SABIO
100 YEARS 1921-2021
SOUTH AFRICAN BEE INDUSTRY ORGANIZATION

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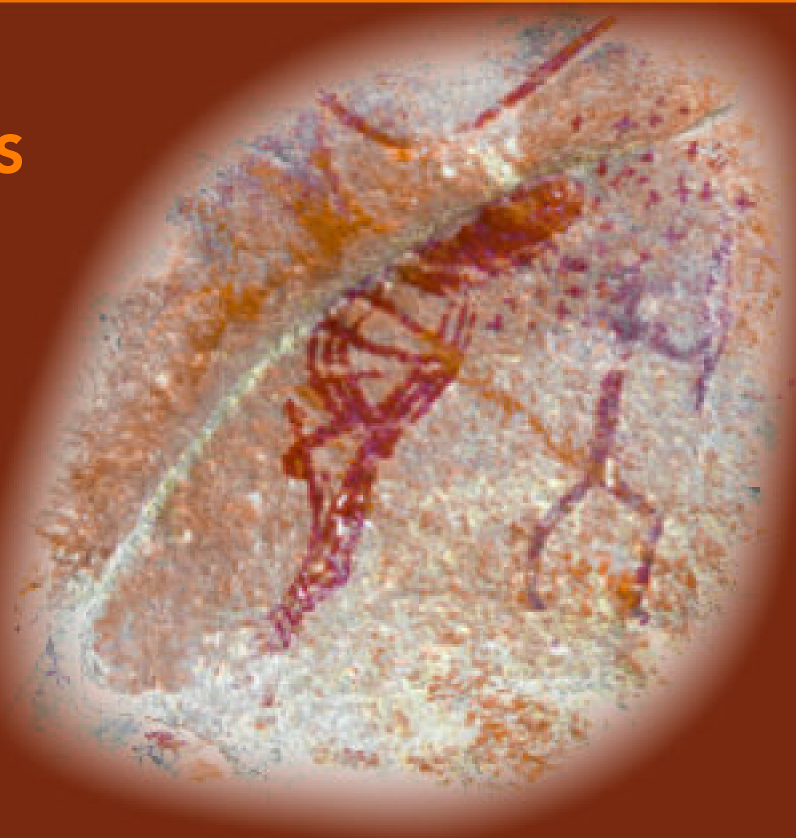

SAN HONEY HUNTERS AS EARLY BEEKEEPERS

SUSTAINABILITY OF PROVISIONING APIARIES WITH WILD SWARMS

INTERACTION BETWEEN HONEYGUIDES AND HUMANS

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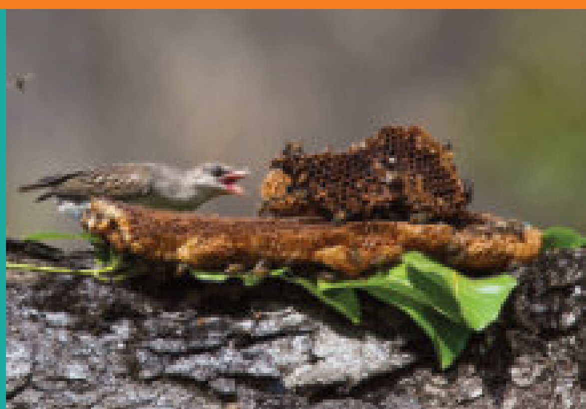
Cover Images: Left painting of a ladder used by San to get to hives.
Right A greater honeyguide on a comb removed from a hive.



SABIO is the official representative of the bee industry of South Africa. Its mission is to "represent and promote the interests of all persons involved in the beekeeping industry in South Africa in order to establish, support and develop an economically viable and sustainable apicultural sector and ensure the environmental security of the honey bee".

Editorial

The New Year ushers in a notable milestone in organised beekeeping in South Africa with the 100th Anniversary of the establishment of a national beekeeping organisation of which SABIO is the direct descendant. During the course of the year there will be a number of events that will honour this achievement. In addition, it appears that the South African Bee Journal was also established by this body at the same time and has been published for 93 years. This issue of the journal (volume 93) will be used to highlight the achievements and challenges of the last century with a view to ensuring a vibrant industry into the future.

The current volume of the journal has an article by Ferdi du Preez that outlines some of the early history of organised beekeeping in South Africa. However, the use of honey bees and their products by humans has a much longer history that goes back for millennia. This was largely in the form of honey hunting which is shown on the cover in a rock painting executed by a San painter in a cave in the Drakensberg. The interaction of the San with honey bees is described in the article by Jeremy Hollmann.

The use of products of honey bees is thus of very ancient origin and probably goes back to the earliest interaction of humans with honey bees. Modern humans have been present for approximately ± 300 000 years, while the honey bee fossil record stretches back for at least 20 million years, so we are relative latecomers to interactions with honey bees. The use of honey bees in agriculture has a much shorter history with clear evidence of organised beekeeping by the Egyptians approximately 4500 years ago. Thus honey hunting and beekeeping have existed side by side over this period of time. However, the commercial use of beekeeping for agricultural purposes on a large scale is only some 150 years old and the consequences of this for the sustainability of beekeeping into the future in South Africa is explored by Masehela and Human in their article. In addition, one of the notable developments in beekeeping over the past century has been growing demand for honey bees as pollinators in support of large scale agricultural production. In our context we highlight management of honey bees for pollination of avocado, litchi and mango and start a discussion about use of bees for pollination and the associated question of the sustainable use of our honey bee population.

-R M Crewe

ERRATUM: In the last issue of the SABJ Vol 92, No. 3, we published an article by Michael Norton, Khutso Phalane and Nina Hobbhahn entitled Neonicotinoids in Africa but did not indicate that this material was reprinted with permission from Chemistry World, Royal Society of Chemistry, London. 10 September 2020.

Chair's Report

Modern movable frame beekeeping practises have existed for more than a century in South Africa. The first account of beekeeping in South Africa appeared in London Nature in May 1883, written by Lord de Villiers who was to be become Chief Justice. It took almost thirty years before any organised activity was seen, when Lord de Villiers was elected as the first President of the Western Province Beekeepers Association in 1911. Soon after this we saw the first publication of the South African Beekeeping Journal in 1912, the forerunner to the South African Bee Journal which was first published in 1921. In time various associations were established and were affiliated with the national South African Association of Beekeepers (SAAB).

First Federation logo, new Federation logo, SABIE logo, SABIO logo, SABIO centenary logo

It is interesting how history repeats itself and this is so true in the local bee industry. When bees find their hives unsuitable, they swarm. Apparently, so do those keeping bees. The two largest Associations, namely Western Province and Natal & Zululand literally swarmed off from organised beekeeping during the fifties to become more independent. So doing they took half the national membership with them. But as with the phenomenon of swarming, there is in human nature also the strong need to belong and to express a unified voice. In 1962 the disaffiliated associations re-joined the national association. To satisfy all parties, the old had to be disbanded and the South African Association of Beekeepers was dissolved. This action resulted in the birth of the South African Federation of Beekeepers Associations. The purpose was to create a strong Federation which could act as an effective lobby for dealing with Government Departments.

It is noteworthy that the contract with National True Foods came into being at that time. This contract gave the new Federation the financial means to fulfill its mandate and was also the reason for the dissatisfaction and eventual collapse of the SAAB. In terms of this contract, True Foods paid a quarter of a cent per pound (more than R5,45 cents per kg in today's terms) to the Federation for all honey sold through its outlets. Interesting to observe how retail policies have changed.

One of the most significant achievements must be the publication of the South African Bee Journal. Through the years it became the common factor in the industry, as the most important means whereby members were and are brought into contact with each other. This accomplishment was due to the unselfish dedication of a succession of editors working on a voluntary basis.

The most written about, unresolved issue in the industry, is undoubtedly the problem of theft and vandalism. The situation, in fact, has reached epidemic proportions and there is evidence that the thieves have not only become more sophisticated in their methods, but also more dangerous when confronted. A number of beekeepers or their assistants have lost their lives as a result in defense of their livelihoods.

On the other hand, looking back, the Federation prided itself on the success achieved in combatting the adulteration of honey. The promulgation of the first official South African honey standards through the combined efforts of the Honey Standards Committee, Bill Crisp and Prof Dippenaar (Head of the Agricultural Inspection Services) in 1964, was indeed an important milestone. The adulteration of honey in South Africa was stamped out. In this, the combined efforts of the Federation, government and the role played by the regional Honey Judges must be acknowledged with pride. Unfortunately, we are celebrating our centenary year by having to host the first ever Honey Fraud symposium.

The Federation and its members had long battled against the indiscriminate use of toxic sprays in orchards and crop fields during the different honey flows. Fortunately, today the bee industry has won the support of the crop chemical industry in this campaign and have, and indeed through close cooperation with CropLife, been able promote awareness on the responsible use of chemicals. SABIO recognises the need to use chemical spraying in orchards or crop fields, and understand our role and responsibility in educating farmers with regard to the value of bees and alternative methods or timing of chemical application.

There had been several other interesting and positive developments in the industry. The establishment of the Apicultural Advisory Committee in 1972 gave credibility to a maturing industry, through the able and accomplished chairmanship of Dr Bing Wiese. These golden years in organised beekeeping came to an end as result of a combination of factors, of which the dissolving of the Apicultural Advisory Committee in 1989, was most certainly the primary factor. It almost seemed as if associations were trying to gain recognition as the most important representative organisation. We saw the disaffiliation of the professional bodies. This was followed by the unfortunate disaffiliation of the Natal Bee-Farmers Association (again) taking away a third of the Federation membership. At the same time the country associations of the Eastern Cape and Lowveld became inactive due to a lack of resources. Though the Federation remained solvent it had to carry huge losses in the printing cost of the South African Bee Journal.

Again, the disadvantages of operating in silos were recognised and the South African Bee Industry Executive (SABIE) was constituted in 1993, which was made up of representatives from the SA Federation of Bee Farmers Associations and the SA Professional Bee Farmers' Co-Operative Ltd. Unfortunately, SABIE lacked the support of the whole industry as the Natal Bee-farmers Association could not be persuaded to join forces with the new SABIE. It also suffered from a lack of financial resources. Notwithstanding, SABIE's biggest success must be its presentations to government with regard to the Cape Invader bee calamity and the subsequent implementation of the Government action plan to combat this catastrophic event. This resulted in the killing of about 60,000 bee hives in 1994 just after the sunflower pollination season in April/May and the successful re-establishment of a massive 40,000 new colonies from September to December of the same year to be ready for the 1995 pollination season. The nineties will be remembered for the Cape bee calamity in the summer rainfall regions, the growth of professional pollination services and South Africa turning to honey imports as local production could no longer meet the demand.

South African beekeeping had to find a common goal again and that came about in hosting the first Apimondia International Beekeeping Congress on the African continent in October 2001 in Durban as host city. Unfortunately, this event followed less than six weeks after the 9/11 terrorist attacks in the USA, which led to international travel bans and the cancellation of various organised tour groups. Nonetheless, a successful congress was hosted with Prof Robin Crewe, Anton Schehle and Adriaan du Toit powering the local organising committee. More than a thousand international visitors were in attendance.

In 2003 SABIE was re-constituted to become the South African Bee Industry Organisation (SABIO). SABIO has retained its structural format since 2003 despite a number of constitutional changes to improve its operations. The first decade of this century was marked by the beekeepers' fight against the unscrupulous eradication of gum trees throughout South Africa. This effort was steered by the three Cape Beekeeping Associations.

Today our industry is home to more than 6,000 beekeepers operating approximately 170,000 beehives. Beekeepers produce a variety of unique indigenous monofloral honeys, such as various fynbos honeys, boekenhout, aloe, buffalo thorn and black thorn, while eucalypt and citrus honeys maintain their consumer favourite status. With the growth in the subtropical crop industries, we are now marketing "new" honeys such as avocado and macadamia honeys.

