THE AFRICAN BEES – CONTRIBUTION TO THEIR KNOWLEDGE*

Prof. N. KEMPFF MERCADO

BOLIVIA

Introduction

In 1956, two species of African bees were brought to the Higher Agricultural School "Luiz de Queiloz" in Piracicaba (Brazil), with the best of intentions: the yellow African (*Apis mellifera adansonii*) which we shall extensively deal with, and the black African (*Apis mellifera capensis*), a small, mild and poorly productive bee which was soon abandoned.

Several reasons existed for the introduction of the above species, of which Warwick E. KERR has singled out:

a) The poor productivity of the black or German bees, the most widely spread race in Brazil; b) the difficulty of introducing Italian queens in black bees' nuclei; c) the great many published accounts eulogizing the *adansonii* species – including that by Virgilio PORTUGAL DE ARAUJO, who, without mentioning its productivity, pointed out that it shows aggressiveness of several intensities, which urges for its selection. R.H. ANDERSON showed in "*African Beekeeper*", Vol. 37, No. 165, pp 9-12, that in the second year of selection of *adansonii* strains he had obtained excellent results: the average crop yielded by the 15 colonies he investigated accounted for 131 kg yearly, the highest crop – of the most productive colony – being of 320 kg.

Of the 170 queens imported from Africa, only 49 were accepted in the nuclei and colonies in Piracicaba; then, they developed so fast as 26 swarmed; this was a completely unexpected event, as nobody intended to spread a strain of pure African bees. The swarms spread so rapidly that they were soon out of control.

In 1968, *adansonii* had already reached Barra de Corda, Maranhao state, beyond which the Amazon region lies; consequently, its advance northward is of 230 km annually.

It spreads westward, to Bolivia and Paraguay, with 150 km annually, and southward at the same rate. At the Symposium on the African bee held in November 1969, it was most resolutely pointed out that by the end of 1973 the first swarms of *adansonii* would reach Buenos Aires province, and that nothing could prevent the advance of *adansonii* southward, as it had been proved that they forage at lower temperatures than the Italian bees (See "Contributions to Solving the Problem of the African Bees", journal "*Producción Animal*", Vol. 2, published by the Faculty of Agronomy in La Plata). Remarks were made in the margin of this statement, and doubts were expressed, but at present it is fully confirmed by events. We must point out that the only South American country which will escape the Africanization of its bees will be Chile, as it is isolated by natural barriers.

Some authors hold that the Amazon river region could be a natural barrier for the advance southward of *adansonii*, because it is a humid zone; but I had the opportunity to see by myself that they had already adapted themselves in Chapare region, the most humid tropical zone in Bolivia, with an average annual rainfall of 6,000 mm, which stands proof of the fact that their advance northward is inevitable, and by mere deduction we can envisage them reaching Panama by 1975, and then spread farther on to Central America, Mexico, and the United States.

In his article "The African Bee in South America" ("*The Beekeepers' Bulletin*", Vol. 14, 1/70, Department of Agriculture, Victoria, Australia), D.F. LANGRIDGE stresses that the African bees will inevitably reach the southern states in the United States and will ruin the bee package industry and queen breeding, and therefore he considers it most important to closely watch the advance of the respective bees on the American continent, and to strictly forbid the import of queens in Australia, as soon as possible. In his capacity as a researcher, he assesses that no barrier – either mountain or rivers or seas – can possibly stop *adansonii*'s advance northward; attempts could be made to stop them in Panama zone, being the narrowest zone between the two Americas, but to this end a permanent barrier should be established, of insecticides, all the year round, for ever after (?).

Given the fact that the spread of the African bees is assessed as inevitable, its impact on the beekeeping throughout America is most serious, all zones invaded by *adansonii* have undergone greater or less damage, dependent on various factors to be examined below; the forest zones are undoubtedly the most affected by Africanization; nevertheless, there exists a common denominator: wherever *adansonii* arrives, everything falls in confusion and most of people give up beekeeping.

