Global Barriers and Facilitators to the Uptake of Biopesticides

Joint CABI and FAO evidence synthesis

Robert Malek, Kris Wyckhuys, Neal Haddaway, Dirk Babendreier, Melanie Bateman, Lukas Wyrwal, Qingpo Yang, Ivy Saunyama, Sini Savilaakso, Gu Baogen, Ulrich Kuhlmann

Bryony Taylor, September 2025

FAO – CABI Partnership Award in 2024…

Strengthened collaboration recognised in 2023 with an MoU focused on:

- Evidence synthesis
- Extension advisory services
- Science communication

FAO partnership award for CABI in 2024 to recognise and reward the efforts of noteworthy and effective partnerships that contribute to achieving sustainable development.

Most recently, as part of the Juno Evidence Alliance, agreed to develop a joint **evidence synthesis** to identify global **opportunities and barriers to the uptake of biopesticides**

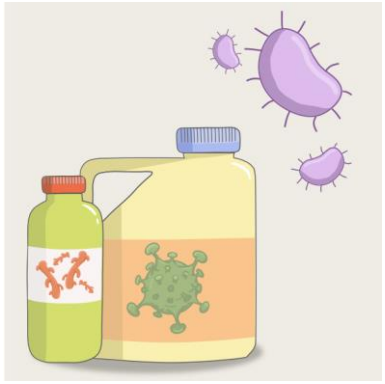
Evidence synthesis overview

- **Problem statement**
  - Despite growing global interest, biopesticide use remains limited compared to synthetic pesticides
- **Research questions:**
  - What research exists on **barriers** and **facilitators** to biopesticide uptake?
  - What are the **barriers** and **facilitators** to biopesticide uptake and where do they occur along the stages of the uptake pipeline?
  - How do they vary by biopesticide type (e.g. microbial, macrobial), literature type and geography?

Scope of the study

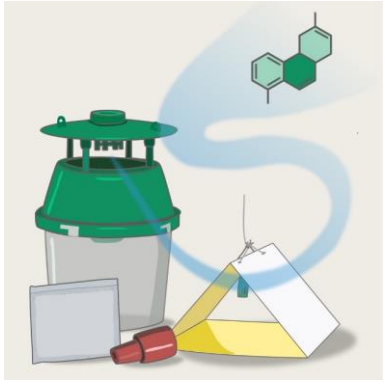
- **Geographical scope:** Global
- **Timeframe:** 2016 – present; in line with the publication of the FAO guidelines for the registration of microbial, botanical and semiochemical pest control agents (FAO and WHO 2017)
- **Population:** Biopesticides
- **Intervention:** the 7 stages of biopesticide production and uptake pipeline
- **Phenomenon:** Contextual barriers and facilitators across stages
- **Literature type:** Academic and grey literature

Types of biopesticides included in our study:



Microbials and their extracts

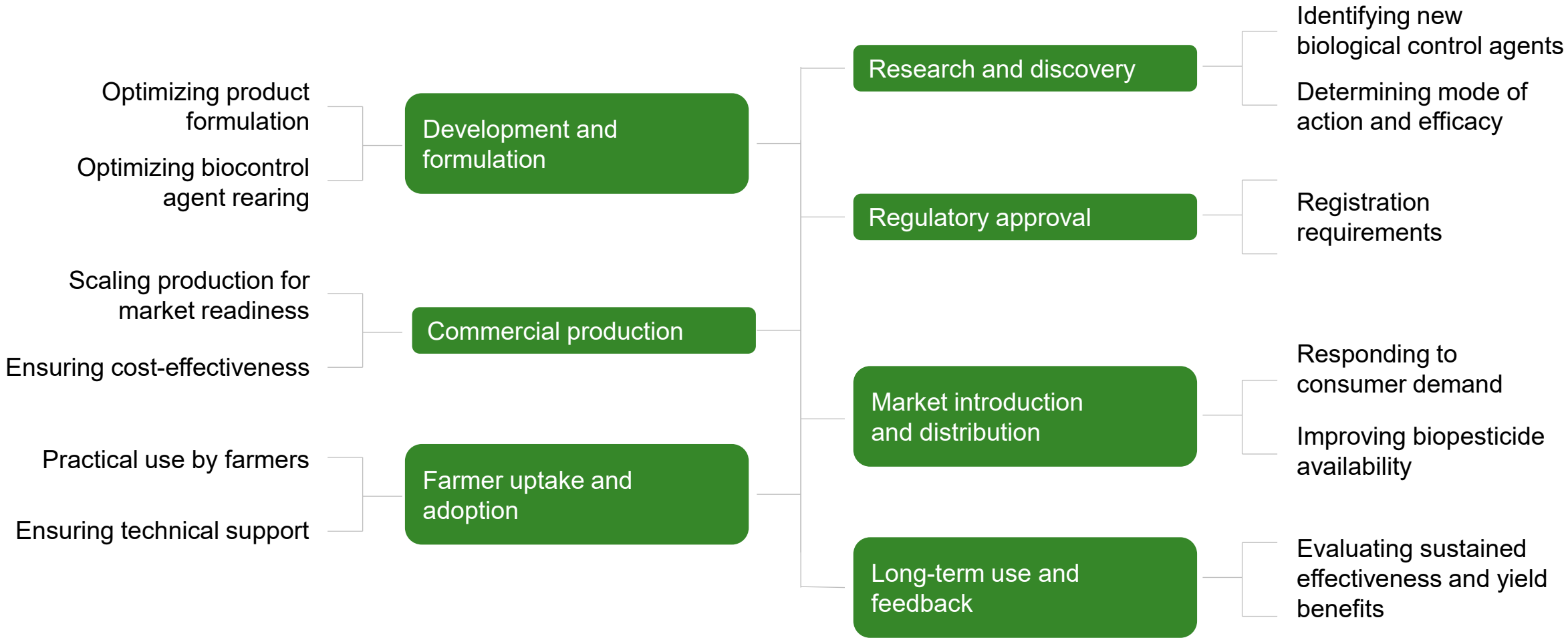
Macrobials (augmentative biocontrol)



Semiochemicals

Botanicals and other natural substances

Biopesticide production and uptake pipeline



Approach: Data extraction

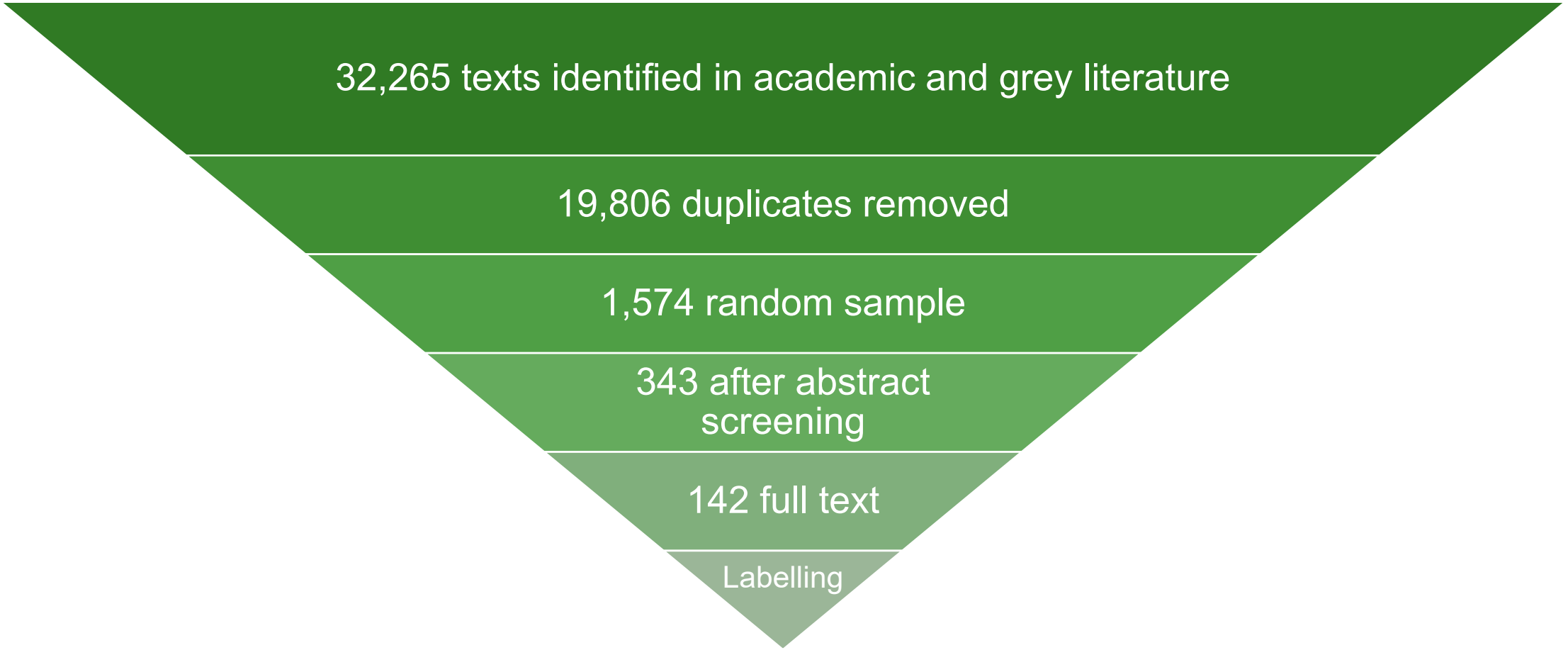
- Define search string (biopesticides, barriers, facilitators, timeline etc.)
- Search **academic databases** (e.g. CAB Abstracts, Scopus, Web of Science) and **grey literature websites** (FAO, CABI, IBMA, UNEP, ICGEB, OECD, APAARI, STDF)
- English language publications