Our beekeeping industry is diverse in its operations, from the hobbyist with a few hives for pleasure and honey on the table, to our commercial and professional beekeepers who run thousands of hives. Added to this a new generation of development beekeepers supported by various government development programmes, are establishing themselves and earning an income to sustain their families. The honeybee industry contributed R30-35 billion annually to South Africa's GDP, of which the major portion can be ascribed to the value of bee-dependant agricultural crops. Honey, beeswax and other hive products contribute R1 billion on their own. Bee farming creates multiple direct job opportunities while many other jobs are created by the input suppliers (manufacturers of equipment and protective clothing, transport, etc) and the output suppliers (processing equipment, packaging and retailing).

The South African honey market is today overshadowed by the international demand for honey, which is close to the point where demand cannot be met by global production. This situation opens the door for "artificial honey" or honey replacement products in the market place. In this regard we experience the encroaching of the blatant adulteration of honey combined with clever sidestepping of labelling regulations. SABIO view this threat to beekeeping and the undermining of trust in honey products by the consumer as so important that Board member Kai Hichert was tasked to lead the field effort in collating information on the extent of the situation, while the Vice Chair, Ms Tumi Mobu will assist Kai in arrangements for the Honey Fraud symposium which will be held on International World Bee Day, 20 May 2021.

To conclude, I would like to quote the late Roger Culbert, stalwart and Chairman of the Federation, who described the Bee Industry fittingly as "in one sense a fragile vessel filled to the brim with memories and expectations and yet in another sense, as the extremely tenuous link which, from moment to moment, joins the past to the future". The future may from time to time appear to be difficult, but the abundance of evidence from the past and the present vitality within the industry, makes me nothing but optimistic that beekeeping in South Africa will continue to thrive.

I would like to honour the contributions of those pioneer beekeepers of the 1960's and 1970's: Schnetler, Dippenaar, Mindenhall, Crisp, Barr, Altona, Rev Anderson, Devenish, Culbert, Guy, Brassler, Warden, Grinstead, Grey, Capper, Leveridge, Byleveldt, D Falconer and Francis.

The founders of today's commercial beekeeping in the 1980's and 1990's: Dr Anderson, Steinhobel, Leanne McGregor, Van Drunen, Botha, Little, Scharff, Johannesmeier, Bester, Pretorius, Hepburn, Keetch, Lear, E Van Zyl, Fletcher, Marchand, Modileng, Kiessling, Deschodt, Lame Ebersohn, Mountain, Viljoen, Morgan, De Villiers, Smith, Booth, Bradford, MacIntyre, Buys, Harding, Van der Nest, Van Eck, Uys, Lichtenstein, Thacker, Dinkelman, H du Toit, D De Klerk, Barnwell, Urquhart, Hartman, Schoenveld, Worral and McQueen.

And from 2000 to 2020: Smit, Schehle, Walker, Ramasodi, Engelbrecht, Banne, Liddy Born, Post, Bence, B Falconer, Kemp, Vilankulu, Crewe, R van Zyl, Lynette Barnes, Phoku, T de Klerk, Hugill, Esterhuyse, Van der Merwe, Wolfaardt, Inge Lotter, Allsopp, Langenhoven, Salamina Maelane, Kelly, L Van Zyl, Steenkamp, Moodie, Du Preez, Vorster, Miles, Theron, Hannelie Human and Campbell.

Adriaan du Toit, South African Bee Industry Organisation, P.O. Box 14861, Sinoville, 0129. South Africa.

GEORGANISEERDE BYEBOERDERY IN SUID-AFRIKA - 'N HISTORIESE OORSIG

Die ontstaan van georganiseerde byeboerdery in Suid-Afrika het ietwat van 'n enigmatiese geskiedenis. Data is fragmentaries aangeteken en is moeilik bekombaar.

Gelukkig gee Scully (1910) in sy Cape Colony - Its history, commerce Industry and Resources, 'n kykie in die verre verlede. Volgens hom het daar reeds in die laat 1800's byeorganisasies op plaaslike vlak in die destydse Kaap Kolonie bestaan. Hulle was egter nie baie effektief nie, en hy skryf met verwysing na die nut daarvan vir die destydse byeboer,as volg: "No Beekeepers Association which has hitherto been started will be of the least assistence to him".

'n Verdere bewys van georganiseerde plaaslike byeboerdery in daardie beginjare vind ons in Attridge se South African Beekeeping (1909.) Hy beskryf homself daarin as "Expert by appointment of the South African Beekeeping Society for the Cape Colony." (Eie onderstreping.)

Die volgende stap na organiseerde byeboerdery op provinsiale vlak was met die stigting van die volgende drie oorkoepelende organisasies: The Transvaal Beekeepers' Organisation (1907), The Natal Beekeepers' Organisation (1909) en die Western Province Beekeepers' Organisation (1911). Binne die eerste jaar van sy bestaan het die Transvaal Beekeeper's Organisation sy naam na The South African Beekeepers' Association (SABA), verander. Hierdie wending het heelwat verwarring in byekringe veroorsaak, want die Transvaalse liggaam was nie van nasionale aard nie, en het voortgegaan om basies net die Transvaalse gebied te bedien. "SABA" het wel 'n mate van nut gehad want gedurende sy bestaan is 'n heuning depot in Johannesburg gevestig, en is die invoer van bye na Suid-Afrika verbied. 'n Tydskrif, die South African Beekepers' Journal is ook begin. Beide SABA en die tydskrif het as gevolg van swak ondersteuning in 1913 weer doodgeloop.

Byna tien jaar sou verloop voordat daar probeer sou word om weer 'n nasionale organisasie vir die byeboer te stig. Die South African Association of Beekeepers (SAAB) is gedurende April 1921 in Johannesburg gestig. 'n Tydskrif, The South African Bee Journal, is terselftertyd in die lewe geroep. Hierdie organisasie, hoewel onder verskillende name, leef tot vandag toe voort. Goeie werk is onder die naam SAAB gedoen en die volgende doelwitte, onder andere is behaal: Die aanstel van 'n regeringsekspert op byegebied (Die legendariese dr. Arnold Lundie), Die propagering vir die wegdoen van die ou "box hive" tipe korf, en die gepaardgaan ingebruikneming van beweegbare rame; die begin van 'n statistiek vir byeboerdery en in 1926 die oprigting van 'n eksperimentele byery in Pretoria.

Die organisasie het deur die jare met sy voortreflike werk voortgegaan en 'n belangrike stap was byvoorbeeld die instel van 'n Byekundige Advieskomitee in 1972 onder die vaandel van die The South African Federation of Beekeepers' Associations. Voortaan kon daar vryelik met verwante regeringsdepartemente op gevorderde vlak geskakel word. 'n Verdere belangrike ontwikkeling was die opstel van 'n eenvormige handboek vir die opeiding van beginner byeboere deur Mnr. Martin F. Johannsmeier.

Vandag word georganiseerde byeboerdery in hierdie trotse eeuelange tradisie voortgesit deur die huidige Suid - Afrikaanse Bye Industrie Organisasie (SABIO). Ook sy tydskrif………. het oorleef.

The origins of organised beekeeping in South Africa have something of an enigmatic history. Data is fragmentary and is difficult to obtain.

Luckily, Scully (1910) in his Cape Colony -Its history, commerce, industry and Resources, gives a glimpse of the distant past. He claims that in the late 1800's, beekeeping organisations existed at a local level in the Cape Colony. They were not particularly effective and he indicates that their value for the beekeepers of that time was as follows:"No Beekeepers Association which has hitherto been started will be of the least assistance to him."

An addition reference to local beekeeping in those early years, is found in Attridge's SouthAfrican Beekeeping (1909). He describes himself in this book as "Expert by appointment of the South African Beekeeping Society for the Cape Colony." (My emphasis).

The following step towards organised beekeeping at a provincial level was taken with the establishment of the following umbrella organisations: The Transvaal Beekeepers' Organisation (1907), The Natal Beekeepers' Organisation (1909) and the WesternProvince Beekeepers' Organisation (1911). During the first year of it's existence, theTransvaal Beekeepers' Organisation changed its name to The South African Beekeepers'Association (SABA). This development led to to a great deal of turmoil in beekeeping circles since the Transvaal entity did not have national standing, and basically continued to serve only the Transvaal region. "SABA" had some value though, since during it's existence a honey depot was established in Johannesburg and the important of honeybees into South Africa was prohibited. The periodical, The South African Beekeepers'Journal was started. Both SABA and the periodical ceased to function in 1913 as a resultof poor support.

Almost ten years would elapse before an attempt was made to establish a national organisation for beekeepers. The South African Association of Beekeepers (SAAB) was established in Johannesburg during April 1921. The periodical, The South African BeeJournal, was established at the same time. This organisation, although with different names, has survived to the present time. Good work was accomplished by the SAAB andthe following goals were achieved: the appointment of a government expert in apiculture (the legendary Dr. Arnold Lundie), the advocacy for the elimination of the old "box hive"and its replacement with movable frame hives, the start of the collection of statistics about apiculture, and in 1926 the establishment of an experimental apiary in Pretoria.

Over the years, the organisation has continued with its important work and a noteworthy step was the convening of an Apicultural Advisory Committee in 1972 under guidance of The South African Federation of Beekeepers' Associations. As a result of the establishment of the committee, it was possible to engage with government departments at a high level. An additional important development was the compilation of a comprehensive handbook for the training of novice beekeepers by Mr. Martin F. Johannsmeier.

Today, organised beekeeping is maintaining this proud century old tradition through the present day South African Bee Industry Organisation (SABIO). In addition, its periodical…… has survived.

- **Ferdi du Preez**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San rock art in the uKhahlamba-Drakensberg, early honey hunters use of honey bees.

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Paintings of bees and related themes

Southern African hunter-gatherer ('Bushman' or 'San') paintings of bees and bees' nests are not common or widespread. They occur in small concentrations in parts of Zimbabwe, Namibia, and South Africa. There is a unique cluster of bee related paintings in a small part of the northern uKhahlamba-Drakensberg (Figure 1). Themes in the bee related rock art include what may be flowers/floral inflorescences, details of honey and brood comb, red and white painted bees' nests, honey-hunting, and dancing next to bees' nests.

