Syllabus of Examination for Proficiency in Apiculture : Senior Scientific written Syllabus for Examination 2023

Although the following is a comprehensive outline of the syllabus, the student is also expected to be up to date with modern research on the honeybee, particularly where this research is dealt with in newer textbooks or in lectures that (s)he has attended. Note this syllabus is indicative not exhaustive (look on both scientific and practical for completeness)

# Natural History

The student will be able to:

* give a detailed account of sex determination in the honeybee
* give a detailed account of the effect of feeding on caste determination in females of the honeybee
* give an outline account of the discussion regarding the differences between royal jelly and brood food
* give a detailed account of the production of swarm, supersedure and emergency queen cells and the influence of “queen substance” on the production of these cells
* describe the signs and the causes of a “drone laying queen” in a colony
* describe the signs of laying workers in a colony and give an account of the circumstance in which they are produced and the pheromones involved
* give an outline account of the physiological differences between laying and normal workers
* illustrate and describe the structure of the egg of the honeybee
* illustrate and describe the development of the embryo within the egg and the hatching of the larva
* illustrate and describe the external and internal anatomy of the honeybee larva
* give a detailed account of the metamorphosis of the honeybee larva
* give an outline account of ecdysis (moulting)
* give an outline account of larval defecation and cocoon spinning
* illustrate and describe the external anatomy of the propupa and its change to the pupa
* give an outline account of the change from pupa to imago
* give an outline account of the structure and main constituents of the cuticle
* give an outline account of the invagination of the cuticle within the body of the honeybee to form linings such as those of the gut and trachea
* give a detailed description of the external anatomy of all castes of the honeybee and tabulate the differences between them
* give a detailed account of the function of all the appendages of the honeybee such as wings, legs, antennae, sting, mouth parts and hairs, give a detailed account of the life histories of one selected species of each of the following: solitary bee, social bee (other than Apis mellifera), solitary wasp, social wasp, found in Ireland.

# Internal Honeybee Biology and Anatomy

The student will be able to describe in detail and illustrate, referring to histological features where appropriate:

* the alimentary canal, including digestion, assimilation, and the production of enzymes
* the excretory system, and substances excreted
* the respiratory system, including muscular ventilation of the main trunks and diffusion of oxygen and carbon dioxide
* the circulatory system, including the heart, dorsal and ventral diaphragms
* the composition and function of the blood of the honeybee
* the exocrine glands and their functions, particularly the hypopharyngeal glands and changes in their function, the mandibular glands and their secretions, the wax glands
* wax production, the Nasonov gland and sting glands
* the nervous system including the sense receptors  the fat body including its storage of metabolites  the reproductive system of queen and drone.

The student will be able to give an outline account of:

* glycolysis and energy production
* the muscular functions in relation to respiration and flight
* the endocrine glands
* sperm and egg production

# Genetics and Evolution

The student will be able to give an outline account of the various races and strains of Apis mellifera commonly found in Europe and will be able to give a description of their appearance and behavioural characteristics and the evolution of the honeybee as a social insect. The student will be familiar with Mendelian genetics, chromosomes, meiosis and mitosis, inheritance in the honeybee, the genetic basis of sex determination including parthenogenesis and dominant/recessive alleles.

# Bee Behaviour

The student will be able to give a detailed account of:

* the function and behaviour of the worker honeybee throughout its life including types of work done, duration of work periods under normal circumstances and variations in behaviour due to seasonal changes and the state of the colony
* the mating behaviour of the honeybee queen and drone including an account of the pheromones involved
* the queen honeybee’s egg laying behaviour including the variation of numbers laid with changing circumstances and time of year
* the seasonal variation in the population size of a honeybee colony and an explanation of such variations
* the organisation of the honeybee colony
* the methods of communication used by the honeybee including food sharing, dancing, scenting and vibration, the behaviour of the foraging bee and its work methods in the field, including orientation, the behaviour of worker bees towards intruders and the theories advanced to describe the means by which colonies recognise intruders
* the collection of nectar and water and their use by the colony
* the inter relationship of nectar, honey and water in the honeybee colony
* the conversion of nectar to honey including the inversion of sucrose in, and the evaporation of water from nectar and the role of the honeybee in accomplishing these changes
* the collection and storage of pollen by the honeybee colony
* the collection and use of propolis by the honeybee colony
* the conditions leading to swarming
* the conditions leading to supersedure
* the behaviour of swarms and the method of selection by the swarm of a site for a new home
* the initiation of comb building and of the construction of comb
* the colony in winter, with special reference to ventilation, humidity and temperature control
* Honeybee Forage Plants and Pollination

The student will be able to give:

* a list of the major nectar and pollen producing flowers of Ireland and their flowering periods
* a detailed account of the wild and cultivated nectar and pollen producing flowers of his own locality
* a list of floral sources of undesirable nectar and a brief description of the characteristics of these nectars
* an illustrated description of the floral structure and mechanisms of the following nectar and pollen producing flowers: clover, apple, mustard, ling, lime and dandelion
* an illustrated description of extra floral nectaries
* an illustrated description of the shape, structure and colour of pollen grains with reference to their diversity of shape and size as an aid to identification
* an outline account of the process of pollination and fertilisation of flowering plants
* an outline account of the factors affecting nectar secretion and variations in its composition in different flower species and differing weather conditions
* an outline account of the main constituents of honeydew and its origins

# Disease, Pests and Poisoning

The student will be able to give:

* a detailed account of viruses and their detection
* a detailed account of the life cycle of the Varroa mite, its detection and treatment
* a detailed account of the life cycle of the Small Hive Beetle and Asian Hornet, its detection and treatment
* a detailed account of the signs and symptoms of American Foul Brood (AFB) and European Foul Brood (EFB)
* a detailed account of the development of AFB and EFB within the colony
* an outline account of the life cycle of the causative organisms of AFB and EFB and the development within the larva
* a detailed account of the ways in which AFB and EFB are spread
* a detailed account of the statutory requirements relating to honeybee pests and diseases and their implementation in Ireland
* a detailed account of the treatment of AFB and EFB including methods of destruction of colonies and sterilisation of equipment
* an outline account of the signs and symptoms of varroasis and methods of detection, treatment and any subsequent problems that might arise
* a detailed account of Addled Brood, Chalk Brood, Sac Brood and Stone Brood; their causes, signs and symptoms and recommended treatment
* a detailed account of the signs and symptoms (if any) of all adult honeybee diseases found in Ireland
* an outline account of the life cycle of the causative organisms of adult honeybee diseases
* a detailed account of the various treatments for adult bee diseases
* a detailed account of the laboratory diagnosis of Acarine, Nosema and Amoeba disease
* an outline account of the life cycle of braula coeca and its effect upon the colony
* an outline account of the signs and symptoms of poisoning by natural substances, pesticides and herbicides
* a list of crops most likely to be sprayed thereby causing damage to honeybee colonies
* examples of methods of spraying and the sprays which are likely to be least detrimental to honeybee colonies, a detailed account of the methods which can be used by the beekeeper to diminish the problem of spray poisoning
* an account of the action to be taken when spray damage is suspected
* give a detailed account of wax moth damage and of the life cycle of both Lesser and Greater Wax Moths (Achroia Grisella and Galleria Mellonella)

# Honeybee Products

The student will be able to:

* give a detailed account of fermentation in honey, approximate results which would be obtained from an analysis of a typical sample of honey and an outline account of the range of variations of the main constituents
* give a detailed account of the properties of honey including specific gravity, viscosity hydroscopicity and reactions to heat,