Screening

Data extraction

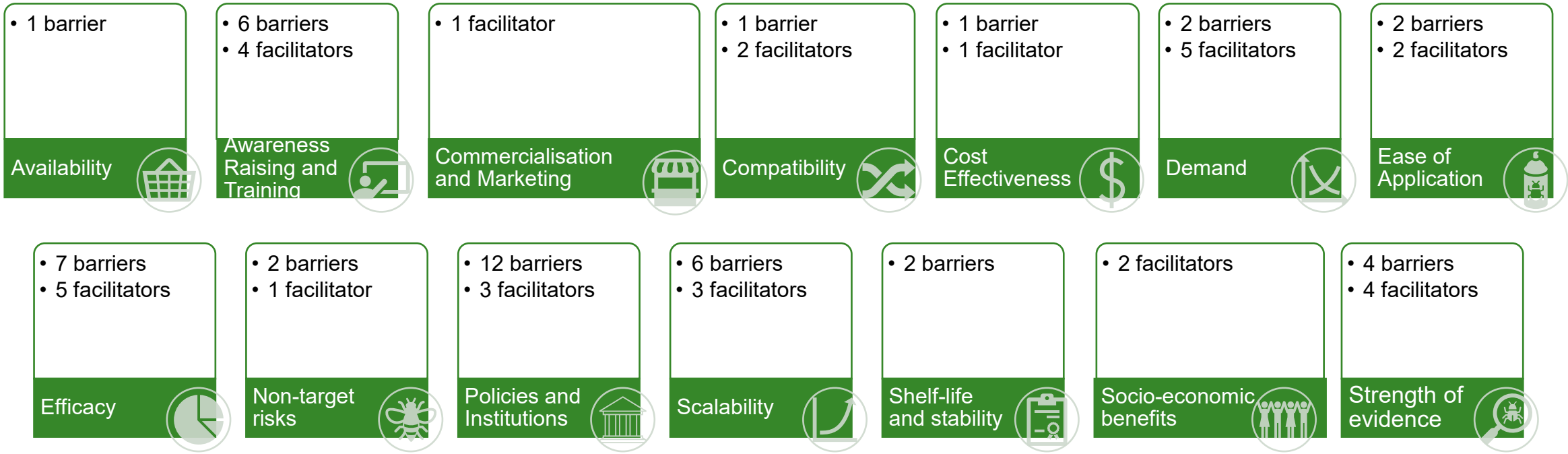
Screening

Synthesis

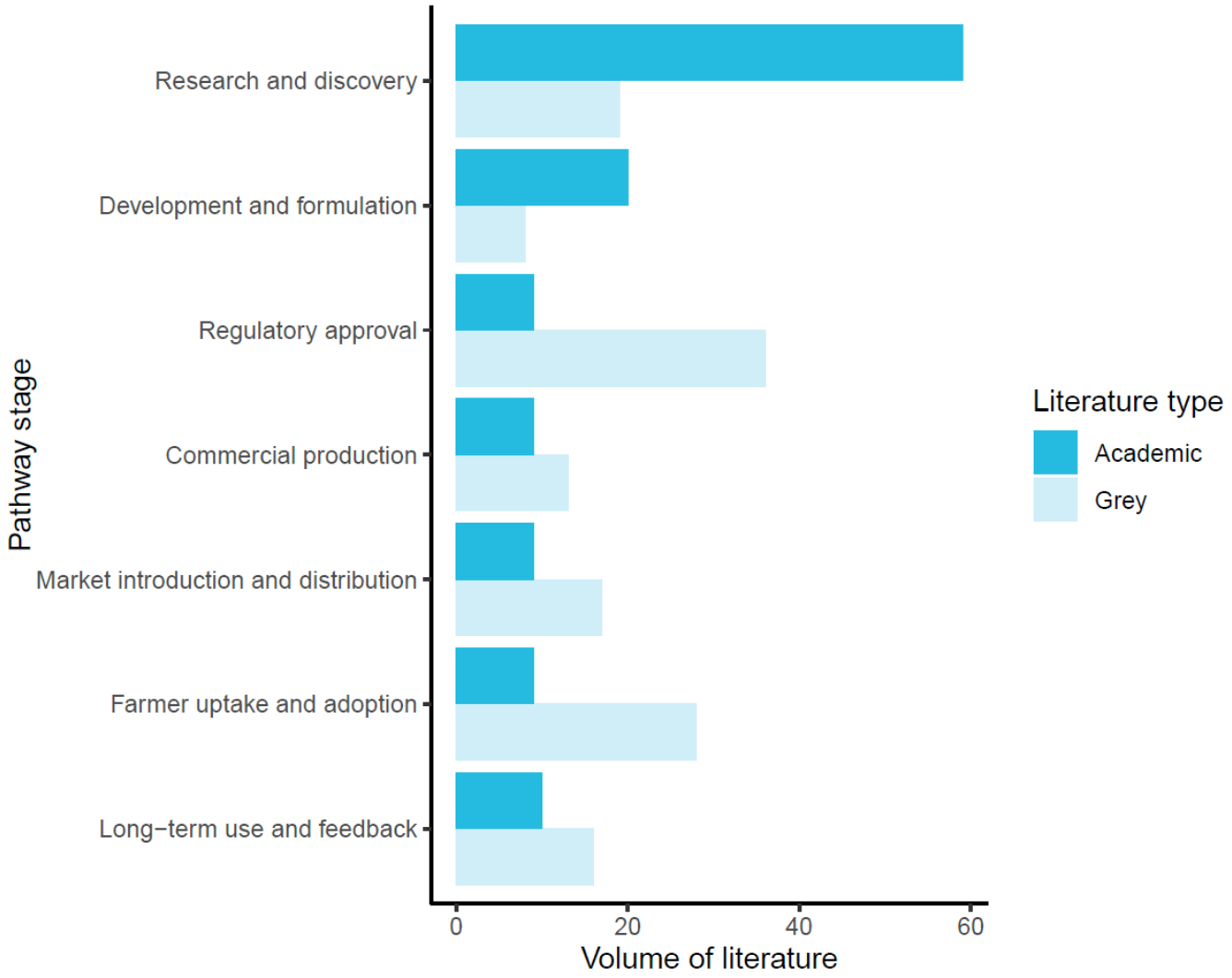


Data coding: Themes and labels

- 83 consolidated labels allocated across the 14 themes
- Other coding and classification: biopesticide type, stage in pipeline, stakeholder group, geographical scope, literature type (academic/grey)