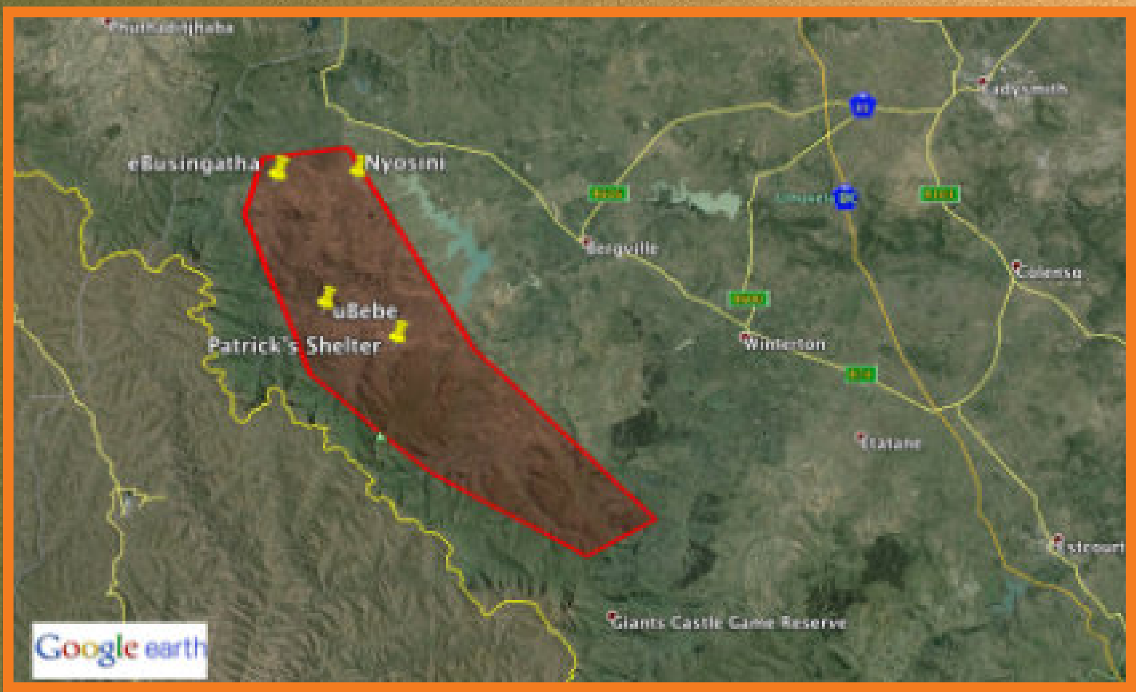

Figure 1. Map of the northern uKhahlamba-Drakensberg, KwaZulu-Natal, South Africa showing the approximate locations of the sites discussed. Map data: Google, AfriGIS; Image: CNES/Astrium

No bee paintings have been dated but archaeological excavations of hunter-gatherer camps in the uKhahlamba-Drakensberg suggest that the paintings were made between c.3000 and 150 years before the present time. Mention of the presence of many bees' nests in the nearby Mooi River hills raises the possibility that bees were plentiful in this area in the past and that hunter-gatherers may have traded or exchanged honey and wax with amaZizi farmers who have lived nearby for the past 600 years or so.

Paintings of bees are small (2-5 mm long), red, ovoid shapes with symmetrically positioned pairs of roughly semicircular white-painted shapes on either side. They are typically depicted en masse and often positioned close to what have been identified as paintings of bees' nests, or next to natural cracks in the rock in some cases (Figure 2).

Figure 2. An example of the manner in which bees are depicted in rock art. The body is red and the wings are white. They are usually painted in groups and are often painted next to paintings of bees' nests and natural features of the rock such as ledges, fissures and holes. The photograph is a digitally enhanced copy.

Honey and brood comb

Brood comb is yellow when new, becoming red-brown as a result of the continual traffic of bees over the comb, which is constantly re-used, and becomes 'dirty'. Honey-containing comb is much lighter in colour than brood comb. Newly manufactured comb is white. The paintings of bees' nests (Figure 3) seem to show this distinction as they generally show them as catenary (u-shaped) shapes of alternating red and white. These suggest the depiction of honey comb (white) and brood comb (red).

Figure 3. Paintings of bees' nests in uKhahlamba-Drakensberg are commonly painted as nested catenary (u-shaped) curves of alternating red and white. This might depict alternating layers of honeycomb and brood comb.

At the appropriately named Nyosini Shelter, ('where the bees are' in Zulu) several combs of varying sizes and shapes were painted in alcoves and next to cracks. The images show detailed knowledge of the behaviour of bees and different kinds of comb.

Beekeepers identified the three red forms in a composition painted in an alcove as depicting capped brood cells (Figure 4). I identify the large cell as a queen cell in which a queen is raised. The conical shape of the white form with red spots is typical of this specialized form.

Figure 4. Red specks painted in an alcove are painted next to three solid red forms. The specks may depict uncapped brood cells, bees, and/or empty cells. The solid forms may be capped brood comb. Enhanced photograph with arrow pointing to possible queen cell

Another painting of comb (a cluster of red dots sandwiched between two white rectangular shapes) is deliberately located next to a cavity with a triangular mouth (Figure 5). The depiction of comb next to a cavity may be intended to suggest, as is sometimes the case, that bees nest inside the hole that is so full that the comb is 'overflowing'.

Figure 5. The photograph shows red spots sandwiched between two sections of white paint painted next to a small natural cavity. This is identified as a bees' nest that is 'overflowing' from inside the cavity.

Ladders and honey hunting

Bees' nests were owned by individual people. Ownership entailed exclusive rights to exploit a particular bees' nest. It also implied possession of the skills to 'hunt' bees, to use the /xam expression. Hunting honey required skill and courage as well as knowledge and planning just as much as hunting a great meat animal. The hunter had to 'stalk' his prey, sometimes scaling perilous heights, then subdue the colony with smoke, before he could use a forked stick to spear and extract the comb. Having cut the combs, honey was carried in a "honey sack" back to the camp, just as meat is carried back to be shared with individuals in the camp.

Wooden pegs driven into cracks of the rock face enabled a person to climb up to bees' nests. The construction of rough platforms situated below bees' nests is described in the ethnography. Paintings of figures on ladders, sometimes apparently collecting honey, are locally common. Rather small and dusty paintings on an uneven rock surface of a ladder comprising about six rungs with a vertical support painted on either side (Figure 6). To the left of the ladder are about eight thin red lines similar in dimension to the rungs of the ladder but painted at a different angle to the ladder and not as parallel and regularly spaced as the 'ladder'. These might represent another length of rungs strung together with rope to form a rope ladder. The 'ladder' ends just below another complex of red painted lines of different lengths and thicknesses. This could depict a platform of branches. This part of the rock surface has a light brown layer over it and some of the painted surface has flaked off so that the images are no longer complete and easily visible. Possibly the painters depicted one, possibly two, figures on the platform; a clearly defined semi-circular shape could be a honey bag.

Figure 6. Honey hunting. At left a ladder and platform are painted below a bees' nest (1). At bottom right, a figure reaches towards a bees' nest (2). There are several nests at the top of the picture (3). This is a digitally enhanced copy.

Carrying honey

The theme of carrying honey is illustrated by a painting of a figure (sadly now flaking off the rock) carrying honeycombs in one hand (Figure 7). The honeycombs comprise two horizontal red painted lines each 2-4 mm wide and spaced about 3-5 mm apart. The figure and the honeycombs are surrounded by paintings of bees (about 30-40 individuals) with red bodies and white wings. The figure wears the head of an antelope on its head–the eyes and erect ears of the animal are visible. The figure's head is depicted in profile and shows an eye and a detailed profile that includes the nose and open mouth with a red tongue. The figure is bleeding from the nose. A painting of a small antelope has been superimposed over the figure.

Figure 7. This figure with an antelope-head cap and a bleeding nose carries red and white combs in is hand. He is surrounded by bees. Digitally enhanced copy.

The 'elephant man'

Perhaps the most dramatic and imposing bee-related image is the so-called 'elephant man' (now in the KwaZulu-Natal Museum, Pietermaritzburg). It is a male figure about 400 mm tall with arms and legs that terminate in elephant-like feet (Figure 8). The figure is depicted with its upper body bent forward and both arms extended and hanging down; this posture might suggest the figure is dancing. The legs are braced as if the right leg (which is slightly bent) is taking most of the body's weight, while the left leg is extended back and articulates in a manner consistent with elephant (not human) anatomy.

Figure 8. The 'elephant man', now in the Kwa-Zulu Natal Museum, Pietermaritzburg. This image incorporates human and elephant characteristics. The figure carries hunting equipment and flywhisks in a large bag. It is surrounded by a swarm of bees. The photograph is a digitally enhanced copy.

The figure, about 350 mm tall, has a normal-sized human head, but this is complemented by a pair of short white (elephant) tusks and a long elephant trunk. It carries a large bag on its back within which are a bow with a white bowstring and two sticklike objects that are probably flywhisks. There is a much smaller form painted next to the right-hand flywhisk in the bag that depicts a perching bird (Figure 9). This may be a honeyguide (Indicator indicator) a bird that leads people to bees' nests (Figure 9).

Figure 9 Perching on one of the flywhisks of the 'elephant man' is a bird, perhaps a honey guide (Indicator indicator). Digitally enhanced copy.

Most intriguingly, painted between the thighs of the elephant are four concentric bands painted alternately in white (which is badly weathered) and red (Fig. 8). They suggest the catenary curves of wild honeycomb. It appears that the figure has a bee's nest between its legs. The figure is surrounded by more than 100 paintings of bees with red painted bodies and white wings. The swarm is most dense in the proximity of the bees' nest, between the figure's thighs and its loins. These important details when taken as a whole suggest that the 'elephant man' is perhaps the quintessential 'owner' of honey. This is curious in view of the fact that elephant tend to avoid bees.

Dancing next to bees' nests

A composition of paintings (c. 225 mm wide and 150 mm long) on the ceiling of an alcove includes figures amidst bees and their nests (Figure 10). A large comb, or cluster of combs, is painted on a funnel-shaped, black–painted background. This arrangement might suggest that the comb/s are situated in a large inner chamber at the end of a narrow opening in the rock. The black-painted shape represents the dark space of the interior of the tunnel and chamber in the rock. The comb/s have more than 20 bees (many with white wings) resting on them. Immediately to the right of the comb-in-tunnel are three figures, two of which are in black paint and difficult to see with the naked eye. A much clearer figure in red, with penis, has a white head, which is thrown back. He holds a short sticklike object in his hand and is poised to step forward.

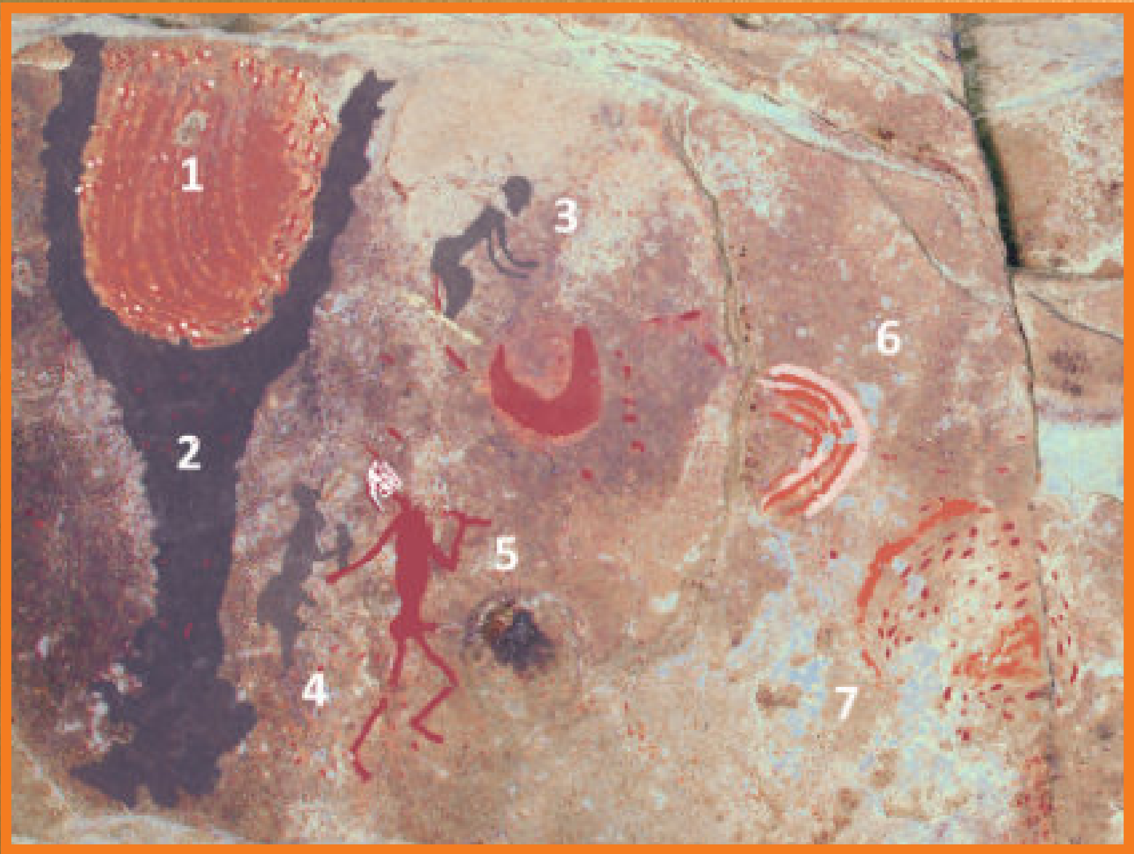

Figure 10. Paintings on the ceiling of an overhang in which figures (3,4 & 5) are dancing next to a bee hive (1) with a black background (2). This background might indicate a large, inner chamber at the end of a narrow opening in the rock, an ideal location for a hive. Other nests (6 & 7) can be seen to the right. The photograph is a digitally enhanced copy.

