# Ambivalent feelings over *Megachile*

**Anthony Raw**

Departamento de Ciências Biológicas,
Universidade Estadual de Santa Cruz,
Ilhéus, Bahia, Brasil. 45650-000
anthony_raw@yahoo.com.br

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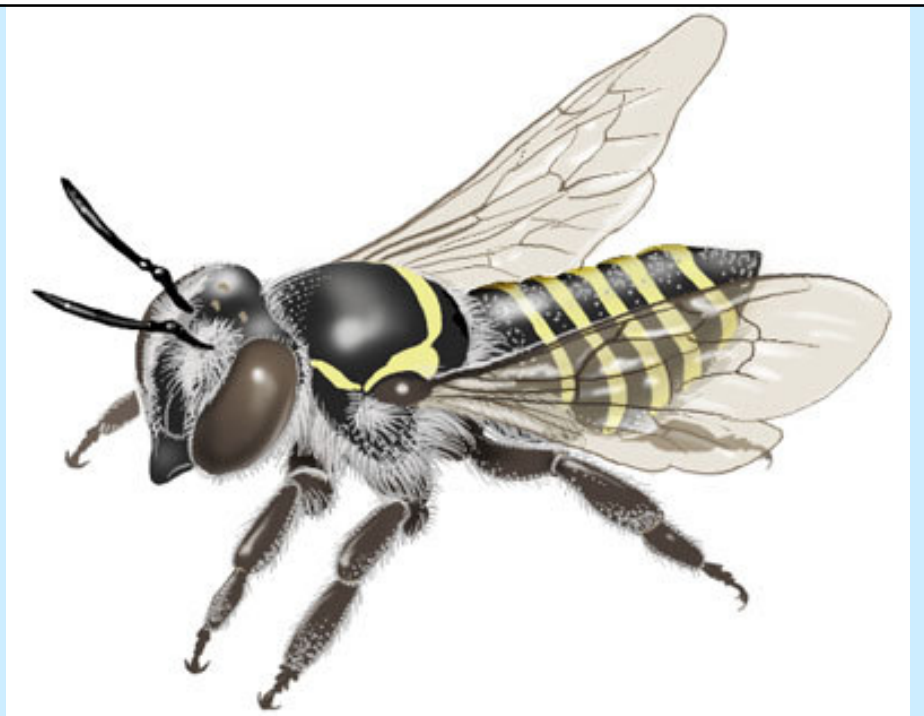
There is much ambivalent feeling among entomologists, pollination botanists and even bee biologists and over the genus *Megachile*.

## The positive side

The bees occur almost everywhere and it is a relief to identify the genus easily and know something of the bees' biology.



## Nest biology

All species are solitary.

Most nest in existing cavities, including trapnests.

The leafcutter species cut leaves to lines their cells.

Some use chewed leaves.

Mason bees use mud and resin to build the partitions or even the entire cell.

Many are important pollinators of crops and native plants.

Major nest predators in most regions are species of *Coelioxys.*

## The negative side

But then; to identify the species ?

What was a godsend turns out to be a nightmare.

There are huge numbers of species and most of them look much the same.

## Number of species

According to Michener (2000) *Megachile* comprises at least 1,320 species world-wide.

He was being cautious.

When I started this work I compiled a world-wide list. I have 2,643 names.

## Identification

For identification even to subgenus, the bees must be adequately prepared.

In both sexes open the mandibles to expose the inner surface.

In males spread the fore and mid legs to examine the lower surfaces.

To determine subgenera of females, open the apex of the abdomen to allow examination of the sixth sternite.

The simplest method to discover how to prepare the bee is to identify freshly caught specimens.

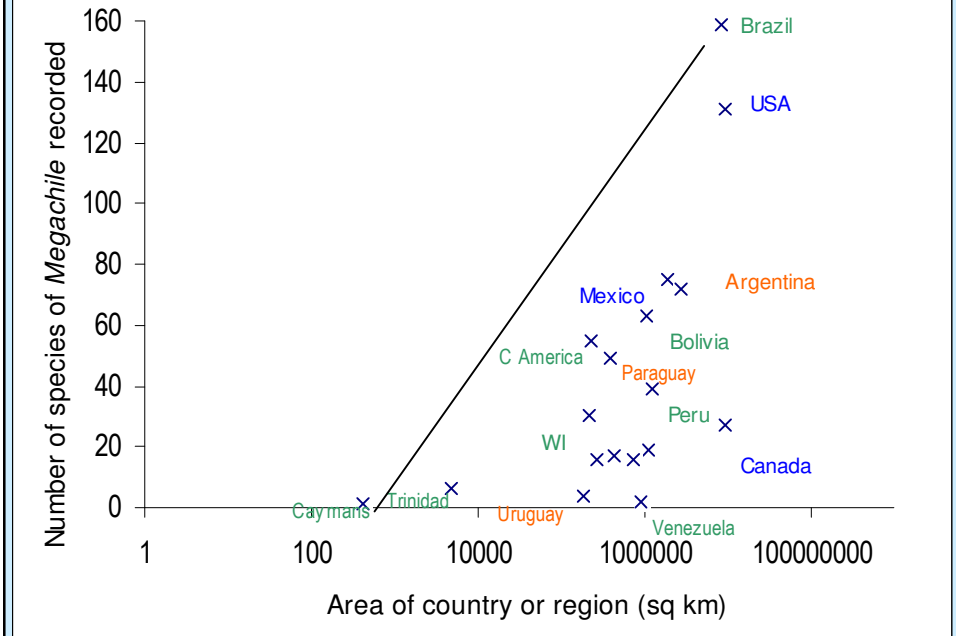
## The species of *Megachile* in the Americas