** Survey made by the Ministry of Agriculture and Live-stock Breeding, Department Direction, Bolivia.*

I shall mention only a few figures illustrating what happened in Santa Cruz district (Bolivia), where beekeeping is practiced on a small scale but is well organized. Before the invasion of *adansonii*, 5,000 hives with Italian bees were kept there, which yielded 200,000 kg yearly. At present, after roughly five years since its invasion, only one fifth of the previous number of hives exist, and their production went down to 40%.

Most of the middle and small beekeepers gave up because they could no more work with such aggressive bees. As it was but natural, the price of honey – all of which is consumed in this country – has increased three times.

The same picture occurs in all zones invaded by the African bees; Dr. Pedro A. BOGGINO, Apicultural Technician, President of the Paraguay Beekeepers' Association, pointed out in his article "Realities about African Bees" ("*Gaceta del Colmenar",* No. 12, Dec. 1971, Buenos Aires): "The African bees reached Paraguay in 1964-1965; their swarms attack the native bees in their hives, in tree hollows or in common boxes, overwhelming them. The invading bees in the boxes developed very fast as they would not loose their time to forage, robbing the other colonies which at last starved. So it happened that all native bees disappeared in Paraguay, being replaced by the "Africanized" ones. Sometimes, the substitution was peaceful: the swarm of African bees would settle itself very close to the colony and at night would steal into the hive through a crack, kill the queen and remain the masters". In the same article, in opposing Erico WOLNIEWICZ's assessment he points out: "To strive to rear and recommend the Africanized bees without crossing them with more gentle races is but a nonessential fanaticism".

In their article "African Bees in Northern Argentina" ("*Gaceta del Colmenar"* No. 6, June 1969, Buenos Aires), Agr. Eng. Moisés KATZNELSON, one of the most competent extension officers in apiculture of INTA (National Institute of Agrozootechnical Technology), don Jacinto NAVIERO, Chairman of "Sociedad Veinticinquena de Apicultores", and don Alfonso FUHR, Chairman of the Beekeepers' Association in Coronel Suares give a general picture of the zones invaded by African bees; they have visited the major apiaries in north, within a 7 km radius, and found out that beekeeping was altogether ruined. Technician Ernesto B. KURTZ of INTA, opined that beekeeping industry should be established on a new basis and outlook.

In Brazil, where beekeeping is already fully Africanized, the picture is quite similar; throughout the region traversed by the African bee, everything was into confusion and most beekeepers renounced the beekeeping practice. All the other bee races had been completely removed and at present crosses of African with Italian or Caucasian bees are made, in order to lessen their aggressiveness. There are several research institutes in Brazil where pure African bees are being genetically improved, with promising results having been obtained. As concerns the present Brazilian beekeeping we may assess with no exaggeration that the beekeepers in Brazil have adapted themselves to the African bees, accepted them and rear them as they are, to improve them and handle them according to their characteristic features.

Identification

The accurate identification of an *Apis* species is quite difficult because dissection is necessary and preparation of slides, with the parts to be examined being previously diluted and coloured (L. DE SANTIS).

The *Apis mellifera adansonii* workers have three transversal bands on the first three abdominal segments, the scutellum is yellow, and the hairs are yellowish, but there exists a large range of intermediary colours in its hybrids, with dark shades prevailing.

Also, they can be identified quite easily by the position of their wings. In other *Apis* species, when they stay on something their wings are crossed, while in *adansonii* they are semiopened, as in taking off position. While Italians walk to the flying deck and then take off, the African bees take off at the entrance.

In *adansonii*, 900-1.000 worker cells exist, while in the combs of Italians – 740-800 cells. Such a small number of cells occurs only in pure lines and in a few of its hybrids.

Biological data

F.G. SMITH pointed out that in the vast area over which the African bee has spread a wide variety of natural conditions exists, ranging from zones with 100 mm rainfall and desert flora to forests with rainfall exceeding 5,000 mm annually, which is a telling evidence of its high adaptability to so different environment conditions. In Bolivia, *adansonii* have adapted themselves in Chapare zone, with an average annual rainfall of 6,000 mm.