Although bees' nests can reach great proportions with individual combs in South Africa measuring 1,5 m in height and width, the scale of depiction of the human figures in relation to the bees and their nests is, I have already suggested, disproportionate–perhaps 'unreal' might be a better description. The bee's nest inside the tunnel is gigantic, about the same height and three times as large in volume as the dancing man.

Themes in rock paintings of bees and bees' nests

Clearly hunter-gatherer artists were well-informed about bee behaviour. Honey is a remarkably nutritious source of quick energy and brood has a high protein and fat content. But as with all hunter-gatherer rock art, the paintings go beyond simple documentation of what people ate. There is more to the rock paintings of bees than initially meets the eye. This is borne out by beliefs and practices of the 19th century /xam people (the so-called Cape Colonial Bushmen) and contemporary Ju/hoansi people in Namibia and Botswana. These peoples regard honey as an anomalous and special substance. Like animal fat, honey transcends the conventional divide between 'eating' and 'drinking'–these substances are both eaten and drunk and they are regarded as simultaneously "wet" and "dry", and "hot" and "cold". Eating honey or fat is a euphemism for sexual intercourse.

Honey and antelope

The status of honey as an 'extraordinary' substance is recognized in /xam creation beliefs. Honeycomb is involved in the creation of the first eland, made from a piece of sandal by the trickster god /kaggen (often translated as the 'Mantis'). Every day the Mantis cuts honey for the growing eland. As a result, the Mantis no longer collects honey for his family. To discover the reason for this neglect they spy on him and discover the eland. They kill it while the Mantis is collecting honey for the eland calf. As a result, the Mantis finds the honey 'dry' (not 'fat' as it usually was), then notices that it seems "as if blood which was the eland's blood did come out". This is a sign that his eland has been killed. It is as if the eland is literally made of honey. It is also noteworthy that the smell of eland has been likened to that of honey.

Fecundity, swarming and dancing

Bee colonies regulate their activities according to environmental factors. The depiction of different kinds of brood comb in the rock art might be linked to a specific phase in the life of the colony--that of a vigorous, expanding and productive colony. During this time the /xam people used a bullroarer to attract swarming bees. The time of swarming is also the time when in the /xam idiom people 'carry' (i.e. collect honey). This is regarded as an especially good time for holding dances. Depictions in the northern uKhahlamba-Drakensberg and elsewhere of dancers juxtaposed with bees and bees' nests may be understood in terms of the southern African hunter-gatherer beliefs about fecundity and swarming described.

Clearly the Later Stone Sage hunter-gatherers observed, understood and exploited bees and the production of honey. Honey was an exceptional resource; its unique properties informed their worldview, in which honey was more than a valuable part of the hunter-gatherer diet. It underpinned the creation of some of the large game animals and was associated with the 'ownership' of honey by entities like the 'elephant man'.

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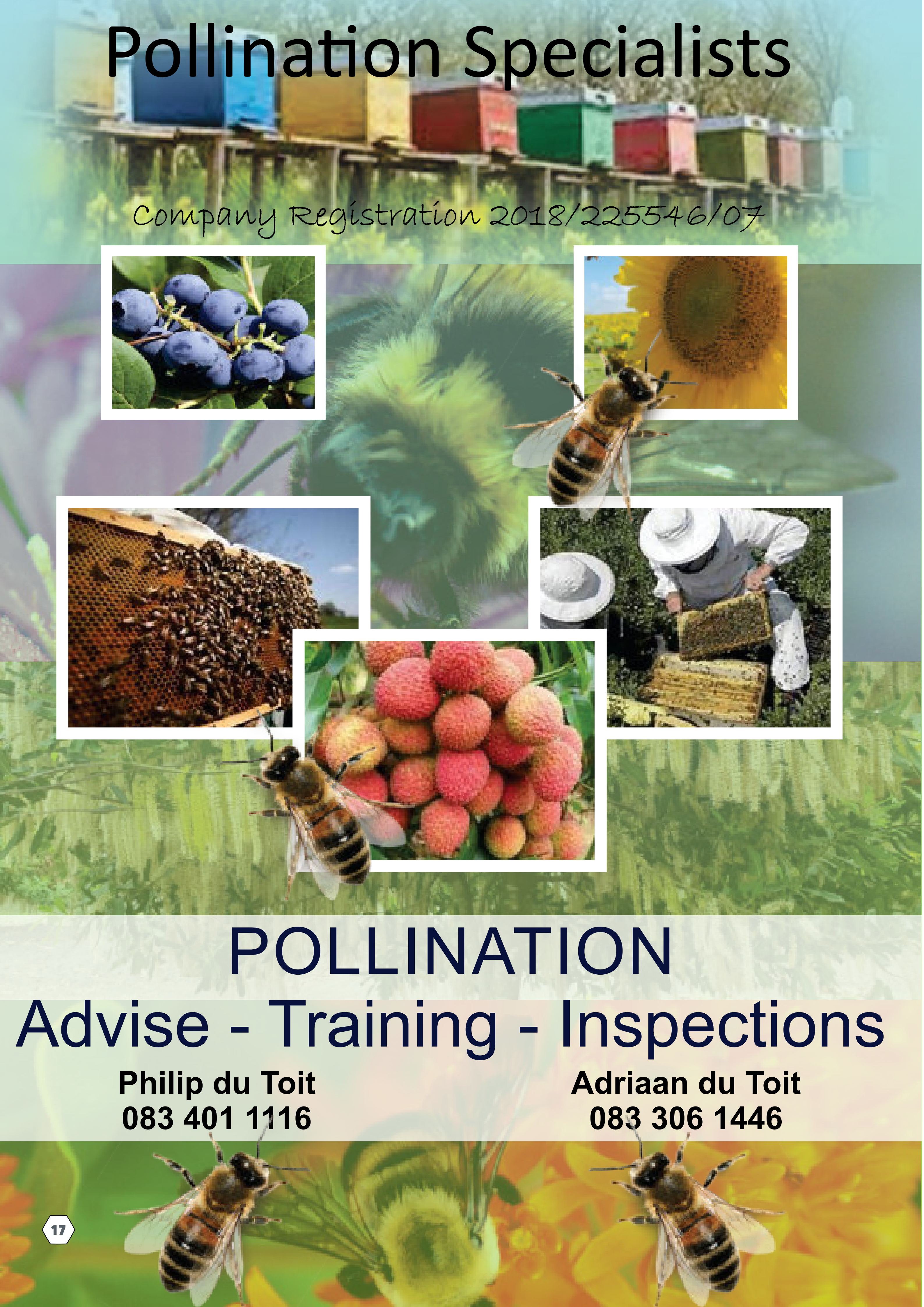
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BESTUIWING DEUR HEUNINGBYE

Nico Langenhoven. Master Beekeeper. Paarl.

'n Kommersiële bestuiwingdiens deur heuningbye in Suid-Afrika kan uiteenlopende menings ontlok. Ek probeer hier 'n agtergrond skep met veral 'n Wes-Kaapse perspektief en om dan 'n mening te gee vir die pad vorentoe.

Kommersiële bestuiwing van veral vrugtebome in die Wes-Kaap het eers werklik posgevat in die vroeë 1980's. Voor daardie tyd was produksie relatief laag en wilde byeswerms het voldoende bestuiwing verskaf. Markte plaaslik en wêreldwyd was beperk. Selfs Besproeiingswater was beperk. Soos bevolkings gegroei het en lewensgehalte van mense verbeter het, het markte vir vrugte, en ander kossoorte gestyg. Watervoorsiening uit nuwe damme en 'n uitgebreide elektriese netwerk vir pomp van water uit riviere, kanale en boorgate het uitbreidings moontlik gemaak. Meer en meer hektare het onder verbouing gekom. Voeg ook hierby die opgang in bloubessiesproduksie en nuwe variëteite wat die bestuiwingsseisoen verleng. Die vraag na bestuiwingseenhede het gestyg en sal steeds bly styg.

Soos die vraag na bestuiwingsdienste gestyg het, het die getal korwe en byebenutters gestyg. Daarmee saam het byeweiding konstant gebly en selfs sedert die begin van die 2000's begin afneem. Dit het gevolg in die daling in heuningproduksie. 'n Eenvoudige grafiek sal duidelik aantoon hoe meer korwe, hoe minder heuning. Dit het meegebring dat vandag in Suid-Afrika is inkomste uit bestuiwing baie meer is as uit heuningproduksie. Volgens my jongste beramings is inkomste uit bestuiwing twee keer meer as uit heuningproduksie. Hierdie tendens sal vir die afsienbare toekoms voortduur. Die negatiewe rol van klimaatsverandering kan ook vermeld word, maar dit is buite my kennisveld. Tog aan die positiewe kant moet die aanplanting van kanola in die Wes-Kaap nie onderskat word nie. Dit het byeboere in die Wes-Kaap geweldig bevoordeel. Hierdie voordeel was meer om bestuiwingseenhede te voorsien. Heuningproduksie by kanola is ondergesik.

Om bestuiwingsdienste volhoubaar te maak is daar twee swakpunte wat uitgeskakel moet word. eerstens; byeboere, ongeag die getal korwe per eenheid, sal hul bestuur moet verbeter. Tweedens sal die verbouers, algemeen bekend as produsente, hul kennis van bye en die bestuur daarvan daadwerklik moet verbeter. laat my toe om 'n hipotese te gebruik. Min motoreienaars weet werklik hoe 'n moderne motor, met al sy elektroniese stelsels, werk. Dit is ook nie nodig nie solank die motor betroubaar is. Daarteenoor sal 'n stoetteler nie enige mooi bul koop nie. Hy/sy sal na 'n klomp syfers en ander genetiise data kyk voor hy besluit. Verbouers sal laasgenoemde weg moet volg.

'n Bestuiwingseenheid moet aan 'n bepaalde standaard voldoen. Hierdie standaard word bepaal deur 'n wedersydse ooreenkoms deur die diensveskaffer (byeboer) en die verbouer van watter kommoditeit ook al. Riglyne vir bestuiwingseenhede is beskikbaar by plaaslike byeverenigings. Dit is belangrik dat 'n swerm heuningbye wat as bestuiwingseenheid aangebied word nie onder standaard sal wees nie. Die teendeel kan ook 'n probleem skep. Dit is swerms wat die standaard noemenswaardig oorskry. Te groot swerms bye sal makliker versmoor. Die beknoptheid in die uur of drie/ vier tydens vervoer sal in effek aanleiding gee tot swermdrang. As dit eers begin het, kan dit nie terug geswaai word nie.

Plasing van bye in boorde en/of lande kan ook bepalend wees. Waarom korwe binne of teenaan 'n boord of land geplaas moet word bly vir my steeds onduidelik. Bye vlieg tot waar hulle wil wees, In of te naby aan die teiken gewas het nadele. Eerstens word bye blootgestel aan gifstowwe wat gespuit word, ongeag of die toediening in die dag of nag gedoen word. Vreemde reuke van die betrokke gewas, byvoorbeeld kanola of uie, kan nadelige effek op die werking van bye hê. Bye kommunikeer deur afskeiding van feromone met mekaar. Feromoon is 'n afskeiding wat veral by insekte gebruik word om te kommunikeer. Dit kom ook by diere en mense voor. Wanneer vreemde reuke in die omgewing of in die korf voorkom, word daardie kommunikasie verbreek. Die gevolg kan onder andere wees dat die koningin met 'n groep werkers die korf verlaat. Die oorblywende bye sorg vir die jongby en van bestuiwing is daar weinig sprake.

