



British Beekeepers Association MICROSCOPY EXAMINATION

PROSPECTUS Applicable from January 2012

Aims

This Examination aims to provide a qualification and measure of achievement for those beekeepers with an interest in pollen, anatomy, pests and diseases relevant to the honeybee.

A certificate holder should be able to give beekeepers practical guidance on the selection and use of microscopes, help them identify a range of pests and bee diseases from samples provided and give them advice on where to find further sources of information.

A pass in the Microscopy Certificate gives exemption to the Microscopy Section of the Advanced Husbandry Assessment.

Conditions of Entry.

The Candidate shall have passed the BBKA Basic Examination or an equivalent Examination approved by the Board. The date on which the certificate was obtained shall be entered on the application Form.

The Assessment.

- (a) Examiners approved by the Board shall conduct the Examination. The Board may wish a trainee Examiner or a member of the Board to be present as an observer, but prior approval of the Candidate must be obtained.
- (b) The Candidate shall provide:
 - Two suitable microscopes, one for dissection and one for the examination of **microscope slides (a compound microscope with x400 magnification and incorporating an oil immersion lens)**
 - Dissecting tools and instruments
 - Spare slides and cover slips
 - 6 pollen slides and 4 anatomy slides made by the candidate from the lists provided in the syllabus
 - **Approximately 40 freshly killed worker bees.**
 - The equipment required to embed one or more bees in wax for dissection purposes
 - Any other equipment the candidate may require.
- (c) A requirement of the Examination is the assessment of the material prepared by the candidate.
- (d) The Examination shall be conducted at a place and time convenient to both the Examiner and the Candidate and shall be of an oral and practical nature.
- (e) The Examination may be expected **to be completed within 2½ to 3 hours.**

SYLLABUS

1.0 CONSTRUCTION AND PARTS OF A MICROSCOPE

The Candidate shall discuss with the Examiner:

- 1.1 The essential differences between microscopes used for dissection and those used for examining the detail on smears and specimens down to about 0.25µm in size
- 1.2 The difference between reflected light and transmitted light for illuminating the object and how these are achieved in the construction of a microscope
- 1.3 The concept of lens magnification for both a single lens and a compound system of lenses in simple terms only
- 1.4 The purpose of the principal parts of the dissecting microscope
- 1.5 The purpose of the principal parts of the high power microscope.

2.0 PRINCIPLES AND THEORY OF THE LIGHT MICROSCOPES

The Candidate shall discuss with the Examiner:

- 2.1 The range of magnification required for a dissecting microscope suitable for dissecting a honeybee and how this range is achieved
- 2.2 The range of magnification of a **compound** microscope suitable for examining specimens for the detection of honeybee diseases except those caused by viruses
- 2.3 The minimum sized object that can be seen using a light microscope and an elementary understanding of the dependence of this on the wavelength of light and the numerical aperture of the objective
- 2.4 The functions of the stage, condenser/mirror, diaphragm, eyepiece, objective lenses, coarse and fine focus, in the high power microscope
- 2.5 The optical features to be taken into consideration in the choice of a microscope. For example, good resolution, minimal distortion of image, a flat optical field, par focal and spring-loaded objectives
- 2.6 What is meant by the term 'depth of field' and its importance
- 2.7 The use of oil immersion for higher magnifications and the significance of the refractive index of the oil
- 2.8 The advantages of using filters of different colours
- 2.9 The use of an eyepiece graticule and its calibration.

3.0 SETTING UP MICROSCOPES FOR BEE DISEASES AND POLLEN IDENTIFICATION

The Candidate shall demonstrate to the Examiner:

- 3.1 The setting up of a dissecting microscope for the identification of Acarine
- 3.2 The setting up of a high power microscope for the identification of Nosema and Amoeba
- 3.3 The setting up of a high power microscope for oil immersion to view very small specimens eg pollen and bacteria.