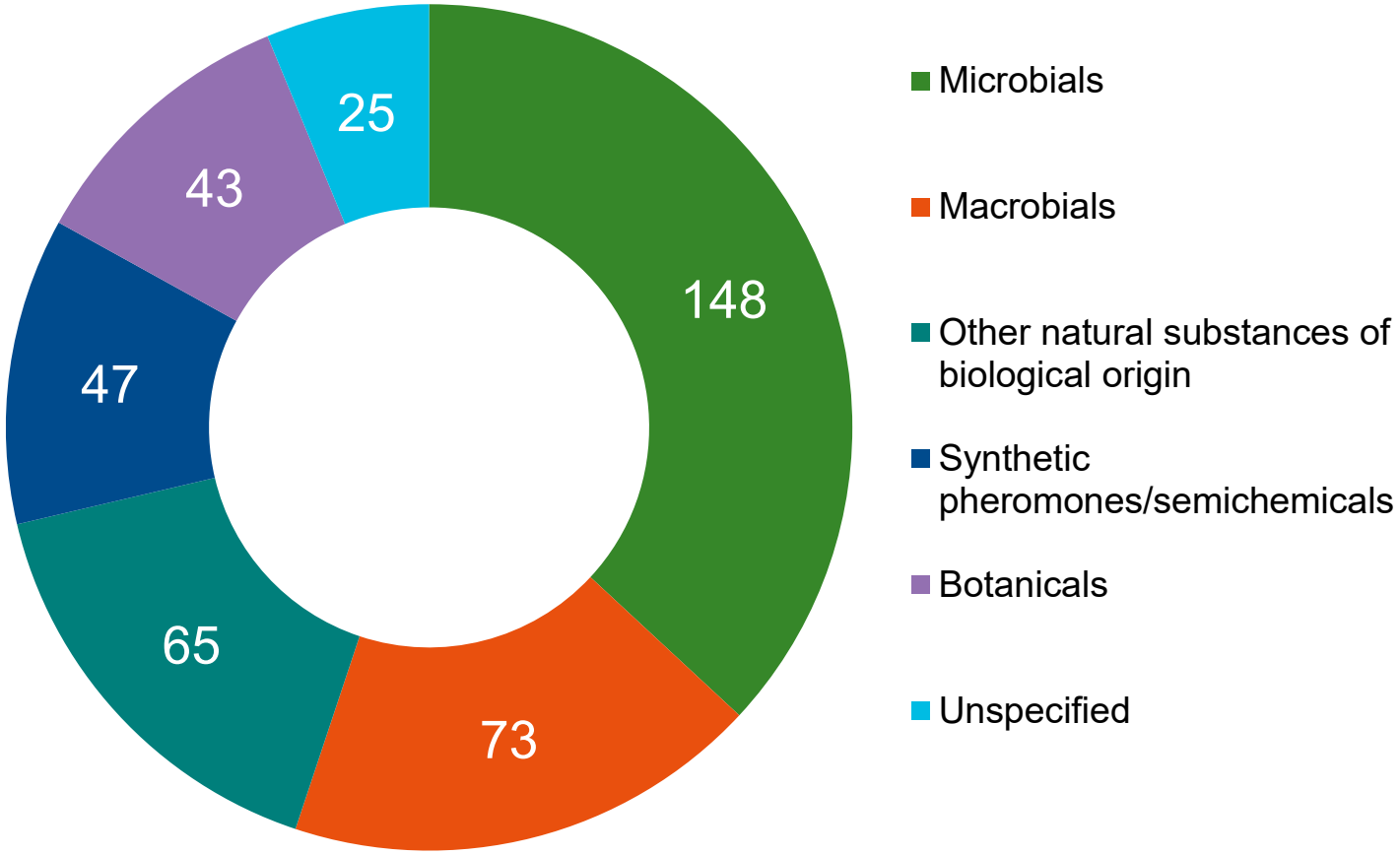


Research distribution by stage and literature type



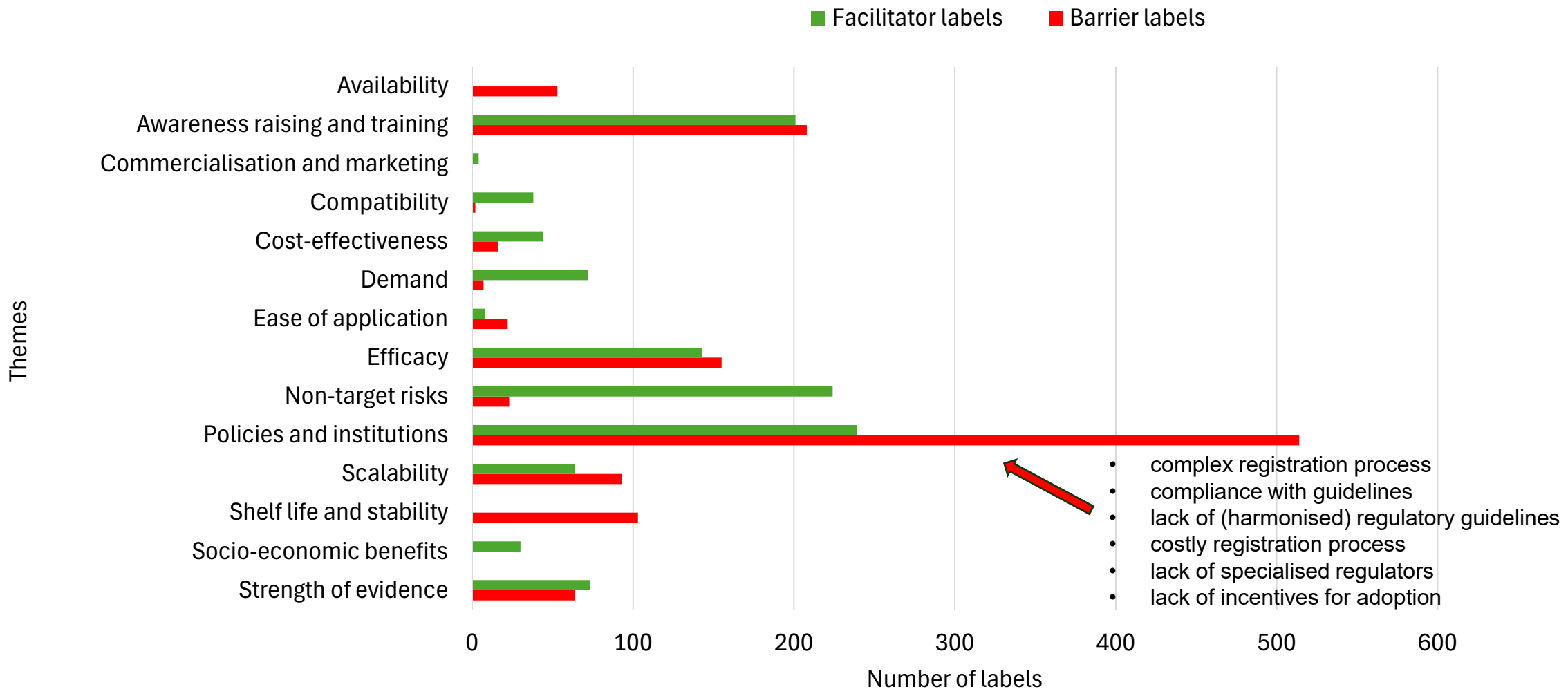
- Vast majority of **academic literature** focuses on the early stages of development
- **Grey literature** gives more attention to regulatory approval and farmer uptake
- The transitional **commercial production** and **market introduction** stages have limited literature, likely due to private sector domination