Verbouers wat van 'n bestuiwingsdiens gebruik maak moet ook weet dat daar 'n paar faktore is wat suksesvolle bestuiwing sal laat slaag of nie. Bye sal altyd die beste nektar verkies. Anders gestel bye weet dat 'n goeie nektarbron verder meer ekonomies is om te ontgin as 'n swakker bron nader aan die korf. Ek het self daar by Mooinooi gesien hoe bye bo-oor 'n kersieboord vlieg om in bloubessies te gaan werk. Terloops kersies is maar net 'n soort pruim (Prunus). Dit is bekend dat pruime nie goeie en noemenswaardige nektar en stuifmeel produseer nie. Verder kan die toediening van insekweerders op die teikengewas ook bye weg hou. Selfs sistemiese gifstowwe wat deur die wortelstel in die voor groeiseisoen toegedien is, sal maande later die bye weghou.

Wat is die pad vorentoe? Ons benodig byeboere wat 'n passie het vir bye, 'n bogemiddelde werkywer, met kennis en integriteit. Verbouers sal hul self moet gewis van die waarde van 'n goeie bestuiwingseenheid. Vergoeding vir so 'n bestuiwingseenheid is nie oor of daar geld gemaak word of nie. 'n vergoeding moet billik wees. Eerstens om die byeboer van 'n aanvaarbare inkomste te verseker en tweedens om die produsent van 'n goeie oes van topgehalte te verseker.

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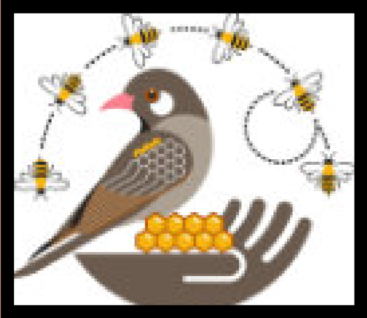


Do you see Greater Honeyguides while beekeeping?

By: Jessica van der Wal and Claire Spottiswoode

You may be familiar with honeyguides as frequent visitors to your beehives. In some parts of Africa, Greater Honeyguides cooperate with humans to find wild bees' nests. A citizen science initiative by the Honeyguide Research Project invites anyone in Africa to share their Greater Honeyguide sightings, which will allow us to map where cooperative relationships with humans are still active, and in the process help to understand how guiding behaviour is acquired (and lost) by the birds.

Greater Honeyguides (Indicator indicator) are a fairly common bird species in savannah woodland and other wooded habitats across sub-Saharan Africa, and familiar to many bush-lovers and beekeepers. They get their name from a curious behaviour: they cooperate with humans to gain access to the content of bees' nests, in an example of interspecific cooperation known as a mutualism. Honeyguides like to eat beeswax and are adept at finding the locations of bees' nests, whereas humans like to eat honey and have the tools to subdue the bees and open the nests, exposing wax for the honeyguides and honey for the humans. This is an extremely rare example of animal-human cooperation that has evolved through natural selection (rather than, for example, through training, coercion or domestication of an animal species). Mutualism with honeyguides is deeply embedded in the culture of many African people, and may be as old, or perhaps even older, than our own species.

While the human-honeyguide mutualism was probably once common throughout sub-Saharan Africa, it now only occurs frequently in only a few parts of Africa where people rely strongly on wild honey collecting, particularly in certain parts of Mozambique, Tanzania, Zimbabwe and Zambia. In many other parts of Africa, Greater Honeyguides are present but only infrequently guide people to bees' nests, presumably because people no longer follow them.

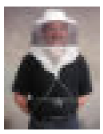
We are interested in understanding how the human-honeyguide mutualism is maintained across time and space. Through the Honeyguiding.me citizen science project, we hope to learn where guiding still occurs in Africa, giving us a baseline against which to monitor future changes. This will allow us to test specific ideas about how honeyguides gain and lose their ability to guide humans.

We have launched Honeyguiding.me to invite anyone who has ever seen a Greater Honeyguide to share their sighting, stating whether the bird attempted to guide you, or not. We'll also ask where and when you saw (or heard) a Greater Honeyguide, whether it was an adult or had the distinctive bright yellow underparts of juveniles/immatures (if you know this – it is important information for us). We welcome both recent sightings as well as sightings from the past. We welcome any additional information, such as any pictures, videos or notes.

Beekeepers occasionally or regularly see honeyguides around their beehives. For example, at Miranda and John Moodie's Honeywood Farm in the Overberg, Western Cape, both Lesser and Greater Honeyguides regularly swoop in from the gumtrees to nibble on the wax remains in the beehive workshop. We warmly invite you to share your honeyguide sightings with us, and we would appreciate it if you could specify when they were near beehives as we are particularly interested to learn more about the relationship between honeyguides and apiculture. Your comments and observations on this would be warmly welcomed. Perhaps the Greater Honeyguide may have alerted you to its presence with a distinctive, nasal chattering guiding call: "tjrrr tjrrr tjrrr tjrrr" – if it did, please indicate this when you submit your sighting.

For more information on the citizen science project, or on honeyguides more generally, please visit www.Honeyguiding.me (available in French, Portuguese and English). You are also welcome to email us more detailed accounts or experiences on honeyguiding.me@gmail.com.

The Honeyguide Research Project is led by Professor Claire Spottiswoode and funded by a research grant from the European Research Council (ERC) (Consolidator Grant number 725185). The Honeyguiding.me citizen science project is managed by Dr Jessica van der Wal. For more information about the Honeyguide Research Project please visit www.AfricanHoneyguides.com.



POLLINATION AND BEE MANAGEMENT IN AVOCADO, LITCHI AND MANGO

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Introduction

Little is known about the pollination ecology of cultivated subtropical crops such as avocado, mango and litchi in South Africa, although the need for cross-pollination is widely recognised. How this should be achieved is highly debated. At present, hived honeybees should be regarded as the most important pollinators of the above subtropical crops. The main reason for this is that honeybees can be manipulated by the beekeeper and brought into the orchard at a specific time and in prolific numbers as demanded by the crop grower. Solitary bee and other potential insect populations are in general depleted through the intensive use of pesticides and a destruction of nesting sites during general agricultural practices. On the other hand, flies are unhygienic and cannot be bred in the numbers required for pollination.

The flowers of avocado, litchi and mango are insect pollinated, but since they originated in other continents, their natural pollinators are not present in South Africa. We therefore have to make use of honeybees as pollinators. In this paper we are going to look at the role and management of honeybees as pollinators in these subtropical fruit crops.

Beekeepers are more and more called upon to render **professional pollination services** as fruit growers strive to maximise production per unit area.

Understanding the concept of pollination and fertilisation

Pollination is the transfer of pollen from an anther to a receptive stigma and the transfer can either be done by wind, insects, other animals and even by water in the case of water plants. Most flowering plants can either set fruit through self-pollination with their own pollen or need to receive pollen form another flower from another compatible plant of the same species, variety or cultivar, known as cross-pollination. Once a pollen grain has stuck to the stigma and is recognised by the stigma, the pollen grain germinates and produces a pollen tube. Each pollen tube contains two sperm cells, as it grows down the style to the ovary (Figure 1). Inside the ovary the pollen tube enters an ovule where the two sperm cells are delivered to the embryo sac of the ovule. One sperm cell fuses with nucleus of the egg cell and the other with the nucleus of the central cell. The latter process is known as **double fertilisation** and is only found in flowering plants. The result of double fertilisation is that the fertilised egg cell gives rise to the embryo and the fertilised central cell gives rise to the endosperm while the whole ovule gives rise to the seed and the whole ovary gives rise to the fruit.

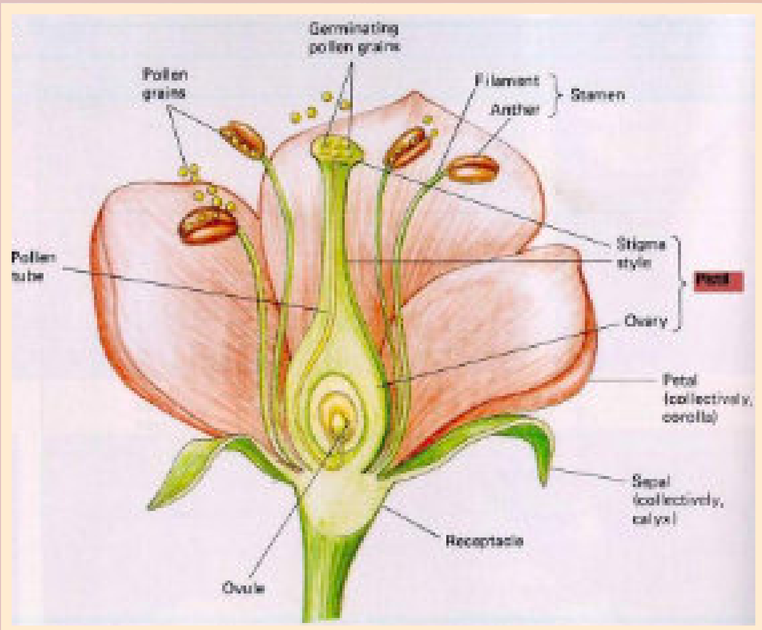

Figure 1. Diagram of a flower, explaining the terminology used in this paper

Fruit set without pollination is therefore impossible except for parthenocarpic fruit like bananas and pineapples where no pollination is required. Self-pollination can lead to undesirable inbreeding and to prevent this, plants like avocado, litchi and mango have evolved strategies to discourage self-pollination but not to prevent self-pollination. In order to understand how these strategies work, it is necessary to have a look at the flower structure of the three mentioned plant species.

To understand the process of pollination, it is important to consider the structure and functioning of the flowers of each crop. All three crops produce large inflorescences, each with many flowers. The inflorescences of avocado are smaller than those of mango and litchi and are borne mostly sub-terminally in clusters at the ends of branches. In the case of mangoes and litchis, the inflorescences are very large and are borne terminally.

Avocado Flower structure

Avocado flowers are described as unique with dianthesis as well as synchronously dichogamous. This actually means that the same flower opens and closes twice over a period of two days with the female phase on the first day and the male phase on the second day. During the opening of the first day the flowers are functionally female with a receptive stigma and closed anthers (Figure 2A). The flowers stay open for a few hours and then close to open the next day as functionally male with a non-receptive stigma and anthers presenting pollen (Figure 2B). They again stay open for a few hours before final closure. Pollination must therefore take place on the first day during the female phase. The reason for this phenomenon is not to prevent self-pollination but to favour cross-pollination. The term 'synchronously' above, is explained by the fact the avocado cultivars are divided into two different types. The A-type cultivars like 'Hass' are functionally female during the morning of the first day and functionally male during the afternoon of the next day. B-cultivars like 'Fuerte' are functionally female during the afternoon of the first day (when 'Hass' flowers are in the male phase) and functionally male during the morning of the second day when 'Hass' flowers are in the female phase.

The avocado belongs to a primitive dicotyledonous family, Lauraceae and unlike flowers of other dicotyledonous plants with four to five parts per flower whorl, avocado flowers have three parts per whorl like monocotyledonous plants. Each flower consists of three outer 'calyx' leaves and three similar inner 'corolla' leaves, six outer stamens, six outer nectaries, three inner stamens, three inner nectaries (staminodes) and a pistil with a single ovule (Figures 2 A and B).

