UNIVERSITY OF ESWATINI

MAIN EXAMINATION PAPER 2019

TITLE OF PAPER : **ENTOMOLOGY**

COURSE CODE : **BIO372/BIO472**

TIME ALLOWED : **THREE HOURS**

INSTRUCTIONS :

1. **THIS PAPER HAS TWO SECTIONS, A AND B**
2. **SECTION A IS COMPULSORY (ANSWER ALL QUESTIONS IN THIS SECTION)**
3. **ANSWER ONE (1) QUESTION FROM SECTION B**
4. **WHEREVER POSSIBLE ILLUSTRATE YOUR ANSWERS WITH LARGE CLEARLY LABELLED DIAGRAMS**

SPECIAL REQUIREMENTS: **NONE**

THIS PAPER IS NOT TO BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATORS

SECTION A (Compulsory)

QUESTION 1

Read the material below and answer questions thereafter.

Africa: Act fast to halt the declining insect numbers

Insects are among the most diverse and successful organisms on our planet and their significant contributions to vital ecological functions including pollination, pest control and maintenance of wildlife cannot be ignored. But a new scientific review of insect numbers startlingly warns that bees, ants and beetles are disappearing eight times faster than mammals, birds or reptiles. Meanwhile, some species such as houseflies and cockroaches are likely to boom. This should concern not only professionals in agriculture but also professionals in health and development as this "plague of pests" could have many detrimental impacts on human health and livelihoods - especially those of the poor who are the most vulnerable. This threat could undermine decades of hard-earned progress in development. Insect-based ecosystem services such as pollination and pest suppression are essential for agriculture and for the people whose livelihoods depend on it. Insect natural enemies of crop pests keep pest populations in check, reducing the likelihood and frequency of outbreaks and the need for synthetic insecticides, which are known to harm human health and the environment.

Why the decline?

Pesticides use is a major cause of the alarming insect declines outlined in the review. They decimate beneficial insect communities including those that control pests. Unlike natural pest control ecosystem services, pesticides also cost money - a burden for resource-constrained farmers in low- and middle-income countries such as those in Sub-Saharan Africa. The development of insecticide resistance by pest species is a key part of this destructive dynamic. It is likely to further worsen the situation, making insecticides more expensive and possibly more toxic to humans, other organisms, and the environment. More alarming is the fact that insect crisis is just one among many threats. This is not surprising because the challenges today's world faces, as well as their many underlying drivers, are interlinked. A recent report from the Institute for Public Policy Research warns of a potentially deadly combination of factors. These include climate change, mass loss of species, topsoil erosion, deforestation, and acidifying oceans, which are driving a complex, dynamic process of environmental destabilisation that has reached critical levels.

The UN FAO's new report on biodiversity for food and agriculture based on data gathered in 91 countries concludes that the plants, animals, and microorganisms that are the bedrock of food production are in decline. If these critical species are lost, it "places the future of our food system under severe threat". The report identifies land-use changes, pollution and climate change as causes of biodiversity loss.

How to halt the decline

What can researchers, development practitioners, and policymakers do? More attention should be directed toward three main areas, with efforts pursued simultaneously. First, there is a need to protect natural and semi-natural habitats in agricultural landscapes and beyond. The diverse values of these habitats in providing a wide array of ecosystem services themselves as well as supporting organisms that provide ecosystem services-should be made more "visible" and accounted for in decision-making. Valuation and modelling studies are needed to help us understand where their benefits lie. This includes both economic and other benefits, who receives them, and what likely interactions and inter-connections exist among species and across land use types.