Among the biological characteristic features of *Apis mellifera adansonii,* most striking is its tremendous capacity of expansion by natural swarming, and its dominating character; in only 15 years, two thirds of the South American continent has been invaded by it. Throughout this vast area, a progressive substitution has taken and continues to take place of the other *Apis* species by the African species, with the resulting consequences which raise new problems. People have to be aware of and accept the fact that in the invaded zone they must work with the Africanized hybrids, because under the conditions existing at

present the substitution of the other species is inevitable, except the zones which are protected by natural barriers – in Chile.

On the other hand, its intense swarming, wildness, easy adaptability and strong migratory impulse have entailed the appearance of wild colonies which have spread in all zones, the forest regions being most utterly affected. The African bees which escaped the control of man pose new problems not only for beekeepers, but also for people in general and the useful fauna; in desert zones, they are attracted by people's sweat, and rush in great numbers into wells and water troughs where they die and spoil the water.

Barbosa da SILVA and SCOTT point out another significant fact: "*adansonii*" is a species of tropical climate, and when under their favourite conditions, they store very little honey and pollen, and egglaying continues. The stores accumulated are used exclusively for increasing the population, and poor flow intervals are overcome by migration". This does not mean that *adansonii* do not thrive economically in zones with shorter or longer flowless intervals.

During one of his investigations, Antonio TRIANINI, beekeeping technician in Porto Alegre, recorded of 100 African bees, 80 which brought pollen in the hive and 20 – nectar, which attests to its tremendous increase in number; while of 100 Italians – 60-80% brought in nectar. He also holds that African bees can not be used in "baby" mating nuclei because when the virgin queens flies out for mating, bees would accompany her.

Aggressivenes

The major characteristic feature of this species and the same time the greatest shortcoming is its being permanently on the alert and its high irritability. According to W.E. KERR, its agressivenes is due to the fact that while in European bees selection was performed – for hundreds of years – precisely of their gentleness, the African bees have undergone the selection process in an opposite direction, because the African native population would destroy the colonies completely by fire, and then eat the brood. As a consequence, only the most aggressive colonies could survive.

Their aggressive behaviour is due to external factors most of which have not yet been studied. Yet, on some days, the African bees are relatively gentle, easy to handle. It often happened that on one day we could take the combs out with quite little trouble, while on the next day, when introducing them into the hive we would face aggressive bees, or vice versa. Most certainly, weather conditions bear negatively upon the African bees, while on the other *Apis* species the influence is less marked.

Overcrowding and the changes in the microclimate of the hive can also cause aggressiveness: small colonies are gentle and easily handled, but with the increase in number, their aggressiveness also intensifies. Sometimes we found colonies which we thought gentle enough to be easily handled, but they were only small swarms or weak colonies which proved their actual temper after they had fully developed. Unlike the European bees, *adansonii* are more aggressive during foraging, especially when abundant nectar sources are available. On one cold day, when putting back a frame in a hive, we were surprised to come across very gentle African bees.

Rami PELED, a beekeeper in Dakar, Senegal ("*American Bee Journal*", June 1971) holds a fact which he had the opportunity to ascertain: "When provoked, a colony of African bees will follow the intruder even inside a dark house, which does not happen with any of the other bee races".

Noteworthy is the aggressiveness of flying swarms, especially of the forest species; Barbosa da SILVA and SCOTT have noticed that the attacks or invasions are the result of these swarms coming accidentally across people or animal; stress must be also laid on the fact that the huge swarms made up of several swarms during flight are most dangerous.

African bees' aggressiveness causes serious damage in many regions; in particular, forest species, which manage to settle themselves in any place because nobody can identify them and therefore are not managed accordingly; published accounts report frequent cases of death caused by these bees, both of people and domestic animals.

The Polish researcher J. WOYKE made a comparative study of the aggressiveness of *adansonii* and other races, in his article "African Honey Bees in Brazil". He excited them and then measured their reaction:

Bee races	Italian	African	Hybrids
Number of seconds till the first sting	19.3	2.9	9.0
Number of seconds till complete irritation	22.9	7.3	15.0
Number of stings in gloves	0.0	39.3	1.4
Time in seconds, necessary to restore calm	149.0	1,801.0	243.0
Distance (in m) covered by them in pursuing the experimenter	28.8	170.3	31.4

The comparative data supplied by J. WOYKE are certainly referring to the tested colonies, because when operations are performed in colonies of African bees – even if it is only cleaning -, irrespective of the hour at which they are made, the bees get excited and keep aggressive all the day round. Therefore, we

usually strive to work with them late in the afternoon because only during night the bees calm down. As we have mentioned above, on certain days, African bees may be handled with no trouble, with no reason accounting for it.