Figure 2A. Avocado flower in functional female phase with exposed stigma and closed anthers (Photo: H Robbertse)

Figure 2B. Avocado male stage flower with non-receptive stigma (purple), inner nectaries (purple) and open anthers (Photo: H Robbertse)

During the female phase the stamens lie flat on the floral leaves and the anthers are closed while the pistil with its receptive stigma is exposed to pollinators (Figure 2A). During the male phase each anther opens with four vales that lift up. The pollen sticks to the underside of the valve to be presented to pollinators (Figure 2B).

Avocado Pollination

The heavy, sticky avocado pollen is ideal for insect pollination and bees are usually listed as the principal pollinating agent. Previous studies in the Lowveld have demonstrated that honeybee visitation to flowering avocado trees remain fairly constant throughout the day regardless of the flowering stage of the trees. This illustrates the sufficient attractiveness of the flowers on a daily basis and further contributed to the success of honeybees as pollinators of avocado during the entire flowering period.

Avocado flowers are very sensitive to climatic conditions. During cool cloudy days the flowers of both A and B-type cultivars do not open until the temperature has risen to above 20oC. Female phase flowers of A-type cultivars may only open in the afternoon and may remain open through the night while the opening of the male phase flowers may also be disrupted. Opening and closing of B-type flowers may also be disrupted with the result the no synchronisation between male and female flowers of A and B cultivars would be possible. On days like this it could be possible for male and female phase flowers to be present on the same tree to make self-pollination possible, but it is also possible that no pollination can occur due to the lack of pollen.

In its natural habitat, avocado flowers are not very attractive to honeybees and tend to abandon avocado orchards when more attractive flowers are available. Collecting insects visiting avocado flowers in its region of origin found honeybees to be active, but ten stingless bee species and the Mexican honey wasp were identified as the main pollinators of the three avocado races (Mexican, Guatemalan and Western Indian) and showed greater preference for avocado flowers. Researchers concluded that, "We assume that the original pollinators of the avocado, before the introduction of the honeybee to the American continent, were stingless bee and wasp species, which are better adapted for its pollination". Since these American stingless bee species are not found in South Africa, we still have to rely on the honeybee for avocado pollination.

Litchi Flower structure

To increase the possibility of cross-pollination, the litchi has two flower types namely male flowers and female flowers both borne on the same inflorescence. When the flowering period starts, mature litchi trees start producing only male flowers for a week or more after they will switch to producing female flowers for another week or more and then will switch again to produce a second type of male flower (Figures 3A and B). The total flowering period can last for 4-6 weeks in Australia.

Figure 3 A. Two male litchi flowers on top, one with a nectar drop on nectar disc and one female flower (bottom) with fertilised stigma, turned brown and two-lobed ovary (Photo: H Robbertse).

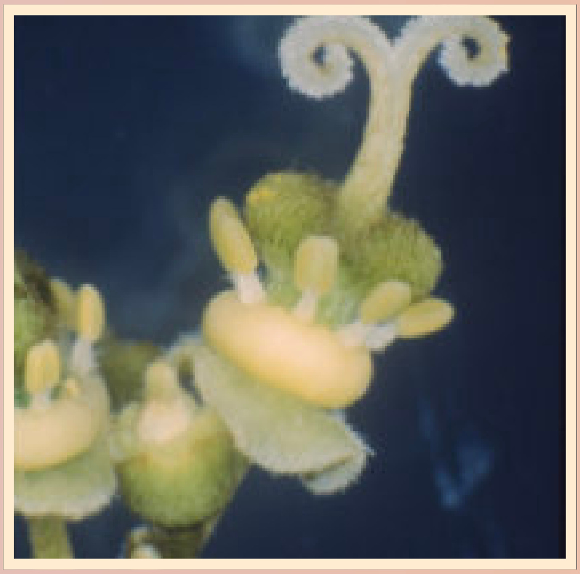

Figure 3 B. Female litchi flower with, white, two-lobed receptive stigma, two-lobed ovary and sterile stamens (staminodes) on nectar disc (Photo: H Robbertse)

The first type male flowers (Figure 3A) are small, with rudimentary floral leaves, usually six fertile stamens on a glandular nectar disc and an aborted pistil. The female flowers are also with rudimentary floral parts, six short, sterile stamens (staminides) on a glandular nectar disc and a well-developed, pistil with a two-lobed stigma, style and a two-locular ovary, each locule with one ovule (Figure 3B). The second type male flowers are similar to the first type male but do have a partly developed, but sterile pistils. The nectar discs produce an abundant amount of nectar as can be seen in Figure 3A. Researchers in Israel observed that there is usually an overlap between the male and female flower production with the result that self-pollination can occur. Trees of different cultivars do not always flower at the same time which allows cross-pollination if orchards are close together.

Litchi pollination

Like mangos and avocados, litchi trees do have their own inherent mechanism to favour cross-pollination. The tree bears its small greenish-yellow flowers in a large panicle with hundreds of florets. Unlike mangos and avocados, litchi flowers produce copious amounts of nectar with sufficient pollen. Honeybees do not seem to have a problem visiting litchi flowers, due to the amounts of nectar and pollen they can collect. This attribute is the reason for litchi to be ranked as one of the top honey producing plants in the world. Nonetheless, fruit set is relatively low with reportedly less than 5% of female flowers that produce mature fruit. It is for this reason that crop growers are keen to understand the management of honeybee colonies during litchi production.

Mango Flower structure

A mango inflorescence can bear hundreds of flowers of which some are male and some are bisexual (hermaphrodite). The male flowers each have five calyx leaves (sepals), five corolla leaves (petals), only one fertile stamen, a few aborted stamens (staminodes) and an aborted pistil (Figure 4A). Like the male flowers, the female flowers also have five a part calyx and corolla, only one fertile stamen, staminodes but a well-developed pistil containing a single ovule (Figure 4B). On the same inflorescence both male and bisexual flowers are open at the same time to make it possible for self-pollination but some cultivars are self-incompatible.

Figure 4 A. Male mango flower with one fertile stamen with dark opened anther (Photo: H Robbertse).

Figure 4 B, Female mango flower with one fertile stamen and well-developed pistil (Photo: H Robbertse).

Mango pollination

Researchers found that Diptera species (flies) and Hymenoptera species (bees) are the most important pollinators of mango. Mango flowers have a pungent smell and are therefore more attracted to flies than to honeybees. Due to the difficulty of luring flies like blue flies to mango orchards, honeybees still remain the best option for mango pollination.

Mango trees are well known for its abundant flower production but relatively low fruit set and mature fruit. Many types of insects have been recorded to visit the mango florets but the significance of most is unimportant due to their low numbers, inability to transfer pollen and lack of seasonal abundance. It is generally recognised that honeybees may not be the natural pollinator of mangos, but their role in pollination are significant due to their availability, ability to repeatedly visit flowers and the successful transfer of pollen. Studies have showed that honeybees carried on average 22 000 pollen grains on their bodies compared to the 480 pollen grains carried by wasps, the other major floral visitors.

Criteria for a plant-insect pollination relationship to be successful

Pollinating insects must

- be active during the flowering period of the target crop,
- bodies should be covered with hairs, upon which pollen can readily cling,
- should have the ability to recognise and imprint plant forms,
- must occur in abundant numbers,
- must visit the flowers of the target crop repeatedly to make contact with both male and female floral parts,
- must have ability to communicate the food source among nest mates is favourable and
- plants to be pollinated should have nectar and pollen of good quality and quantity available as reward.

General management of honeybees in orchards

Honeybees are relatively domesticated as they are kept in manageable hives which can be brought into a monoculture planting otherwise too extensive for pollination by naturally occurring pollinators. Areas planted with crop plants are usually intensive cultivated regions where agricultural activities have led to a reduction in the local honeybee and solitary bee populations. Although honeybees are considered not to be the natural pollinators for crop plants such as avocados, mangos and litchi, they play an extremely important role in pollination due to their pollinator attributes, behaviour and environmental friendliness.

Pollination requirements of avocado, mango and litchi crops

Beekeepers have to realise that paid pollination is a service which they sell to the fruit grower. This, by its very nature, become a production cost to the grower, similar to his other input costs. Pollination requires that the beekeeper hires to the grower the maximum number of honeybee colonies to achieve the level of fruit set desired by the grower. Opposite to this, the honey producing beekeeper, who's aim is to collect a good honey crop, would place only the optimum number of colonies required so that he would obtain maximum honey returns. These two facets of beekeeping should not be confused. The grower must be prepared to hire the honeybee colonies he needs for pollination, while the beekeeper should not expect an optimal honey crop as it becomes his duty to provide the desired pollination coverage. In this, he will effectively overgraze the available food source for the honeybees. Even so, the beekeeper should manage this overgrazing, not to exhaust the honeybee population and secondly to avoid the foraging bees to seek alternative food sources.

Some subtropical fruit crops will have an abundance of food for honeybees such as with litchis. The food resource available when pollination avocados should be enough to maintain honeybee colony levels but it will unlikely be able sustain colony expansion. Periods of a lack of forage reward may occur during the first two to three weeks of flowering. This will require effective management of the number of honeybee colonies or intermediate supplementary feeding of colonies. In a crop such as mango, with its extremely limited nectar and pollen resource to sustain honeybee colonies, it may be required to alternate honeybee colonies on a fortnightly rotating basis or permanently feeding the colonies or both.

The pollinating honeybee colony must have a good work force of foraging honeybees to be efficient during pollination. Added to this, it must have a vigorous young queen that is laying well to ensure that all stages of brood are present. The developing brood act as stimulus for the foraging workers to collect pollen and nectar to feed the young and ultimately achieve pollination. The pollinating unit should have a minimum of two frames with brood with approximately six frames covered with honeybees. During avocado and mango pollination, the pollinating honeybee colony could be housed in a single chamber brood hive. In the event of litchi pollination, ample provision should be made for honey supers and further supers may be added or harvested during the flowering period.

At present, the recommended number of honeybee hives to be used for effective subtropical fruit pollination is 5+ hives per ha for avocados; 4+ hives per ha for litchi and 2+ hives per ha for mangos. In the case of litchi, the determination of a paid pollination service versus a good honey crop would most likely be a limit of 2 hives per ha for honey production. Various factors will determine the final number of pollination hives contracted by a grower. This will include among others total area cultivated, cultivars and cultivar combinations, planting density and age of trees.

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Provisioning apiaries with wild swarms in South Africa: time to think about sustainability

Tlou Masehela (SANBI) & Hannelie Human (UP)

Global organisations, agencies and respective governments have over the years outlined the various challenges facing the planet – our environment and surrounding landscapes. In addition, economists and environmentalists continue to urge policymakers to develop and implement various policies and legislation what will steer countries towards combating and addressing the cascading environmental challenges. All this needs to be done while ensuring that efficient and sustainable use of natural resources is maintained in order to provide food, renewable raw materials, energy and the supply of clean drinking water.

The sustainable use of natural resources has to balance exploitation with the provision of renewable sources of supply. However, it can get complex given the various underlying processes which are essential for the sustainable use of resources. For example, the level of biodiversity needed to maintain the various ecosystems (and their functions) and landscapes. The degree to which they function effectively is dependent on their resilience against changing abiotic and anthropogenic influences. In recent times, the much-needed reliance on these ecosystems and landscapes has been tested and continues to be threatened by natural and man-made events (disasters). These include, among others: climate change, introduction of invasive alien species, biodiversity loss and land degradation, prolonged droughts, harsh and more frequent fires, various forms of pollution, pests, pathogens and diseases, and many others.

