

PRELIMINARY INVESTIGATION ON THE DISTRIBUTION OF AFRICANIZED HONEY BEES IN ARGENTINA

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SUMMARY

The preliminary results of a survey for Africanized honey bees conducted in 17 provinces of Argentina from January, 1983, to May, 1984, are presented. About 1300 colonies in 120 apiaries were sampled and evaluated with the defensive behavior test. Roadside samples and bees from feral colonies were collected at 392 sites. Morphometric analyses were used to determine the taxonomic status of the collected honey bee samples. Africanized honey bees were collected for the first time in Mendoza and at an altitude of 2000 m near Rodeo, San Juan. Additionally, Africanized honey bees were found in the province of Rio Negro (39°S), the southernmost location ever reported.

INTRODUCTION

The introduction of *Apis mellifera adansonii*, into Brazil in 1956 is well documented (KERR, 1967, 1969 ; GONCALVES, 1974 ; MICHENER, 1975 ; DIETZ, 1982). Recently, RUTTNER (1981) reported that the introduced bee was *A. m. scutellata*. In many popular publications this insect has been referred to as the Brazilian or killer bee. This misnomer was corrected by GONCALVES (1974, 1982) who recommended the term Africanized for the hybrid of imported African and European bees. The subsequent spread of Africanized bees into Argentina has not been clearly established. KEMPFER MERCADO (1973) reported an annual westward migration rate of 150 km to Paraguay and Bolivia and the same rate for the southward movement. According to his estimate, Africanized bees reached the Santa Cruz district of Bolivia in 1968 after an invasion of Paraguay in 1964-1965. The occurrence of Africanized bees in northern Argentina (Misiones) during, or shortly prior to, this period is highly probable.

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The distribution map presented by De SANTIS and CORNEJO (1968) shows the presence of Africanized bees in Formosa, Misiones and Corrientes in 1968. Africanized honey bees reached the northern border of Misiones in 1965 and by 1966 occupied about half of this province (De SANTIS and CORNEJO, 1968 ; TAYLOR, 1977). Additional provinces (Formosa, Corrientes) were invaded in 1967 and probably most of Chaco and the northern part of Santiago del Estero and Santa Fe by 1968. The southward spread of Africanized bees, is illustrated by GONCALVES (1974) and TAYLOR (1977). The arrival of Africanized bees in the region of Cordoba by 1970 (KERR *et al.*, 1982) is an indication that the bees migrated at a faster rate than the 120 km or 150 km reported respectively by TAYLOR (1977) and KEMPF MERCADO (1973).

KERR *et al.*, (1982) reported that from the 30th to almost the 33rd parallel there is a resistance to the invasion of Africanized bees because of not only the cool and humid Argentine Pampas, but also due to the presence of a well developed beekeeping industry. They estimate that the honey bee population consists of about 30 percent aggressive colonies and 70 percent gentle, mostly Italian bees in this area. It has been suggested (KERR *et al.*, 1982) that the inability of Africanized bees to become permanently established in areas south of the 33rd parallel is due to changes in ecological conditions. Consequently, the natural limit of the Africanized bee in Argentina has been placed between the 33°S and 34°S between the provinces of Entre Rios, Santa Fe, Cordoba and San Luis (KERR *et al.*, 1982). These authors have also suggested that the appearance of Africanized bees south of this area are due to the commercial movement of bees and queens and not the result of natural swarming.

The distribution of Africanized honey bees in Argentina has not been studied in detail ; nevertheless, environmental conditions appear to limit the southern spread of these bees. The identification of the conditions that limit honey bee colonization could be of considerable importance, not only to the U.S. beekeeping industry, but also to the general public.

The purpose of this investigation was to determine the distribution of Africanized bees in Argentina and to identify the transition zone of Africanization along a north-south gradient.

MATERIALS AND METHODS

The survey in Argentina was begun in January, 1983. During the next 5 month period, we tested the defensive behavior of a total of 600 colonies in 50 apiaries located in the following 9 provinces : Buenos Aires, Cordoba, Entre Rios, Formosa, Mendoza, Santa Fe, San Juan,

Santiago del Estero and Tucuman. 570 honey bee samples were collected from these apiaries for supportive morphometric analysis. The second year survey was completed during the period of November, 1983, to May, 1984, and included an additional six provinces (Catamarca, La Rioja, La Pampa, Neuquen, Rio Negro and San Luis). During this period over 700 colonies were sampled and tested in about 70 apiaries. In addition, 392 roadside samples and bees from feral colonies were collected when possible every 50 km in the provinces of Chaco, Salta, Tucuman, Catamarca, La Rioja, San Juan, Mendoza, La Pampa and Rio Negro. Isolated collections of bees were also made in the provinces of Santiago del Estero, Entre Rios, Santa Fe, Cordoba, and Buenos Aires.