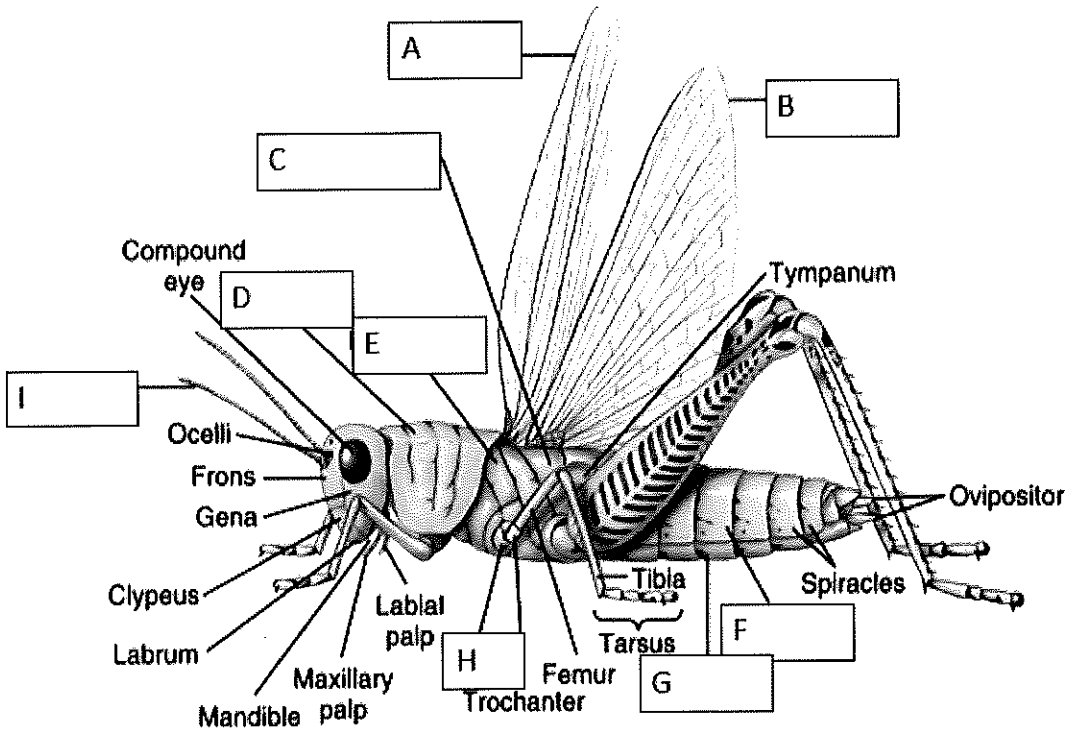
Second, the adoption of biodiversity-friendly practices should be accelerated. While becoming more common, these are not growing quickly enough. CGIAR researchers are well positioned to explore this topic and use their work to inform the public and policymakers on existing obstacles and the technological and institutional innovations needed to accelerate the adoption of ecologically-based practices by farmers at all scales in developing and developed countries.
Third, researchers, development practitioners and policymakers should support farmers to sensibly use synthetic insecticides and other agro-chemicals. Both regulatory and market-based interventions are needed to reduce farmers' reliance on insecticide-based control in the long run.
Together, these three strategies can help address the threat posed by the dangerous decline in insect populations. Managing the crop pest problem so that pests and natural enemies co-exist and sustain a balance resilient to environmental shocks is our first line of defence. If this line holds, we can avoid trying to "control" the problem and many of the negative social, economic and environmental consequences associated with our interventions.

1. Identify factors contributing to insect decline. (3)
2. What solutions are suggested to halt the decline? (3)
3. Explain why should we be concerned about the decline in insect diversity? (10)
4. Alternately, why should we not be concerned? (8)

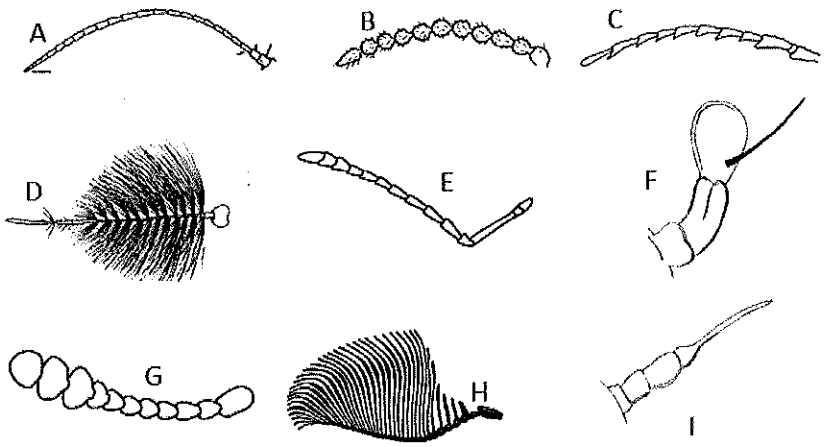
[Total = 25 marks]