Handling of African bees

Because of their aggressiveness, adequate management methods must be used; special heed in this respect must be paid in the apiaries close to inhibited areas, roads or live-stock breeding farms.

When the process of Africanization started in our apiaries, many of them were abandoned because they were located close to dwellings or stables. The beekeepers who were aware of the danger spelt by the invading bees have moved their hives during night, by using ammonium nitrate, to more isolated places. Some of them have burnt out their hives not wanting to hear anything more about beekeeping.

Our experience will be useful to the wise beekeepers in the regions not yet invaded by African bees, who will thus be able to move their hives to safe places, in due time. Those who think will escape Africanization are deceiving themselves. Those who wish to continue their beekeepeing practice will be able to do it only if they adapt the management methods to a more aggressive bee which could be improved with the passing of time but only under rigorous and permanent control, by requeening the more aggressive colonies. After the first swarm of African bees, hundreds will follow, every year, for ever and again.

The apiary must be located at least 200 m from places where people, animals, dwellings or stables exist. Each hive must be placed on a stand, at 3 m distance from one another; one should not place several hives on the same sheltered site because the bustle in a hive will disturb the neighbour colonies; one should also enclose the apiary by barbed wire to keep animals away, or by quick hedge – which is even more efficient.

With the experience already gained, the case does no more seem so desperate to us as to renounce keeping African bees. By adapting management methods to these more aggressive bees we will be able to rear them, and by systematic and constant hybridization more or less workable bees shall be obtained, by requeening the more aggressive colonies.

The beekeepers' clothes must be the proper ones, capable to ensure the best of protection; the leather gloves must be very smooth in order to avoid too many stings in them; it is better to protect them with rubber gloves, thus avoiding almost completely stinging which always irritates the bees. Also, an efficient smoker must be available; when working in a hive the hive close to it must also be smoked before the bees in it get harassed by the presence of the beekeeper; when the bees in an African colony are irritated, nothing can calm them down and they would keep stinging the whole day, except when using ammonium nitrate.

That is why, it is advisable to work on the African bees the latest possible in the evening, the frames taken from hives being preferably put back in the hive at night, under red light. The combs taken from hives should be transported at night, after the bees have entered their hive, in order to avoid the irritated bees to follow the truck. Evidence exists of a case when a truck transporting combs by day time was pursued by bees for more than 1 km, and they attacked people and animals all long their way.

In special situations, when African colonies must be worked on in populated zones or close to dwellings or breeding farms, there is only one method to be applied: to take out combs at night, by using laughing gas.

The laughing gas or nitrogen protoxide (N_2O) is obtained by heating the ammonium nitrate (NH_4) NO_3. Above the smoker in which red-hot coal was introduced, a small quantity (approximately half of a little spoon) is put, wrapped in paper; under the heat generated, ammonium nitrate turns into gas, which, when released at the hive entrance, benumbs the bees for more than two minutes, making them drowsy and causing them a total amnesia.

The laughing gas may be used in handling African bees in the following cases:

a. When one requeens very aggressive colonies, with a more gentle queen. After the bees had been benumbed, the queen to be removed is searched for. As the benumbed bees fall on the bottom of the hive, one should better take them out in order to be able to identify the queen. During this operation, one should be careful, not to damage any queen cell, as very many such queen cells exist because of the high swarming impulse of the bees. Concomitantly, the ready to emerge drones are beheaded with a knife. After eliminating the undesired queen, a frame with Italian, Caucasian or hybrid queen and bees is introduced into the benumbed colony. In 45-60 days, the temper of the colony improves itself, with the newly emerging population.

b. Another efficient method is to introduce one or two queen cells of good origin in the benumbed colony from which the queen had been removed.

c. When, for a special reason, the entire African population has to be removed from an aggressive colony, the operation must be performed on cold nights, when all bees are inside the hive. After benumbing them with laughing gas, all bees are burnt out, first by scratching the combs above the fire, and then burning all the bees on the bottom of the hive.

d. The laughing gas is also useful for calming down irritated colonies, and for preventing robbing. We must keep constantly in mind that African bees are wicked robbers.

e. The laughing gas is also used for anesthetizing the colonies in order to transport them at night, to a far enough and safe place.