The field test of honey bee colony defensive behavior (COLLINS and KUBASEK, 1982; COLLINS *et al.*, 1982) was used to quantify aggressiveness in our distribution study. This field test consists of the following three types of stimuli (chemical, physical and visual-tactual) which are successively presented to the test colonies : a) a synthetic pheromone, b) a marble shot at the colony and c) two mechanically jiggled red suede targets (5 by 5 cm). The presentation of each stimulus in a 30 second time interval sequence elicits four steps of defensive behavior : alerting, activating, attracting, and stinging. All observations were recorded and are presently being analyzed. Each colony was also inspected for parasites and diseases, their population of brood and bees estimated, and a sample of 30 to 60 honey bees from brood combs collected for morphometric analysis. Dr. H. V. DALY, University of California, Berkeley, California identified morphometrically 40 samples of honey bees collected from colonies in the first year of the survey (see DALY and BALLING, 1978). The morphometric analysis of all other samples of field tested colonies were performed at the U.S.D.A. Bee Breeding and Stock Center Laboratory, Baton Rouge, Louisiana.

RESULTS AND DISCUSSION

The analysis of the data is incomplete, but based on some selected sampling and limited morphometric analysis, we found feral Africanized bees and managed colonies in the anticipated transition zone of Africanization between the 32° and 34° latitudes south of the equator. Surprisingly, we also collected a sample composed of 60 % Africanized and 40 % European bees in a colony near Cinco Saltos, Rio Negro. To our knowledge, the findings of Africanized bees near the 39°S is the most southern location ever recorded. The results presented in Fig. 1 represent roughly 6 % of the total collected samples. We have also recorded for the first time the occurrence of Africanized bees in Mendoza and near Rodeo, San Juan.

During our survey, we encountered highly aggressive colonies of bees in the southern part of the province of Buenos Aires (see Figure 1 and Table 1). However, morphometric analysis indicates that these bees are clearly European even though they were as aggressive as the most aggressive Africanized bees encountered in Formosa and other areas. While the defensive behavior test is an excellent method of field identification of aggressive honey bee colonies, it must be supported by morphometric analysis for definitive taxonomic determinations.

