A multi-agent model of the population dynamics of mirids in a cocoa farm

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1- INTRODUCTION

Cocoa

- Primary sources of income for several African countries;
- Raw material for certain agri-food, pharmaceutical and cosmetics industries.

Related works on mirids

- Macroscopic level without considering local interactions among the individual mirids;
- As this kind of systems is complex, it is essential to understand these interactions in order to forecast the evolution of the cocoa production.

Proposal of a multi-agent model

- Agents represent the mirids through their life cycle in cocoa farm environments;
- Based on the biological and ecological partial knowledge found in the literature;
- Built according to the ASPECS methodology.

Challenges of cocoa farm

- Mirid (Sahlbergella singularis) is the key insect pest of cacao in West Africa;
- Controlling the mirids' population and understanding its impacts on the cacao.

Figure 1: *(a) Sahlbergella singularis adult on a cacao pod in Cameroon. (b) Sahlbergella singularis nymphs and the caused damage on cocoa pods in Cameroon. (c) Old caused damage of Sahlbergella singularis on a cacao tree in Cameroon [1]*

2- AGENT MODEL

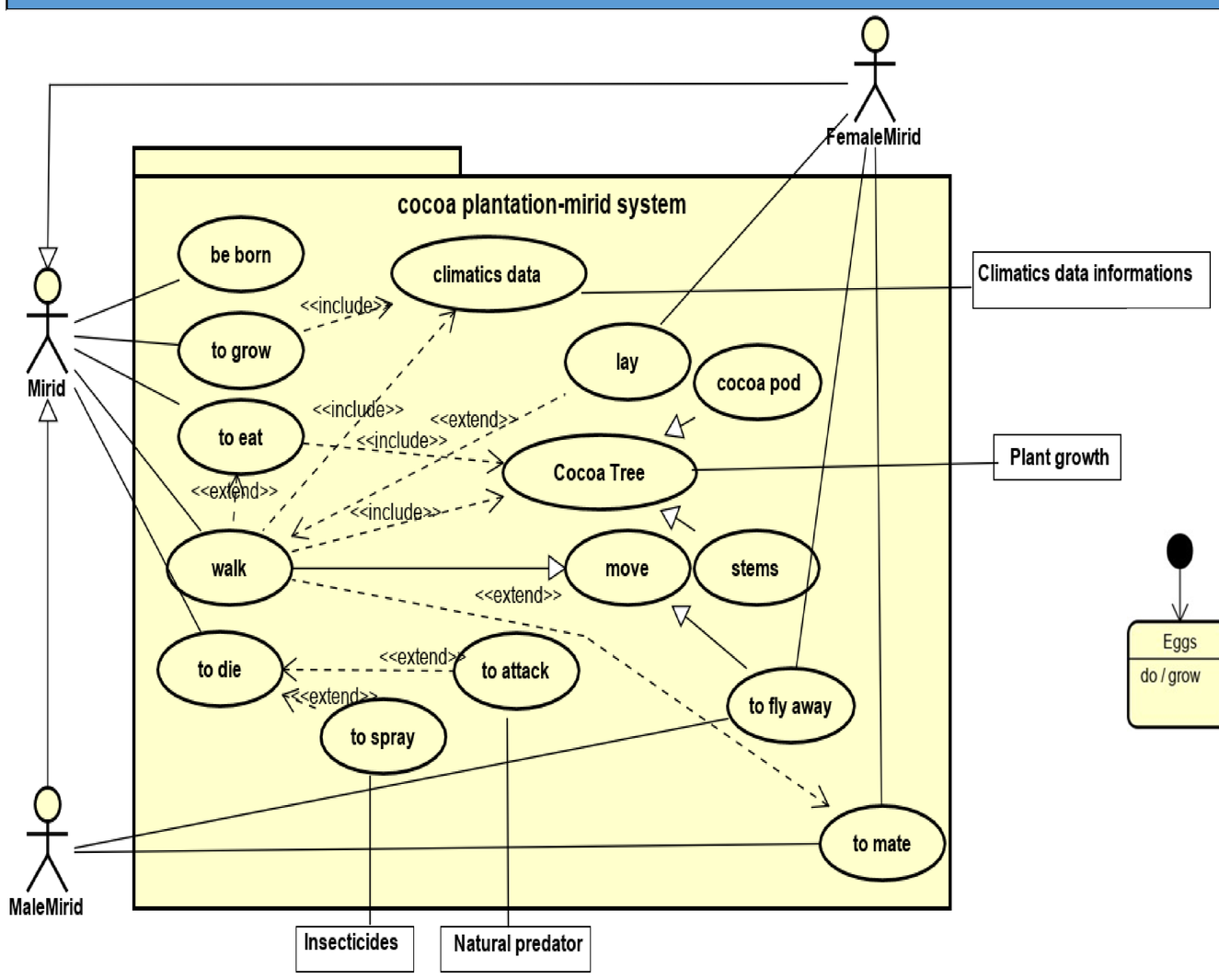

Figure 2: *Use case diagram of the cocoa plantation-mirid system*

Figure 3: *State diagram of the life cycle of mirids*

3- CONCLUSION AND FUTURE WORK

- An initial agent-based model representing the population dynamics of mirids in a cocoa farm;
- Our model aims to create a comprehensively design-specific, detailed, and integrated system to control specific pest species within specific crop zones.

