Classical Biological Control

Common approach to Classical Biocontrol

- Involves control of exotic pest species... by introducing NE discovered at pest’s native habitat.
- Exotic species... transplanted/introduction to a new land... will flourish unhindered & become pests because NE left behind in the native habitat.
- In the native habitat the pest is not a problem... regulated by the natural enemies.
- Basic principle... by introduction. NEs collected from true OR native habitat of the pest, the pests (in outbreak) abundance is reduced in that new land... by the NEs

- Foreign exploration for NEs is the first step taken.
  - Involves searching mainly within presumed native range of the exotic pest.
  - Guide to searching ?? consider...
    - Taxonomy... include closely related taxa.
    - Ecology... related taxa occupy similar niches.
    - Candidates from... different seasons, climates, elevations.

- Discovery phase... once candidates identified...
  - Put through a series of evaluations at the native habitat... to minimise the danger of accidental introduction.
  - Evaluations... category of NE... 1° but not 2° or 3° parasitoids, good functional response, good reproductive capacity, very adaptive,
    - Self-perpetuating, similar climate, etc.
  - Can be mass-cultured for release...
    - Strict quarantine security is observed.
    - Facilities well equipped with insect-proof labs. BUT limited personnel access.

Classical BC - to curb exotic pest

- Sequence of activities...
- Exploration & Discovery.
  - Pest evaluation
  - Its biogeography
  - Its host plants
  - Its natural enemies
- Foreign exploration
  - NE recovery
  - QUARANTINE
- Research laboratory.
  - Mass culture, insectary
- Establishment & spread
  - Field colonisation
  - Post-colonisation & evaluation
  - If effective, end intro.
  - Otherwise, continue
  - Repeat procedure

- First attempt in Malaysia.....
- Early 19th century... in 1930s
- Since then many more attempts to introduction or import BC agents against exotic pests.
- Some eg.
  - The weed, Cordia curassavica controlled by the beetle Schematiza cordiae
  - The DBM, Plutella xylostella controlled by the wasp Diadagma semiclausum
  - The CPB, Conopomorpha cramerella by the wasp Trichogrammatoidea bactrae
First successful exploration...
  ladybird beetle Rodolia cardinalis... collected from Adelaide... attacked cottony-cushion scales Icerya purchasi... BUT exotic pest of citrus, Cali.
Koebele also brought over a dipterous parasitoid, Cryptochetum iceriae. Both predator & parasitoid became established colonisers within a year, dramatic success!
How come ??
California & South Australia = Mediterranean climate

Relevant concepts leading to success of search
  Pest amenable to BC... immigrant pest offers better prospect for success than indigenous sp.
  Long-standing pest-predator association in their native habitat.
  Climate similarities between area of origin and the destination.
  High host-specificity (single introduction)... or interspecific competition (multiple introduction)... providing a sequence of attack against all host (pest) stages in time & space.
  Search on host plant affected by the pest... in the land of destination.
  Pest is non-polyphagous... perennial crop... provided source of refuge.

Ways to increase number of NE
  Import new NE for establishment & hope get self-perpetuation in the pest environment.
  Manipulate environment to favour NE... through plant diversity, nectariferous weeds, etc.
  Addition of supplemental food or host resources to increase reproduction & ensure survival, eg. provide honey source for parasitoids.
  Releases programmed to augment... to conserve... numbers of NE produced naturally by :-
    Inoculative release (reestablishment)
    Sustained inundative release (overwhelming)
    Strategic massive release...
  Take max. advantage of the natural host resources (made available by mother nature)... or plant them in strategic locations... to produce additional NE progeny in the field.

Details of Colonisation Procedure.
  1. Colonisation site
     Choice depends on...
     - diversity of environment features.
     - specific requirement relating NE suitability.
     - strive optimum condition for NE performance
  2. Timing of release -
     at earliest seasonal availability of host (pest)
     favourable weather for NE
     subsequent releases planned in advance
     releases done early morning... allows early adaption to habitat
  3. Storage of NE -
     Desirable in the form of continuous culture.
     Stored pupae, eggs at specific temperature & RH.
  4. Types of release material -
     Depends on biology of host pest and NE (sex)
     Usually adults are released... mated females
     At times the pupae are released... females
     Sometimes infested host stage, egg parasitoid
  5. Mating prior to release -
     Make sure functional not abortive mating... requires longer time together
     But, not overmating, exposed too long or many males at a time... will get more male progeny... because female get over excited and eggs not fertilised.
6. Ovipositional capacity -
Â Know reproductive biology of NE... some oviposit immediately... some require an extended period of mating.
Â Hold time after mating... put in culture, may cause reproductive degeneration... resorption of eggs.

7. Food & water -
Â Usually honey water is used... some require fresh honey.
Â Some require body fluid of host... so dead host are kept in refrigeration.

8. Open field release -
Â Must observe orientation & searching habit, have information on functional response
Â At immediate vicinity of host
Â Attempted oviposition should be monitored, can ascertain perpetuation of generation

9. Confined release -
Â Possible to examine conditions conducive for attacks... can evaluate climatic influences
Â Reduces competition from existing resident NEs... esp. when starts with limited number or limited availability at first.

10. Release number
Â Depends on number available
Â Number adequate for a given area...
   Â guided by NE’s functional response...
   Â can estimate NE : pest ratio to be introduced
Â Do limited colonisation first before mass field release... inoculative (intermittently) then inundative release.
Â Commercially... release in pill boxes together with the host as initial food

11. Continuation of release period -
Â General rule... seldom succeed (not lasting) with the initial intro/establishment... cause lack adaptability
Â Require sequence of repeated attempts... will require some time
Â After 3 years still not established... failed, ineffective NEs... relook at strategy of introduction... stage, time, crop stage, etc.
Â How can we ascertain ??... recovery attempts... do field sampling