| | Restricted to neotropics | Restricted to nearctic | Both realms | Total Americas |
|---|---|---|---|---|
| **Number of species** | **387** | **117** | **11** | **515** |
| **Percentage** | **75** | **23** | **2** | |
| **Number of subgenera** | **16** | **4** | **10** | **30** |

# Identification of *Megachile* species in Brazil

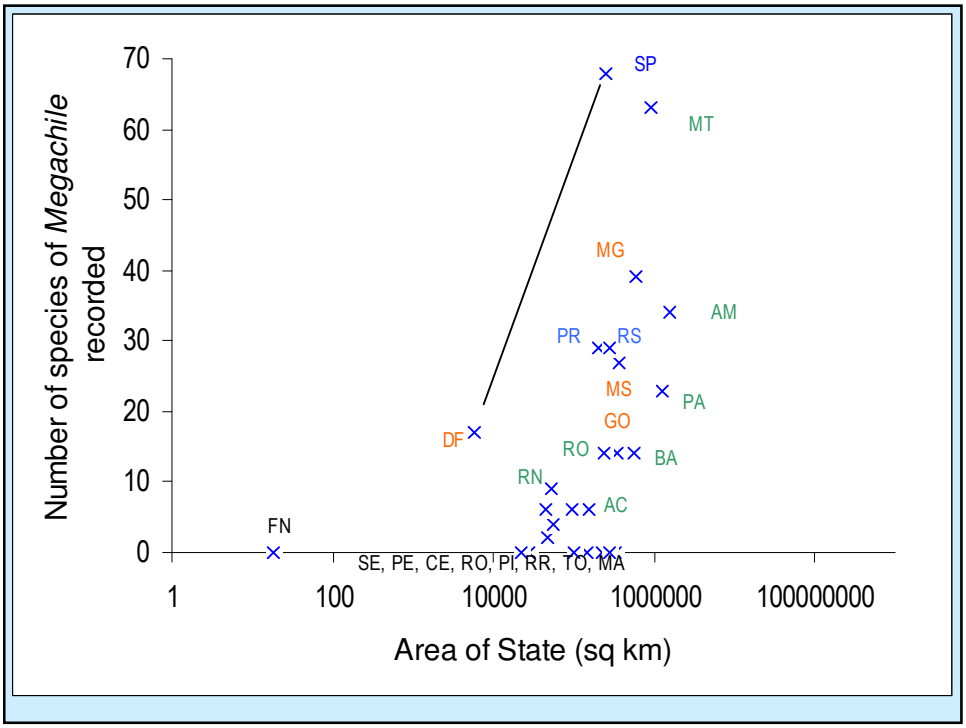
**Citations in many publications are made only to generic level.**

| Publication | Number identified | Number not identified | % not identified |
|---|---|---|---|
| Cure et al 1992 | 4 | 2 | 33 |
| Silveira & Cure 1993 | 2 | 3 | 60 |
| Martins 1994 | 12 | 14 | 54 |
| Schlindwein 1995 | 14 | 7 | 33 |
| Carvalho & Bego 1996 | 10 | 13 | 57 |
| Alves dos Santos 1996 | 26 | 12 | 32 |
| Carvalho & Bego 1996 | 6 | 9 | 60 |
| Zanella 2000 | 8 | 10 | 56 |
| Viana & Alves dos Santos 2002 | 36 | 28 | 44 |



**Distributions of 515 extant species of *Megachile* of the Americas**

| | Number of species recorded | % of total |
|---|---|---|
| Canada | 27 | 5·2 |
| U.S.A. | 131 | 25·4 |
| Mexico | 75 | 14·6 |
| Central America | 55 | 10·7 |
| West Indies | 30 | 5·8 |
| Colombia | 19 | 3·7 |
| Venezuela | 2 | 0·4 |
| Trinidad | 6 | 1·2 |
| Guianas | 17 | 3·3 |
| Brazil | 158 | 30·7 |
| Ecuador | 16 | 3·1 |
| Peru | 39 | 7·6 |
| Bolivia | 63 | 12·2 |
| Paraguay | 49 | 9·5 |
| Uruguay | 4 | 0·8 |
| Argentina | 72 | 14·0 |
| Chile | 16 | 3·1 |



## Associating the sexes

A frequent question with Hymenoptera is to associate the sexes.