Next areas of our work could be:

- The simulation and validation of our proposed model;
- The evaluation of damage caused by the mirids;
- The integration of the impact of human actions (spread of insecticide) on the mirids population;
- How to auto-regulate the population of mirids by the use of ants for biological control of insects;
- Testing our model and simulating it with entomological research data.

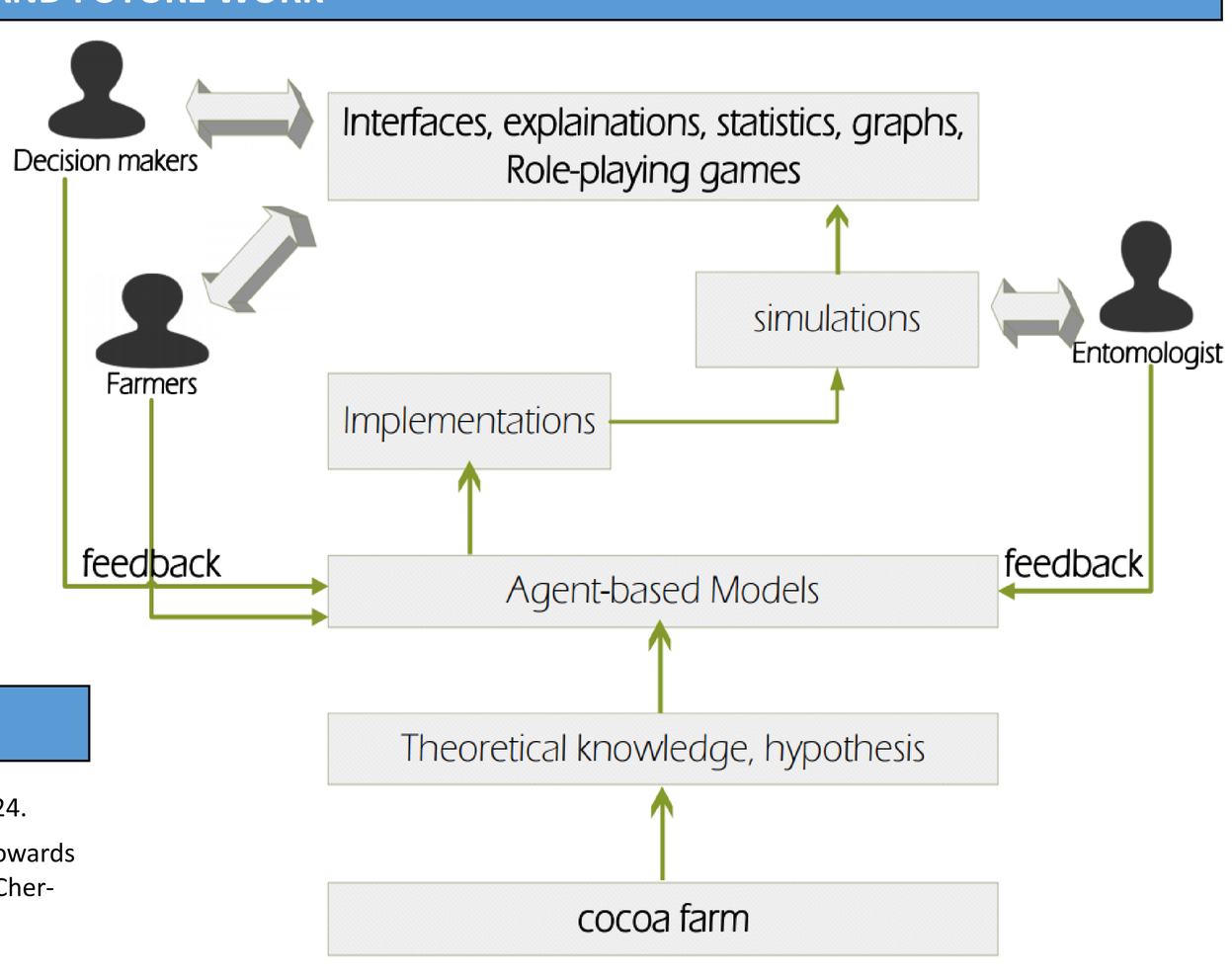

Figure 4: *Workflow of our future work [2]*

REFERENCES

[1] Bagny, Leila, R ́egis Babin, and Gerben Martijn Ten Hoopen. "Insect pests affecting cacao." (2018): 1-24.

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