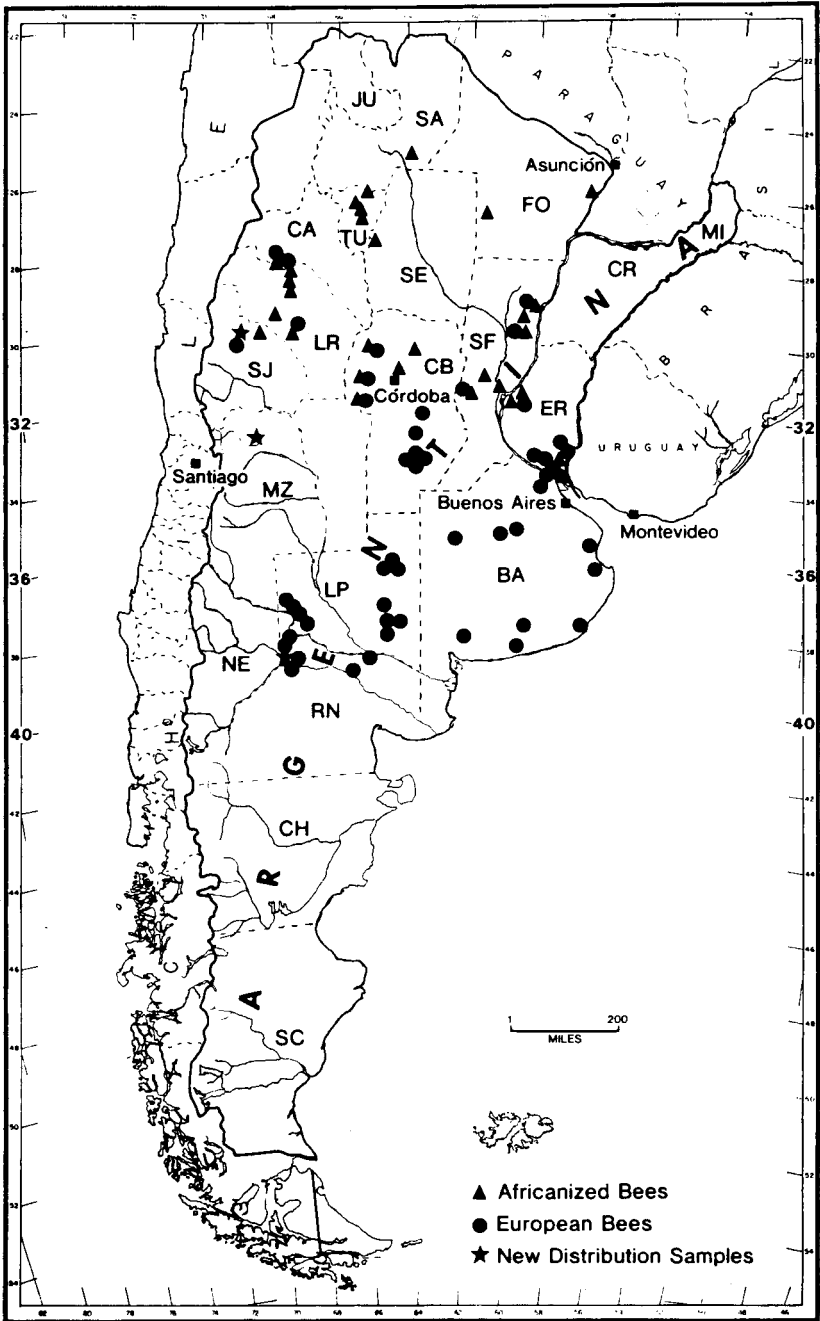


FIG. 1. — Preliminary survey of Africanized honey bees in Argentina

TABLE 1. — Summary of field tested colonies and morphometrically analyzed honey bee samples collected in 17 provinces of Argentina (1983 and 1984)

Provinces		No. of Collections			Classification		
		Apiaries	Colonies	Feral & Roadside	Total No.	Africanized	European
BA	Buenos Aires	19	211	72	21	0	21
CA	Catamarca	4	24	12	3	2	1
CH	Chaco	0	0	5	1	1	0
CB	Cordoba	17	188	114	13	4	9
ER	Entre Rios	11	128	3	14	5	9
FO	Formosa	4	39	0	1	1	0
LP	La Pampa	9	92	8	12	0	12
LR	La Rioja	2	18	3	6	5	1
MZ	Mendoza	10	112	17	1	1	0
NE	Neuquen	2	22	0	0	0	0
RN	Rio Negro	5	49	5	8	1	7
SA	Salta	0	0	2	1	1	0
SJ	San Juan	10	119	21	3	2	1
SL	San Luis	5	54	0	0	0	0
SF	Santa Fe	15	168	124	10	6	4
SE	Santiago del Estero	1	11	1	1	1	0
TU	Tucuman	6	65	5	5	4	1
		120	1 300	392	100	34	66

Based on our evaluation of the available temperature data, it appears that climatic factors alone are not the only reason for limiting the range and distribution of Africanized bees (Fig. 2). The samples collected in Mendoza, Rio Negro and San Juan in riparian forest support this contention. Lack of adequate nesting sites, shortage of water and limited food sources in large areas in San Juan, Mendoza, and San Luis may be just as critical as weather conditions. Although the limiting factors are unknown, it is possible that some small populations of Africanized bees could maintain themselves near riparian habitats and irrigated agricultural areas and thus extend their range. Even though we found Africanized and European honey bees at an altitude of about 2000 m (Rodeo, San Juan), they were no longer present at a nearby valley separated by 20 or 30 km of desert and 500 m of altitude. SMITH (1961, 1973), however, collected *A. m. adansonii* from the sea level on the coast up to 3 500 m in Ethiopia. Since the identity of many of our collected bees is presently unknown, a detailed description of the factors limiting the range of Africanized bees awaits the complete analysis of our honey bee samples.