Variation of research (grey + academic) by biopesticide type

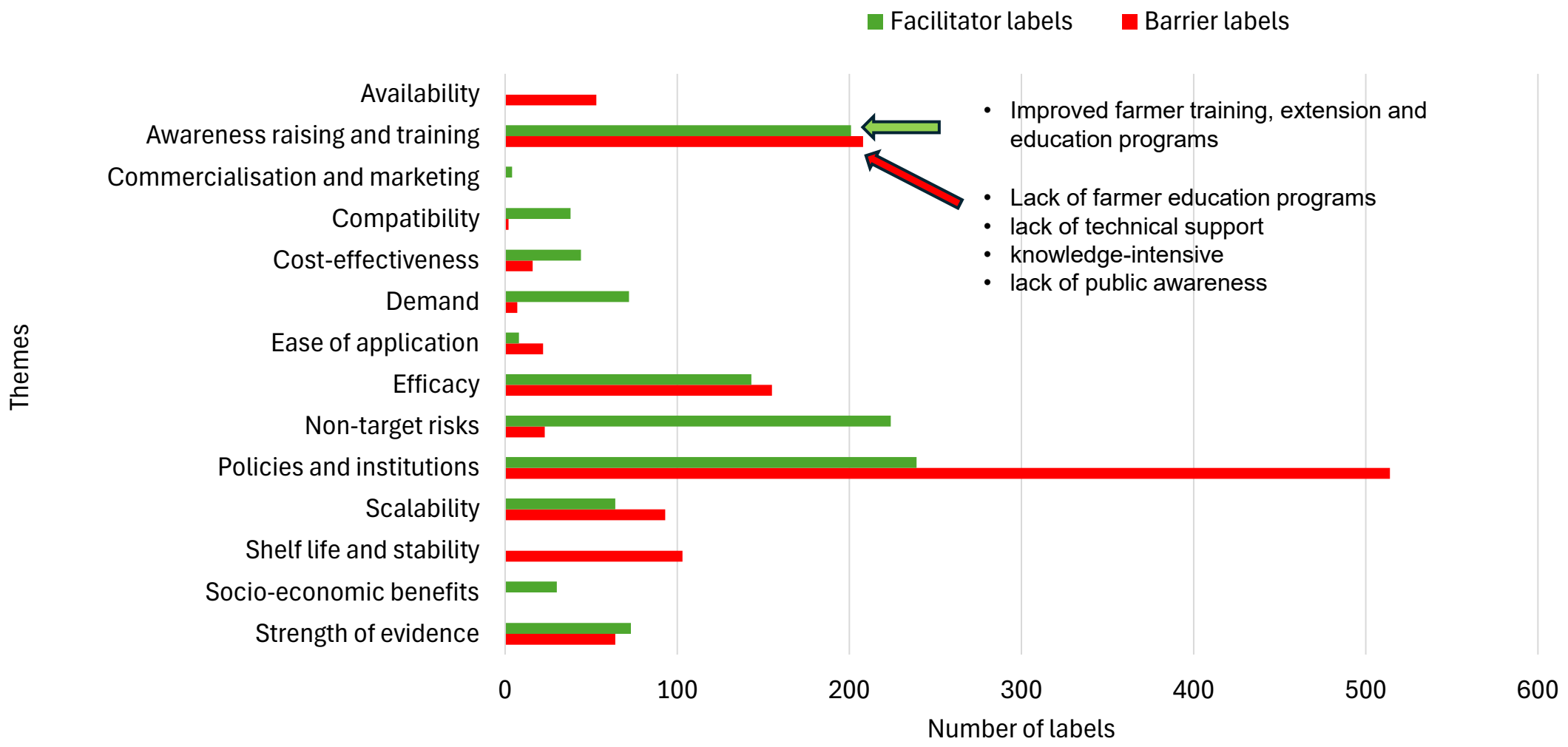


- **Microbial (148)** biopesticides are the most researched, possibly due to their commercial relevance, diversity, and regulatory precedence