Our honey bees are at the centre of most ecosystem and landscape functions providing us with much needed pollination for both the natural environment and agricultural crop production. It is estimated that nearly 90% of all the flowering plants of the world depend in part, if not entirely, on animal pollination. Recent global assessments have stressed the importance of this service. As much as 87 (~ 70%) of the 124 leading crops grown worldwide depend on insect pollination. This pollination is provided by both wild and managed pollinators, with one of the most widely-used managed pollinators being honey bees. It is important to note that both managed and wild pollinators need habitat to sustain them when they are not foraging in crop fields. This habitat allows them to sustain their populations in order to ensure survival and to provide adequate numbers of nesting sites. Honey bees need a variety of flowering plants (providing different pollen and nectar) in their diets to remain healthy, the same likely holds for wild pollinators. Thus, natural ecosystems, with their variety of flowering plant species, and habitat for nesting, support both wild and managed pollinators that provide crop pollination services. Therefore, natural habitats are vital for conserving both wild and managed pollinators, which in turn supports beekeepers, farmers and the ongoing health of the natural environment itself.

Recently, concerns have been expressed by the beekeeping community in relation to certain beekeeping practices driven by the increased demand for pollination services. At the top of the list, is the practice of catching/harvesting wild swarms for beekeeping purposes. In hindsight, this is by no means a new practice. For the African continent in particular, the introduction of modern beekeeping and the establishment of apiaries has driven this practice. Beekeepers and beekeeping communities in general, have over the years taken advantage of the swarming behaviour of honey bees. Swarming is a natural part of the annual lifecycle of African honey bee colonies and reflects seasonal patterns of growth, development and colony reproduction. Swarming normally occurs in early spring-summer, in response to warmer spring and summer temperatures and increased forage resource abundance. Beekeepers catch swarms in order to both replace lost colonies and increase their colony stocks. The origin of trapped swarms remains unclear, and some would dispute that all trapped colonies are "wild". Many of the swarms may have been produced by or absconded from neighbouring managed colonies and later trapped in new hive boxes. Swarm trapping relies largely on factors imbedded around the natural swarming behaviour of honey bees, which in turn, depends on the colony's ability to reach a certain stage of development through the availability and access to good-quality nectar and pollen flows. This delicate balance, has both a direct and indirect impact on the beekeepers' chances of catching their desired swarm(s) annually. Swarm trapping is by no means the only way to replenish colony stocks or increase hive numbers. Other methods include purchasing of new colonies, removal of problem colonies and hive splitting. Outside the African continent, bee breeding programs also provide an alternative for acquiring new colonies.

Swarm trapping remains favourable in South Africa owing to its cost effectiveness and relative simplicity. It is less labour and time intensive compared to other methods. So why the recent concerns if all seems very practical and viable regarding this practice? Well, there are several factors to this concern: i) this practice requires a healthy-well functioning ecosystem and landscape to provide/ensure enough good forage to maintain wild colonies and trigger reproductive swarming; ii) wild colonies themselves should be at good to above average numbers to allow for population turnover or surplus annually/seasonally; and iii) that there be a balance between losses (by keepers) and trapping (from the landscape). All three scenarios are also dependent on the ecosystems and landscape's resilience against changing abiotic and anthropogenic influences. For now, we know and are very much aware of the various natural and man man-made threats (disasters). However, the extent or impact that these could have on this practice is not known, documented nor fully understood. At the same time, we continue to witness how different competing land uses, such as the demand for land to cater for urban development, housing and expanding intensified agricultural activities, are impacting on land available to keep (maintain) healthy-productive colonies. Perhaps this is the time to take a step back and ask ourselves how we are going to provide for the increased demand for pollination services, are our migratory beekeeping practices sustainable/optimal to satisfy this demand? In addition, what is the impact of migratory beekeeping on spreading diseases such as American Foul Brood (AFB) and parasites e.g. Capensis? So, can we assume, with any certainty, that local beekeeping will continue to enjoy the benefits of this practice for a few good years to come?

Path of least resistance versus sustainability

Earlier, we posed a question as to whether this practise can continue to benefit beekeepers in the long run. In reality, the fate of fisheries suggests that this not be the case. There is limited research and anecdotal data within the industry to suggest that some areas (regions and provinces) are already experiencing low to no catches in the spring to summer months. Even with these trends, there are major variations year to year, given the other variables and factors at play. Both experience and literature tells us that preserving our ecosystems and landscapes will prove critical for maintaining this practice. However, we still have no idea as to the state of our wild populations. What the numbers look like, in turn, how viable they are. Does this mean that we should continue along the path of least resistance? Or is this the time to reflect, take stock of what we have and plan towards sustainable use of our bees? The next questions are pretty obvious, aren't they? As always – who will do this, how and with what support? Well, it is not up to the South African beekeeping industry to take a lead on this…after all, it is the industry's bread and butter, and we all have a pretty good idea of what will happen once the buzz stops.

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A Personal Review

The Dark Side of the Hive
The Evolution of the Imperfect Honey Bee.
By: Robin Crewe and Robin Moritz.
Oxford Press 2018 – ISBN 9780190872281.

By: John Moodie -Honeywood Farm, Swellendam, Western Cape

Part 2

On to **Chapter 6** which is about worker bees. It focuses on the tricks and subtleties there are in woman with a suitable epigraph from Chaucer about bees. The quote is however from the Merchant's Tale epilogue (1206-1213) and not the Squire's tale, but that is a minor slip.

In most recent research about honey bees, we find a slightly romanticised image depicted of worker bees. Seen in this light we are encouraged to emulate their example as one of social harmony and efficiency. Is this however accurate? Not according to the darker side of the hive. Honey bees have to deal with sloppy builders, bees who foolishly die in order to defend their colony, policing bees who murder unwanted eggs as well as diploid male drones, lazy workers, as well as stupid ones and then workers who are ever eager and keen to steal and rob should the opportunity arise. Variance in learning speed in worker bees is also identified. Individual worker bees, like humans, can lean quickly and be open to change, only adjust conservatively or simply remain stubbornly resistant to learning and change the 'stay' worker bees. The social functioning of the swarm is as a cohesive organism but to be justly understood, cognisance of individual variance is vital. This chapter needs to be read in full as I cannot cover all areas in any detail. Two areas of worker behaviour, however, that I found particularly interesting were those dealing with the shape of honeycomb cell and of course the capensis laying worker bees. Cells are not the rigid hexagon design created by clever worker bees, but their shape varies and, indeed, changes from a round one to a hexagon one, not because of the bees engineering ability but because of the physical qualities of wax. Mr G.W. Onions and his discovery of thelytoky, of the laying Cape worker bees is covered, but has been done comprehensively in a previous SABJ and most South African bee-keepers are all to familiar with the problem this has caused to bee-keeping in South Africa. Whether they have acted on this awareness or not is a moot point.

Chapter 7 asks the question as to why bees, which are such hygienic creatures maintaining a sterile environment in the hive, are still prone to diseases and pests. Their immune system is not well developed The nectar they gather has anti-microbial qualities enhancing resistance to disease. In spite of this, they are prone to serious diseases, as well as pests, that disrupt their colonies. They will remove seriously infected individuals as well as try and treat them if they are able to. The serious pests are wasps, varroa and the hive beetle and these are discussed fully. Bees cope with most diseases rather like a living cell organism with apoptosis by removing the offending 'cell' or diseased bee. The other drastic and rather extravagant remedy is for the colonies to abscond. They leave their accumulated honey and young, making it a costly exercise, but they also leave accumulated bacteria viruses and pests behind. This more typically happens in the tropics than in the temperate climate zones, which may explain the African bees ability to cope better with bacterial and viral diseases than the European bee. In nature, left to develop and cope with these issues, wild swarms generally cope. Bearing this in mind, it is important for bee-keepers to ensure that whatever measures they decide to use for pest and disease control do, in fact, aid the problem and not exacerbate it.

Regeneration is crucial for the survival of any species. **Chapter 8** investigates the well known ability of honey-bees to swarm and by doing so reproduce and survive. Why does the old mated queen leaves the hive and not the virgin newly hatched queen? Is this really the most efficient process evolved over the centuries? Why are so many cells raised and then simply destroyed by the first queen to hatch? Is the first queen always the best? These regeneration patterns are all feasible, but not necessary the optimal ones. Then the mating game. Drone concentration areas expose the virgin queen to risk and the drone dies after mating. Drones themselves are an extravagant yet essential luxury in a swarm. They absorb more energy than worker bees to feed and nurture and do nothing to contribute to food gathering or hive maintenance. An unanswered question remains about queens. Are those raised as emergency queens better than prepared queens raised for supercedure? There seems to be little evidence or scientific research to back up a significant difference between these two queen origins, in spite of logic arguing that a prepared queen should be the better option. Certainly an area for future research especially for those interested in breeding queens.

We all dream of perfection and seek it in the hoped for after life. Brother Adam tried to create the perfect bee – the Buckfast bee. The problem is what sort of perfection did he strive for in his bees? Honey production, pollination, docility or disease resistance? All these traits are identifiable in the different Apis Mellifera species. Honey bees can be bred to perform in a desired manner. However, would it be achieving the perfection we need? Our concept of perfection may not be the desired one in the long term. Honey bees have never been tamed by man, yet have endured and survived our interference - sometimes to their advantage and sometimes their detriment. The Langstroth hive, for example, improves ventilation and the bees ability to move around their combs in spite of some recent arguments that they do not like square boxes.. The introduction of Apis Mellifera to China,for example, increased honey production hugely but they threaten the indigenous Apis Cerana colonies. Apiaries themselves increase the risk of disease as multiple colonies are kept in close proximity to each other. Colony Collapse Disorder was given multiple causes, but it occurred as a result of bee-keeper manipulation of their bees, because small scale bee farmers were less affected by the problem and wild colonies survived. Regulations to control and conserve bees are possible and necessary yet bee-keepers, as we well know, are seldom willing to comply and heed regulations introduced to protect their charges. Bee-keepers need to heed this warning from the past. If they do not there is no reason to believe that it could not re-occur. Ultimately, it is argued, that it is more important to understand the existing bee biology, rather than to look for the perfect bee.

Historical examples of bee modification by science in **Chapter 10**. The role of science, bees and the keeper of bees is discussed. The authors honesty in this regard is best summed up by their own words (Pg. 145 Chap10)

"But this very personal impression may appear very different from the viewpoint of the beekeepers (for better or for worse). So perspective and personal interest are essential to determine the value of a specific research result, and we are happy to leave the assessment of the quality of research to others. In addition, scientists inevitably make errors, and these errors will sometimes be published in prominent journals, sometimes conflict with the truth, and sometimes conflict with another error. In the latter case, this will result in long- lasting controversies. Yet, this is actually the best of all scientific worlds because then issues are dealt with in a comprehensive way with a good chance that a better understanding might eventually materialize."

The movement of the African honey-bee to South America by Warwick Kerr is an example of science causing a dramatic modification of honey bees and bee-keeping. How this happened and the end result of migration of African bees into the USA is more than adequately explained. They do show, that in spite of this take over by managed Apis Mellifera there was apparently little, if any, serious competition resulting in harm to the solitary bees and the environment in general. Managed bees thus do not seem to be as serious a threat to the environment as is sometimes argued.

The final chapter explores the future of bees. It gives no silver lining. It argues that bees have survived periods of environmental stress in the past. Honey-bees depend on the exploitation of mass forage and their ability to store this food as energy to survive. Those that do best are not managed by huge commercial operations, but are generally wild colonies and smaller bee-keeper operation. In addition, the failed attempt by Australia to eradicate Apis Mellifera's to stop the pollination of 'Patterson's Curse' shows that bees are more difficult to eradicate and modify in the environment than is imagined. In the end it natural selection prevails. The huge impact pesticides must be having on honey bees is not really discussed in any detail but there is hope that bees will, in all likelihood, outlast the more recent, more fragile species - humankind.