At the start of our investigation, a transitional zone of mixed European and Africanized bee populations was expected along the southern limit of Africanization

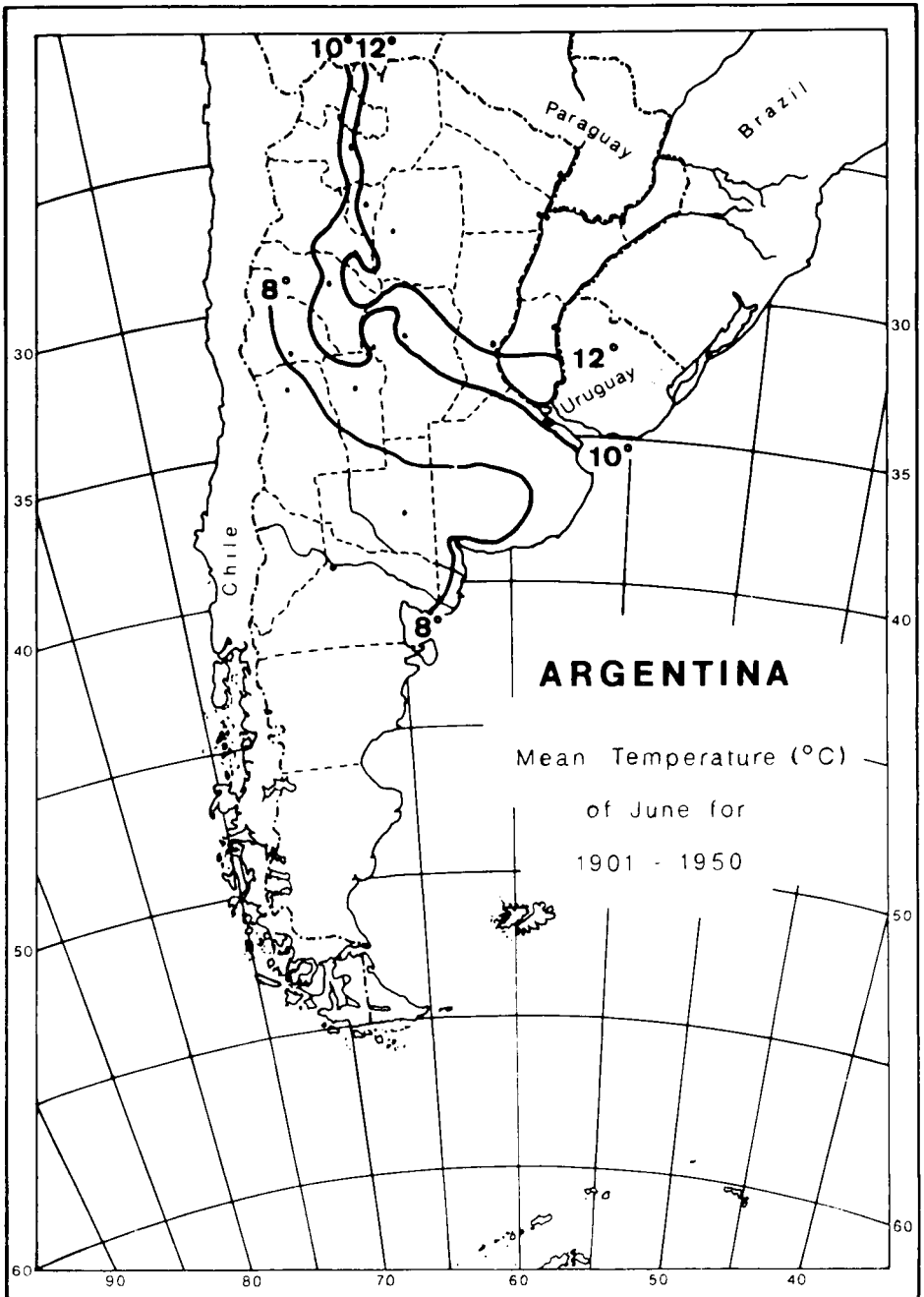


FIG. 2. — Mean temperature for June 1901-1950 (Similar mean temperature for July)

(32°S to 34°S) according to KERR *et al.* (1982) and TAYLOR (1977). Recently, TAYLOR and SPIVAK (1984) reported more extensively on the predicted distribution of Africanized bees in Argentina and the prospective limits of their distribution in the U.S. Because of the small number of morphometrically analyzed samples presently available, but the surprising finding of Africanized bees near the 39°S in Rio Negro, in Mendoza and near Rodeo, San Juan, a revision of the previously suggested distribution of Africanized bees for Argentina and the U.S. may be necessary. The results of our recently completed study on overwintering (KRELL *et al.*, 1985), and additional studies still in progress, should shed more light on the factors limiting the distribution of Africanized bees in Argentina.