Substitution of African queens

"Associación Gaucha de Apicultores" (The Peasant Beekeepers' Assoaciation) in Rio Grande do Sul State (Brazil), recommends the following method for requeening African colonies:

Before the operation, the beekeeper must take efficient protection measures: light, self-coloured thick cloth, large overalls, thick, rubber-coated gloves – yellow if possible resistant gauze, thin wire net, with sleeves introduced in the gloves. Intruders and animals must be driven away, at least 200 m distance.

The hive with African bees is moved to another place. A hive body is put instead of it, with new combs with brood and eggs from gentle colonies. The African foragers will come back to their former location and will build queen cells from which a gentler queen will emerge.

After one day, the African aggressive queen in the hive which had been moved to another place, is replaced by a new queen, or a frame with sealed queen cells – taken from the other colony – is introduced into the hive.

The searching for the queen will proceed more simply and will be less dangerous, because in the hive only a small number of bees remain – most of the foragers being lost -, and only the new population is important.

Excesive swarming and saturation of zones

The excessive swarming is one of the most negative features of the African bees and their hybrids.

The Italian bees in the subtropical zone in Brazil are swarming very little, only very often more than 1% annually, usually in April and May, at the beginning of the season, concomitantly with the first flourishing plants. After the invasion of Africans and with the existence of hybrids, swarming takes place all the year round.

Small and large swarms are seen almost every day. In the large swarms, including several smaller swarms joined during flight, often several queens get along in harmony, which never occurs in other bee races. Such large swarms with several queens may divide themselves any time, into as many individual swarms as queens exist. One may often come across very small swarms – a queen and only a handful of bees – which settle themselves close to a hive and stay there for several days, after which they enter the populated hive and replace the queen; because as a rule the African queens are more vigorous than the Italian and Caucasian ones, they are almost always the vainquisher.

Their excessive swarming and dividing impulse is a logical consequence of the oversaturation with bees in forest zones or in places where favourable nesting conditions exist. As every apicultural zone has a limited food potential, the holding apiaries produce lower crops because of the competing colonies established within the foraging radius of the holding apiaries. These wild colonies can and must be destroyed by all means, but usually it is difficult to find them. The colonies must be destroyed by burning them out or by starving them – by blocking hive entrances; it is not advisable to poison them, because the bees of the colonies in the apiary, which could be attracted there by honey flavour could also die.

The oversaturation in forest zones is quite worring. The production in holding apiaries will decline because of the competition in foraging nectar; may be, this phenomenon does not occur everywhere because of special reasons, but the tropical and subtropical forest zone in Bolivia is already overcrowded by African bees.

The average yields of the Italian colonies before the invasion of African bees stood at 50-60 kg per colony, and in some years even more. At present, the yields of African colonies stand at only half.

Worth mentioning is also the fact that the colonies with pure Italian or Caucasian queens produce even lower crops, which means that they can not compete in nectar collection with the African colonies which are more active, start foraging half an hour earlier than the Italian ones, and end one hour later, and work at lower temperatures. This makes us to keep pure colonies of other races only for obtaining hybrid queens which at least are more easily manageable than the Africans.

Behaviour of African swarms

In general, it is more difficult to keep African bees in boxes than Italians; they are more prone to leaving the boxes in which they are put after being caught; the African bees are more aggressive in the swarm boxes. But these swarms have also a marked propensity to settle in boxes with wax waste; in one

year we used more than 20 swarms which had settled themselves in boxes in empty hives; as these swarms are very eager to forage, frames with foundation must be supplied to them immediately.

One should take advantage of their behaviour in this respect and leave in all apiaries several such empty boxes in order to catch the swarms; one or two refuse combs could be left in the boxes, as wax odour attracts them even more. The swarms of African bees which settle themselves in combs infested with wax moth destroy it completely.