In time we, like the bees, all evolve imperfectly! Age has few advantages. One of them, however, is that time gives one's life view depth covering events and personalities that have meant something and have made a difference to ones world view. Growth and change can petrify - then you are old, like the 'stay bees'. As long as there is stimulation and a challenge then at least the term 'young at heart' applies. As I mentioned at the beginning of this review, bees have been a constant in my life for as long as I can remember. I am pleased to say that I have been privileged to have learnt from a wide range of scientists stretching back to Dr Lundie, the first bee scientist I learnt from on one of his courses, to more recently meeting Tom Seely at Cornell University. Many, many others, too numerous to mention, have been a source of learning and inspiration about bees. I am grateful to them all and especially grateful for having been able to enjoy this exploration of the dark side of the hive by Robin and Robin. My only regret is that I could not share it with my father. He was a keeper of bees and a scientist, whom I know would have been delighted to explore and discuss the questions raised in the book. Had it not been for Hitler, I am sure he would have devoted his life to bee research, after completing his brilliant degree in Botany and Zoology at Rhodes in the 1930's. I know that he would have joined me, without any hesitation, in giving this work a 'thumbs up'.

ARTICLES OF INTEREST

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KUNGL. VETENSKAPS-AKADEMIEN

PERSPECTIVE

Why bees are critical for achieving sustainable development

Vidushi Patel, Natasha Pauli, Eloise Biggs, Liz Barbour, Bryan Boruff

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Abstract Reductions in global bee populations are threatening the pollination benefits to both the planet and people. Whilst the contribution of bee pollination in promoting sustainable development goals through food security and biodiversity is widely acknowledged, a range of other benefits provided by bees has yet to be fully recognised. We explore the contributions of bees towards achieving the United Nation's Sustainable Development Goals (SDGs). Our insights suggest that bees potentially contribute towards 15 of the 17 SDGs and a minimum of 30 SDG targets. We identify common themes in which bees play an essential role, and suggest that improved understanding of bee contributions to sustainable development is crucial for ensuring viable bee systems.

Keywords Bees · Biodiversity · Complex systems · Human–environment interactions · Pollination · Sustainable Development Goals

explore the interconnections between bees—a critical group of insects with diverse economic, social, cultural and ecological values—and people, in the context of the SDGs.

BEES, PEOPLE AND THE PLANET

Bees comprise ~ 20 000 described species across seven recognised families (Ascher and Pickering 2014), with many more species yet to be described (Fig. 1). The evolutionary radiation of bees coincided with the evolutionary radiation of flowering plants (Cappellari et al. 2013), and bees occupy an important ecological role as pollinators of a range of flowering plant species. Although bees are not the most diverse group of pollinators (butterflies and moths comprise over 140 000 species), they are the most dominant taxonomic group amongst pollinators; only in the Arctic regions, is another group (flies) more dominant (Ollerton et al. 2017). The ability of bees to transport large numbers of pollen grains on their hairy bodies, reliance on

Edited by **Jennifer Sills**

Holistic environmental risk assessment for bees

In January, the European Food Safety Authority (EFSA) proposed a honey bee (*Apis mellifera*) pesticide risk assessment that uses a systems approach (*1*). The strategy accounts for multiple stressors and sub-lethal effects, unlike current assessments. We support this long-awaited paradigm shift for environmental risk assessment. However, the initial focus on honey bees alone is not enough to protect the majority of pollinators, nor will it help substantively address the plight of biodiversity. Therefore, EFSA should augment the approach to include more relevant species.

Although there are many socio-political, historical, and practical advantages for honey bees as a model, this bee species is an exceptional case in the bee world. Honey bee colonies are superorganisms whose social organization provides a highly resilient buffer against environmental stressors that solitary and less social bees lack. They are nurtured by beekeepers, who provide shelter, supplementary food, and disease control. Honey bees are a good place to start, given how much we know about them and their place in the public eye, but they are simply not representative of most wild bee species that provide the bulk of pollination services. The overall bee–environment interaction would be better represented by extending the EFSA approach to more representative bee species.

Establishing which species are good analogs for modeling other, more vulnerable bee species should be prioritized. Knowledge should then be gathered for such species to allow modeling of other bee species, and ideally other non-target organisms. The environmental and toxicological context should also be modeled and monitored accurately to provide high-quality inputs to the species models. These steps would support a much more rigorous environmental risk assessment and would enhance this already long-awaited and necessary paradigm shift (*2*).

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COMPETING INTERESTS

C.J.T. is vice chair of the EFSA Panel on Plant Protection Products and their Residues, which is a scientific support to EFSA for regulatory issues for pesticides. All authors are affiliated with PoshBee (https://poshbee.eu/).

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U.S. immigration reform for STEM doctorates

In their Policy Forum "Rethinking immigration policies for STEM doctorates" (22 January, p. 350), M. Roach and J. Skrentny suggest that U.S. immigration reform should provide an easier path to permanent residency for those who work in science, technology, engineering, and mathematics (STEM) fields and have Ph.D.s from U.S. universities. Before implementing the strategies they suggest, policy-makers should address such a program's unintended consequences.

Granting permanent residency to STEM doctorates upon graduation may stimulate educational institutions to seek STEM designations for their traditional non-STEM programs, such as business, management, and social sciences, to attract more foreign applicants. To counteract declining international applications (*1*), some business schools have already been working with the U.S. Department of Homeland Security to classify their MBA programs as STEM programs. This designation would make international students with F-1 visas eligible for an extended Optional Practical Training period (*2*), currently an extra benefit granted to STEM students only (*3*).

Indiscriminately expanding the scale of STEM designations could conversely result in chaotic consequences in the immigration system. Each year, there are approximately 140,000 employment-based immigrant visas made available to qualified applicants around the world (*4*). Granting green cards to all STEM doctorates, including those graduating from the nontraditional

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RESEARCH

PESTICIDES

Applied pesticide toxicity shifts toward plants and invertebrates, even in GM crops

Ralf Schulz[1,2]*, Sascha Bub[1], Lara L. Petschick[1], Sebastian Stehle[1,2], Jakob Wolfram[1]

Pesticide impacts are usually discussed in the context of applied amounts while disregarding the large but environmentally relevant variations in substance-specific toxicity. Here, we systemically interpret changes in the use of 381 pesticides over 25 years by considering 1591 substance-specific acute toxicity threshold values for eight nontarget species groups. We find that the toxicity of applied insecticides to aquatic invertebrates and pollinators has increased considerably—in sharp contrast to the applied amount—and that this increase has been driven by highly toxic pyrethroids and neonicotinoids, respectively. We also report increasing applied toxicity to aquatic invertebrates and pollinators in genetically modified (GM) corn and to terrestrial plants in herbicide-tolerant soybeans since approximately 2010. Our results challenge the claims of a decrease in the environmental impacts of pesticide use.

Dept. of Agriculture, Land Reform and Rural Development (DALRRD)

CONTACTS FOR BEEKEEPING

Mr Riaan van Zyl and Mr Kobus Kemp are the persons who beekeepers should contact if they have any suspicion about bee diseases or the presence thereof such as AFB and the Capensis clones.

They can also be contacted regarding legislation concerning honey labelling and the standards of import requirements of honey.

They do not provide advice on beekeeping practises, but will if possible direct persons with enquiries to the correct or experienced sources.

PLEASE CONTACT THEM:
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Kobus Kemp: (Scutellata)
Tel: 012 309 8762
Cell: 082 873 1678
Email: kobusk@ dalrrd.gov.za

CONTACT DETAILS

NATIONAL ASSOCIATION

SABIO: South African Bee Industry Organisation
Chairman: Adriaan du Toit, Pretoria, Gauteng
Cell: 083 306 1446 * Email: info@sabio.org.za * Web Address: https://www.sabio.org.za/

REGIONAL / LOCAL ASSOCIATIONS & INTEREST GROUPS

Eastern Highveld Beekeepers' Association
Chairman: Capie du Toit * East Rand, Gauteng
Cell: 072 368 0476 * Email: capiedutoit@absamail.co.za

Eastern Cape Development Beekeepers
Co-ordinator: Sisiphiwo Dingana (Sabio board member)
Cell: 073 715 8450* Email: dsisiphiwo@gmail.com

Knysna Beekeepers' Association
Co-ordinator: Owen Williams * Knysna, Garden Route
Cell: 078 724 6425 * Email: honeychildhoney2@gmail.com

KwaZulu-Natal Bee Farmers' Association
Chairman: Phil Walker * Pietermaritzburg, KwaZulu- Natal
Cell: 084 510 1556 * Email: gdahoney@sai.co.za

Mpumalanga Beekeeping Interest Group
Co- ordinator: Inge Lotter * Nelspruit, Mpumalanga
Cell: 082 821 5011 * Email: inge.lotter@gmail.com

Northern Cape Bee Interest Group
Co- ordinator: Douglas Bee Farms * Douglas, Northern Cape
Cell: 053 298 1101 * Email: dbf@vodamail.co.za

Northerns Beekeepers' Association
Chairman: Jan Steenkamp* Cell: 076 061 3700
Communications: Riekie van den Berg * Pretoria, Gauteng
Cell: 082 972 1889 * Email: justrie@mweb.co.za

Eastern Cape Interest Group
Co-ordinator: Sonja Miller
Cell: * Email: Sonja@keeperskeep.co.za

Southern Cape Bee Industry Association
Chairman: Andre de Jager * Email: andredjager@vodamail.co.za
Co- ordinator: Hannes van Zyl * George, Southern Cape
Cell: 082 922 6756 * Email: suidkaapbye@gmail.com

Southerns Beekeeping Association
Chairman: Kai Hichert * Johannesburg, Gauteng
Cell: 082 561 0346 * Email: hichert@worldonline.co.za

Western Cape Bee Industry Association
Chairman: Tlou Masehela * Cape Town, Western Cape
Cell: 078 285 2553 * Email: info@wkbv.co.za

INTERNET FORUMS

BeesSA Email Discussion Group
Moderator: Robert Post * Joostenbergvlakte, Boland, Western Cape
Tel: 021 971 1022 * Email: crpost@telkomsa.net

Apiculture SA Email Discussion Group
Moderator: Dean Lennox * Cape Town, Western Cape
Email: deanlennox@gmail.com
Web Address: http://groups.google.com.co.za/group/apiculture-sa

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Buzz Bee honey (Pty) ltd. TA001.
0792917392 | Elrenske@gmail.com

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Chris Viljoen
0833028695

Photo: Sharon Crouse

20 MAY 2021
09h00-12h30

HONEY FRAUD WORKSHOP

A sticky illegal mess

The status of international Honey Fraud and the impact on Southern Africa

This event will provide the latest information on the seriousness of the situation and the complexity of the deception. International honey experts will educate buyers of honey to ensure the supply chain in South Africa is not an unwitting partner in crime with the international food fraud syndicates. The event will also highlight the importance of active and immediate collaboration to protect the integrity of honey and our fragile honey market.

Defining food fraud and how it is manifested in the industry.

Food fraud is the intentional deception of consumers using food products. Honey, a precious and natural foodstuff has been at the heart of many internal food fraud scandals due to adulteration, substitution, misbranding, counterfeiting or others. This type of economically motivated illegal activity is an increasing international concern.

Who Should Attend?

Beekeepers; Honey Bottlers; Honey Traders; Retailers; Pharmacies; Health Shops, Certification Bodies, SANAS, Food Safety Auditors; Food Manufacturers using Honey as an Ingredient; Government Officials from DALRRD; DOH, DTI; Government Provincial Departments of Agriculture; Environmental Health Practitioners from Local Municipalities; Consumer Organisations; Testing Laboratories; Agricultural Research Council; anyone who enjoys honey.

DON'T MISS THIS EVENT
FREE REGISTRATION

SABIO
SOUTH AFRICAN BEE INDUSTRY ORGANIZATION
100 YEARS
1921-2021

Register at: www.honeyfraud.foodfocus.co.za