The Candidate shall discuss with the Examiner:

- 3.4 **The magnification required for the identification of Acarine, Nosema, Amoeba, AFB and EFB giving the approximate size of the pathogens**
- 3.5 **The magnification required for the identification of pollen giving the approximate range of sizes of pollen grains commonly collected by the honeybee in the UK.**

4.0 DIAGNOSIS OF ADULT BEE DISEASES AND COLONY INFESTATIONS

The Candidate shall demonstrate to the Examiner

- 4.1 The dissection and examination of a worker bee for the presence of Acarine
- 4.2 The preparation and examination of a sample of bees for Nosema and Amoeba

The Candidate shall discuss with the Examiner:

- 4.3 **The identification of worker bees with signs of Deformed wing virus or Chronic paralysis virus from specimens or images provided by the examiner**

4.4 The identification of two pests from specimens, slides or images provided by the examiner and discuss the anatomical features that enabled this identification. These pests will be selected by the examiner from the following list:

Varroa destructor, *Tropilaelaps sp*, *Braula coeca* and the larval, pupal and adult stages of small hive beetle, greater and lesser wax moths

4.5 The size of the sample required for the examination of adult bee diseases and its statistical significance

4.6 How and where the adult bee sample should be taken from the hive and the reasons involved

4.7 The assessment of the level of infection or infestation and likely outcomes if treatment is withheld.

4.8 What advice should be given to beekeepers on the actions to be taken and sources of information in the event of an adult bee disease or colony infestation being identified.

5.0 DIAGNOSIS OF BROOD DISEASES

The Candidate shall discuss with the Examiner:

5.1 The key features of American and European Foul brood including the difference between healthy and diseased larvae.

5.2 What advice should be given to beekeepers on actions to be taken/ sources of information in the event of AFB /EFB being identified.

5.3 The identification of chalk brood from specimens or images provided by the examiner.

6.0 POLLEN IDENTIFICATION

The Candidate shall discuss with the Examiner:

6.1 The general construction of a pollen grain

6.2 The collection and preparation of pollen from (a) flowers, (b) pollen loads from the honeybee, (c) honey

6.3 Six slides, made by the candidate, labelled with the date the slide was made, the scientific name and the approximate size, selected from the following list of pollen grains:

forget-me-not, dandelion, rape, lime, sycamore, poached egg plant, crocus, willow, heather, hogweed, rosemary, hawthorn, hazel

6.4 How the slides were made and how they should be stored for long term use

6.5 How the size of the pollen on the slides was determined

6.6 Three pollen slides provided by the examiner.

6.7 An outline of how microscopic analysis can be used to determine the floral sources and geographic origin of honey samples including the need to take into account the over and under representation of pollen in a multifloral honey.

6.8 How the presence of honeydew in a honey sample can be detected by microscopic examination

7.0 DISSECTION AND ANATOMY OF THE HONEYBEE

7.1 The Candidate shall provide **freshly killed** workers, demonstrate ability to embed them in wax during the examination and be able to perform and discuss the abdominal dissection as requested by the Examiner.

7.2 The Candidate shall make and provide for discussion four labelled anatomical slides with one slide made from each of the following four lists. At least three of these slides should be prepared as permanent hard mounts .

List A	List B	List C	List D
Front, middle and hind leg of worker	Mouthparts of worker (displayed)	Fore and hind wings of worker or drone	Sperm
Comparative slide of a hind leg from drone queen & worker	Comparative slide of mandibles of drone, queen and worker	Antennae of both worker and drone	Two Varroa (one mounted dorsally and the other ventrally)
Everted endothallus of drone genitalia	Sting of worker or queen	Portion of trachea	Hypopharyngeal gland

8.0 HEALTH AND SAFETY

The Candidate shall discuss with the Examiner

- 8.1 The potential hazards of working with chemicals, naked flames, microscopes, electrical devices & dissecting instruments**
- 8.2 The need to undertake a risk assessment before commencing any activity of a practical nature**
- 8.3 The need to wear protective clothing, chemical resistant gloves and goggles when handling hazardous chemicals and to always work safely with respect to themselves and others.**
- 8.4 The safe disposal of hazardous waste e.g chemicals, broken glass slides, scalpel blades and remains of bees.**