QUESTION 2

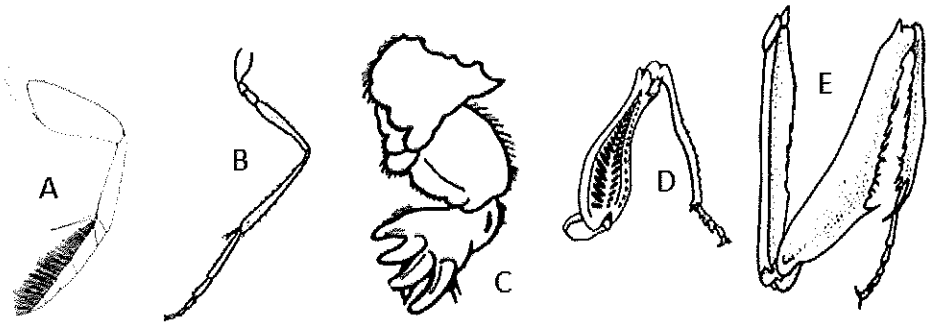
a. Label the parts A to I. (9)



b. Identify **any 6** types of antennae from the diagram below. (6)



c. Identify the type and function for the legs below and identify their function. (10)



[Total = 25 marks]

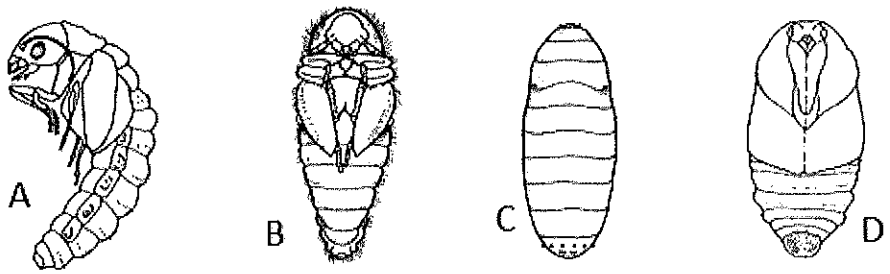
QUESTION 3

a. From the table below, match the function to the relevant structure on the left. (10)

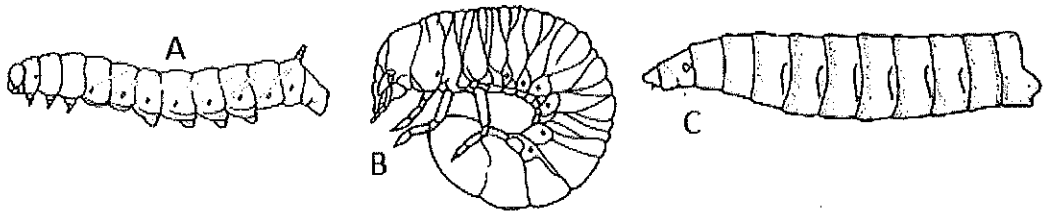
Mouthpart / wing / structure	Function
i. Mandibles	A. hind wings are reduced to form small, club-like structures for balance
ii. Labrum	B. lateral pincers handle and manipulate the food
iii. Maxillae	C. cutting jaws capture and break up food
iv. Labium	D. leathery forewings
v. Hypopharynx	E. forewings that are leathery at base and membranous near the tip
vi. Elytra	F. upper lip help keep food in the mouth
vii. Tegmina	G. tiny hooks on anterior margin of hind wing attach to posterior margin of forewing

Mouthpart / wing / structure	Function
viii. Hemelytra	H. hard, sclerotized front wings
ix. Halteres	I. tongue-like structure moves food around
x. Hamuli	J. lower lip and sensory palp

b. Use two of the following words to identify each of the following pupae below: exarate, obtect, coarctate, decticous, adecticous (8)



c. Use two of the following words to identify each of the following larvae below: campodeiform, polypod, vermiform, scarabaeiform, apod, elateriform, oligopod, eruciform (6)



d. What does Isoptera mean? (1)

[Total = 25 marks]

SECTION B

Answer only ONE (1) question from this section.

QUESTION 4

Insects illustrate a diversity of reproductive strategies. Discuss the different modes of reproduction observed in this Class.

[Total = 25 marks]

QUESTION 5

Insects have different types of developmental patterns. Describe these and explain how these have contributed to insect success.

[Total = 25 marks]

QUESTION 6

Differentiate between the following:

i. Parthenogenesis and polyembryony	(4)
ii. Stadium and instar	(4)
iii. Paleoptera and Neoptera	(3)
iv. Coarctate, adecticous and Exarate, decticous	(10)
v. Defoliator and leaf miner	(4)
	[Total = 25 marks]