The sexes of many species of *Megachile* are very different in appearance. Fortunately, many are adventive nesters and the researcher might rear both sexes from a nest.

## *Megachile* at flowers

Innumerable scattered publications refer to the plant taxa that *Megachile* species visit.

Many species are polylectic. In southern England *M.centuncularis* averaged more than seven plant families per cell.

Many prefer particular plant families like Compositae and Leguminoseae.

Polylectic species visit flowers near the nest so often they collect most of the pollen from a few plant taxa.

Little detailed information is available on the nesting behaviour and foraging behaviour of tropical species.

## Pollination

Species of *Megachile* are well adapted for pollination.

The female carries the pollen on her abdominal scopa.

She does not transfer the pollen to a leg.

The female alights directly on the anthers and stigma of the flower so it is easily transferred from one flower to another.

## *Megachile* at flowers

Some species are more oligolectic, the bees restricting their choices to a particular species or genus

*M. gravita* and *M. pascoensis* are oligolectic on *Clarkia* in western U.S.A.

Members of the subgenus *Ptilosarus* visit *Piper* flowers

## Alfalfa pollination

*Megachile* species are effective pollinators of alfalfa.

An individual female of *M. perihirta* tripped 372 flowers per foraging trip.

A nesting female averaged 75 foraging trips per cell for 15 cells.

Thus, each foraging bee may trip 418,500 flowers to produce two kilos of seed.

## *Megachile* at alfalfa

For a yield of 1,300 kilos of seed per hectare in the absence of other pollinators a density of 500 foraging females of *Megachile* per hectare of flowering crop is recommended.

In most of U.S.A. *M. rotundata* is the most important pollinator. It provides yields of 2,200 kilos of seed per hectare; a twenty-fold difference over its absence.

## Pesticides

An important revelation of the above data is the great importance of individual bees and, hence, the need to exercise great care when applying pesticides on the crop so as not to kill the pollinators.

*M. rotundata* is more susceptible to pesticides on alfalfa than are honeybees (possibly because the bees cut leaves as well as visiting the flowers).

## Alternatives to *M. rotundata*

The use of *M. rotundata* in regions with a severe winter is complicated because the overwintering stages must be stored in frost-free conditions.
In southern Alberta two native species, *M. dentitarsus* and *M. perihirta*, effectively fill the role.

The developmental stages of *M. rotundata* cannot survive high daily temperatures (>42$^{o}$C).
In warmer climates (southern U.S.A. and the West Indies) *M. concinna* is an efficient pollinator of alfalfa.

## Small enclosures

*M. rotundata* has been used to pollinate alfalfa in glasshouses.

*M. concinna* is a candidate as a pollinator in small enclosures. It nested successfully in a flight room of 12 $m^3$.

## Vagility I

Many species nest in abandoned beetle burrows in wood and cracks in timber. This has given them great vagility and some are among the most widely dispersed of any bees.

They occur on many oceanic islands, presumably because their nests were transported.

The American species, *M. gentilis*, native to western U.S.A. has become established in Hawaii.

The Chinese species, *M. sculpturalis* Smith has recently appeared in eastern U.S.A.

## Vagility II

Ten palaeotropical species have become established in the West Indies. Nine are African and *M. lanata* is Indian and has spread to Africa. Undoubtedly nests were carried to the Caribbean on slave ships on the "Middle Passage".

It is strange that no palaeotropical species has been recorded from Brazil.
In the West Indies, males of *M. lanata* often hold territories at flowering *Crotalaria*. I have searched the same species of *Crotalaria* in many parts of Brazil, but have never seen *M. lanata* here.

## Deliberate introductions

The Eurasian species, *M. rotundata* arrived, apparently accidentally, in U.S.A. in the 1940's and is now widespread.

In order to improve the pollination of alfalfa, it has been introduced into Chile, Australia and New Zealand.

## The Catalogue

For several years I have been compiling information for a catalogue:

For each species:

all nomenclatural changes are given with information on types;

all the available information is summarized under nine headings.

The information on each species is under nine headings.
The references are given with indications of what each contains by symbols:-

D = Geographical distribution.
F = Flowers visited (including pollination studies).
K = Keys to identification.
L = Life history (including mating, development of young, sex ratios, dormancy, emergence, life-tables).
M = Morphology and anatomy.
N = Nesting (nest sites, nest architecture, building and provisioning cells, building materials).
P = Predators (inquiline bees and flies, predators on the developmental stages, predators on adult bees, fungal diseases and other pathogens).
R = Redescription of type sex or description of allotype. Female = (R-F); male (R-M) and both sexes = (R-FM).
T = Taxonomic information (includes locations of types).