Relevance of barrier and facilitator themes

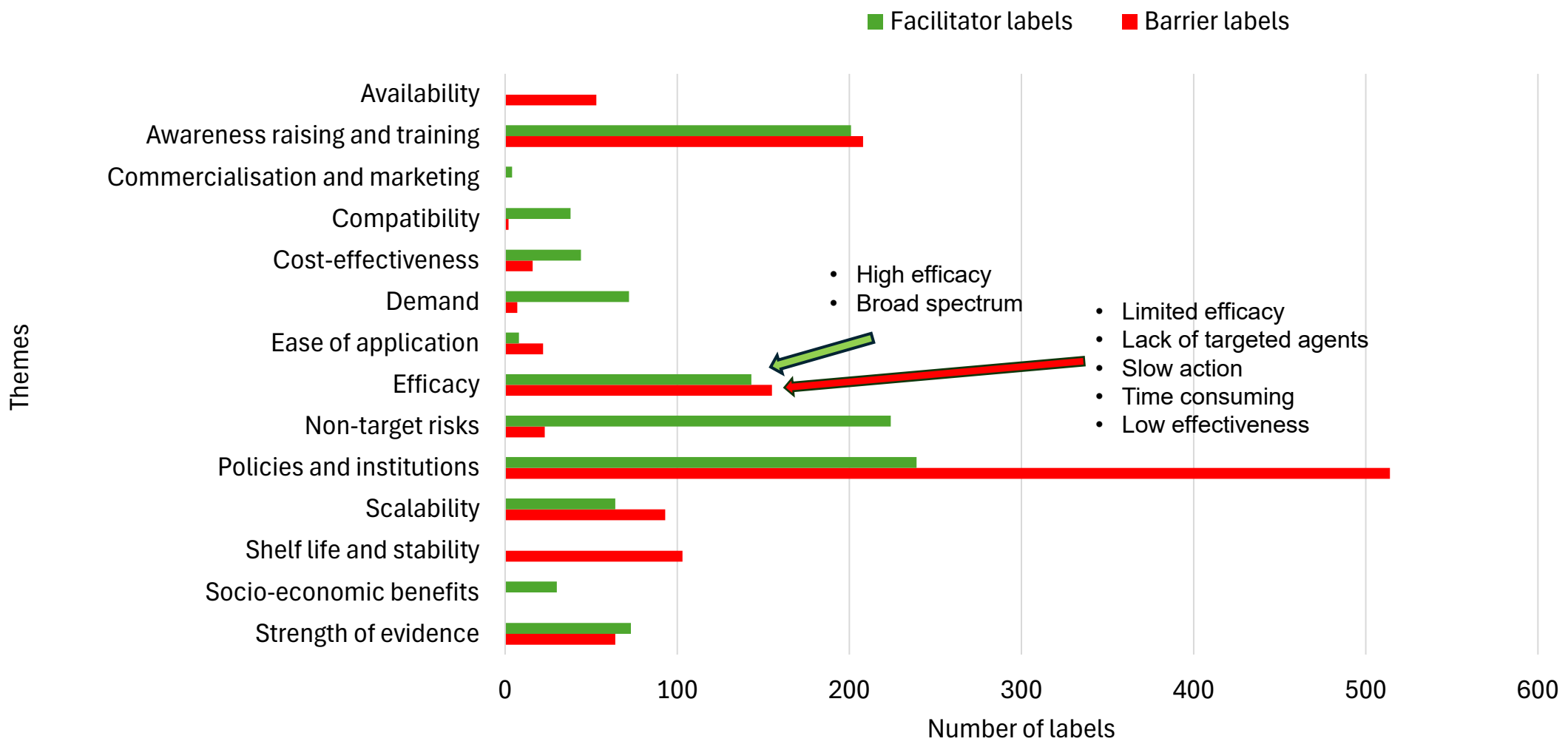


Relevance of barrier and facilitator themes



Relevance of barrier and facilitator themes

Relevance of barrier and facilitator themes



Relevance of barrier and facilitator themes

Initial take home messages

- Large discrepancies by **literature type:**
  - **Academic literature** more geared towards research and discovery
  - **Grey literature** focuses on regulation and farmer uptake
  - **Overall literature** is skewed to the early stages of development
- Strong focus on **microbial** biopesticides across the literature suggests an advanced commercial relevance
- Most prominent **barriers** to biopesticide uptake dealt with the theme **'policies and institutions'** such as complex registration process, compliance with guidelines, lack of (harmonised) regulatory guidelines costly registration process and lack of incentives for adoption; this may be a prime area to target

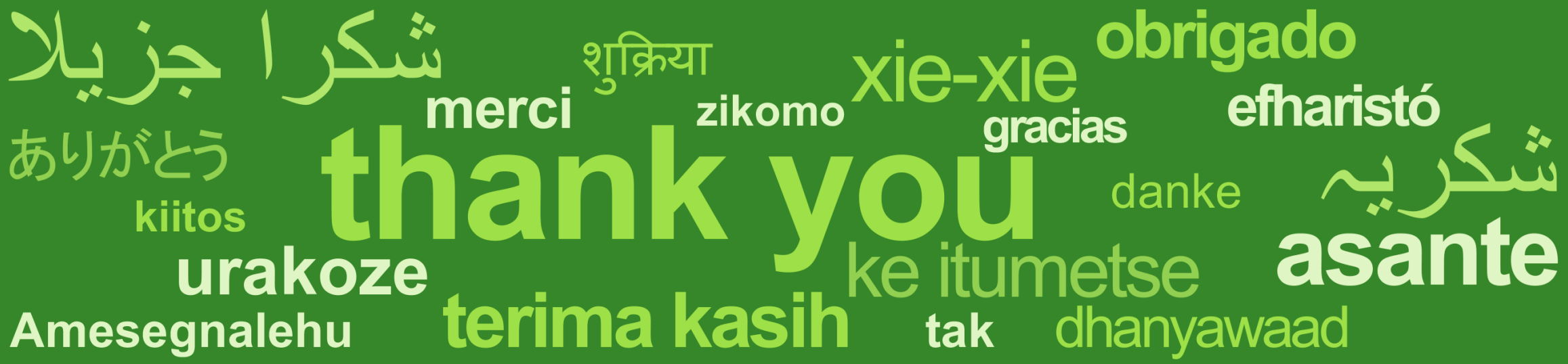
Initial take home messages

- The most prominent **facilitator** for uptake of biopesticides was their **high level of safety and low level of risk for human** and environmental health
- **Barriers** touching on technical aspects such as efficacy, scalability, application- or shelf-life issues were altogether less prominent and are also difficult to take action on
- One important theme of **barriers was the lack of technical support** and farmer education programs; however, similar number of labels were found mentioning **improved farmer trainings as a facilitator**

Next steps and outputs

CABI-FAO next steps and Outputs:

- Conclude screening and data analysis
- Scientific paper
- Evidence-based **policy brief** published by FAO to provide recommendations that help countries:
    1. Overcome the identified barriers and
    2. Capitalise on identified facilitators to biopesticide production and uptake



CABI as an international intergovernmental not-for-profit organization, gratefully acknowledges the generous support received from our many donors, sponsors and partners. In particular we thank our Member Countries for their vital financial and strategic contributions.