conditions in order to understand the factors which affect its rate. | The “Body Farm” |
| 8 | Stiffness **or** rigidity of skeletal musclesof the corpse | (Rigor mortis) |
| 9 | A growth curve used to calculate maggot duration using temperature and maggot length | Isomegalen diagram |
| 10 | the amount of heat needed for insect growth and is useful in estimating the age of larvae in forensic cases. | Accumulated degree hours/days calculations |

1. **Write the sign or X in front of the following statements (10 marks):**

|  |  |  |
| --- | --- | --- |
|  | The statements |  |
| 1 | The PMI is between 8 and 36 hours When the corpse is worm and stiff | x |
| 2 | More fat means faster decomposition of a corpse |  |
| 3 | Sung T’zu (1235) is the First reference to forensic entomology |  |
| 4 | Databases should be developed for every region in which insects are being used to determine time of death. |  |
| 5 | heroin has been shown to decrease the rate of maggot's growth | x |
| 6 | When the corpse is cold and stiff, this means that death occurred more than 36 hours. | x |
| 7 | The shorter the actual PMI, the less accurate the estimate of the interval. | x |
| 8 | Use 70-95% ethanol or formalin to preserve specimens for morphological and molecular identification | x |
| 9 | The degree of putrefaction present in a body lying in the open air for one week corresponds to that found in a body after lying in the water for two weeks. |  |
| 10 | 'Hairy' maggots belong to pioneer flies that are purely corpse feeders. | x |

1. ***Write on* DNA barcoding and *its use in* forensic entomology*. (10 marks)***

An essay written by the student

1. **Case study 1 (10 Marks)**

Calculate the Accumulated degree hour (ADH) required for each stage of the Green Bottle Fly’s life cycle.

# Table 1: ADH of the Green Bottle Fly

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| From | To | Temp. | Hours | ADH (accumulated degree hour) |
| Egg | First instar | 72° F | 15 | 1080 |
| 1st instar | 2nd instar | 72° F | 23 | 1665 |
| 2nd instar | 3rd instar | 72° F | 25 | 1800 |
| 3rd instar | pupa | 72° F | 130 | 9360 |
| Pupa | Adult | 72° F | 137 | 9864 |
| Total |  |  | 330 H | 23760 ADH |

1. How many days does it take for a green bottle fly egg to become an adult fly?

13.75 Days or (330 Hours)

1. For a maggot at the beginning of the second instar stage, how many hours does it take to reach the third instar if the ambient temperature is 77 °F?

From Table 1, the ADH needed for the development of second instar to third instar is  **1800** ADH.

Then, how long does it take to reach 1800 ADH at 77 °F ? 1800/77 °F = 23.37 hours

1. **Case study 2 (10 Marks)**

On Saturday morning of 25/12/2016, a dead body for a woman was found in a farm with many fly adults and pupae of *Lucilia sericata*, the ambient temperature at the site was 16 °C, the maximum temp was 27 °C and the corpse temp was 21 °C. Pupae brought into the lab gave adults after 193 hours. Look at the table (table, 2) and Calculate the PMI for this case.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Temp(°C) | Egg | Larva 1st Instar | Larva 2nd Instar | Larva 3rd Instar | Pre-pupa | Pupa | Total time (days) |
| 16 | 41 | 53 | 42 | 98 | 148 | 393 | 32 |
| 21 | 21 | 31 | 26 | 50 | 118 | 240 | 20 |
| 27 | 18 | 20 | 12 | 40 | 90 | 168 | 14 |

(Table, 2) Development rate of the blowflies, *Lucilia sericata,* (in hours) at three different temperatures are found on the following table

Answer:

PMI = (41 + 53 + 42 + 98 + 148 + 393 – 193)/24 = **24.25 days**

***With my best wishes and regards***

*Prof. Abdelwahab A. Ibrahim*