**4. *Megachile* (*Leptorachis*) *aureiventris* Schrottky**
***Megachile aureiventris* Schrottky 1902: 441. Female. Type locality: Jundiahy, S. Paulo [state], Brazil, 1897 (Schrottky). Type repository: MZSP. Examined.**
***Megachile* (*Leptorachis*) *aureiventris* : Mitchell 1943b: 663.**
**ADDITIONAL REFERENCES. Graf 1967a: 127-130 (M); 1967b: 131-133 (M). Moure 1948: 326 (K). Schrottky 1913a: 141 & 144 (K), 175 (D, R-F). Silveira *et al* 2002: 213 (D).**
**DISTRIBUTION. BRAZIL: DF- Brasilia (Raw), Planaltina (Raw); MG; PR; RS; SP- Campinas, Ipiranga, Jundiaí.**
**MORPHOLOGY. Anatomy of head glands.**

**Catalogues must be produced for the people who will use them.**

**They need to be produced for many genera of bees and the presentation should be standardized.**

## Questions for the user

**How accessible is the information as it is presented ?**

**How to cite the distribution ? Often only the name of the country or state is known and these vary enormously in size. Geographical coordinates are known for few localities.**

**The catalogue would be best made available on an Internet site, but where ?**

## Promoting *Megachile*

A combination of identification to subgenus or species group coupled with knowledge of the geographical distribution will reduce the difficulties of identification of the species to feasible proportions.

We need workable keys for particular localities.

Then, non-specialists (botanists, agronomists, entomologists) can identify the species.

Easier identification should stimulate new studies on the bees' role as pollinators and on management of their populations.

## Promoting bee conservation

To conserve bees the interest of lay people needs to be stimulated

Many people are fascinated with the idea of providing trapnests for bees in their gardens

It is an effective way to involve people in conservation

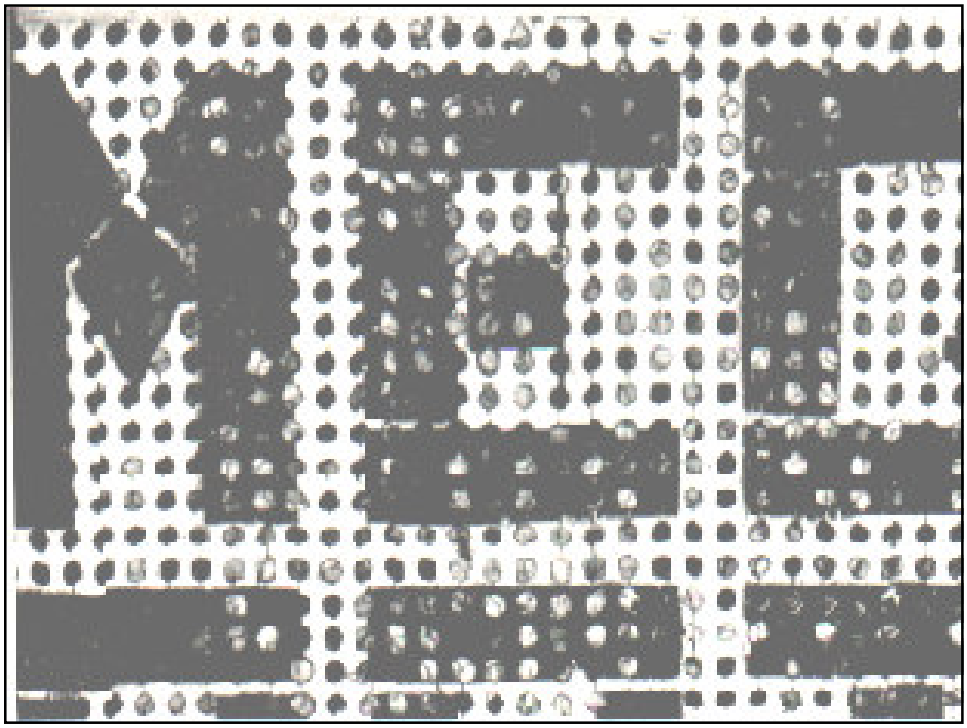
But they want to know the names of the bees they are living with

*Megachile* is common and several species use trapnests in gardens

The amateur entomologist can study the bees' nesting biology easily and cheaply

## Trapnesting

Trapnests attract larger numbers of bees when they contain large numbers of tunnels



## Trapnesting

Females of *M. rotundata* prefer trap-nests used by the previous generation to new tunnels. Apparently they detect aromas secreted left by the previous occupants rather than nest residues.

A nesting female of *M. centuncularis* recognizes her own nest as different from those of her conspecifics.

**Thank you for your attention**