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RÉSUMÉ

RECHERCHES PRÉLIMINAIRES SUR LA RÉPARTITION GÉOGRAPHIQUE DES ABEILLES AFRICANISÉES EN ARGENTINE

On rappelle brièvement la route d'invasion des abeilles africanisées vers l'Argentine. On présente les résultats préliminaires d'une étude d'ensemble menée dans 17 provinces d'Argentine, de janvier 1983 à mai 1984. On a évalué, avec le test mis au point par COLLINS et KUBASEK (1982), le comportement de défense de 1 300 colonies réparties dans 120 ruchers. Pour chaque colonie on

a également recherché les parasites et les maladies, estimé la surface de couvain et la population d'abeilles et prélevé sur les rayons de couvain un échantillon de 30 à 60 abeilles pour analyse morphométrique. De plus, on a récolté, dans la mesure du possible tous les 50 km dans 9 provinces, des échantillons sur le bord des routes et des abeilles provenant de colonies sauvages (Tabl. 1). Environ 6 % de tous les échantillons pris soit dans les colonies testées, soit sur le bord des routes, ont été identifiés du point de vue morphométrique. Le tableau 1 et la figure 1 donnent leur répartition géographique ainsi que celle de tous les échantillons non identifiés.

D'après notre évaluation des chiffres de température disponibles, il semble que les facteurs climatiques seuls ne constituent pas l'unique cause de limitation de l'extension et de la répartition géographique des abeilles africanisées (Fig. 2).

On a trouvé pour la première fois des abeilles africanisées en Mendoza, à l'altitude d'environ 2 000 m, près de Rodeo, San Juan. On a également récolté un échantillon composé de 60 % d'abeilles africanisées et de 40 % d'européennes dans une colonie près de Cinco Saltos, Rio Negro. La présence d'abeilles africanisées à la latitude proche de 39°S est à notre connaissance la plus méridionale connue.

Au début de notre recherche, on s'attendait à trouver une zone transitoire de populations européennes et africanisées mélangées le long de la limite sud de l'africanisation (32°S à 34°S), d'après les rapports des autres chercheurs.

En raison de la surprenante découverte d'abeilles africanisées aux alentours du 39° degré de latitude sud dans le Rio Negro, le Mendoza et près de Rodeo, San Juan, il pourrait être nécessaire de réviser la distribution, admise jusqu'à présent, des abeilles africanisées en Argentine et aux Etats-Unis, en dépit du petit nombre d'échantillons actuellement analysés.

ZUSAMMENFASSUNG

VORLÄUFIGE ERGEBNISSE EINER UNTERSUCHUNG DER VERBREITUNG AFRIKANISierter HONIGBIENEN IN ARGENTINIEN

Die Einwanderungswege der Afrikanisierten Bienen nach Argentinien werden kurz beschrieben. Dazu werden die vorläufigen Resultate einer Überprüfung vorgelegt, die zwischen Januar 1983 bis Mai 1984 in 17 Provinzen Argentiniens durchgeführt wurden. Insgesamt wurden auf 120 Bienenständen 1 300 Bienenvölker mit dem Test auf Verteidigungsverhalten nach COLLINS und KUBASEK (1982) geprüft. Jedes Volk wurde auch auf Parasiten und Krankheiten untersucht. Volksstärke und Brutumfang wurden geschätzt und es wurden Proben von 30-60 Bienen von Brutwaben für die morphometrische Untersuchung entnommen. Zusätzlich wurden noch 392 Proben von Bienenvölkern entlang der Straße und von wildlebenden Völkern aus 9 Provinzen Argentiniens gesammelt, wenn möglich in Abständen von 50 km (Tab. 1). Ungefähr 6 % der im Feldtest geprüften oder entlang der Straße gesammelten Proben wurden morphometrisch identifiziert. Ihre geographische Verteilung und die aller noch nicht bestimmten Proben sind in Tab. 1 und Abb. 1 eingezeichnet.

Nach unserer Auswertung der verfügbaren Temperaturdaten hat es den Anschein, daß klimatische Faktoren allein nicht der einzige Grund für die Begrenzung des Verbreitungsgebietes und der Verteilung der Afrikanisierten Bienen sind (Abb. 2).

Zum ersten Mal wurden Afrikanisierte Bienen in Mendoza und in einer Höhe von ungefähr 2 000 m bei Rodeo, San Juan, gefunden. Ferner sammelten wir eine Probe mit 60 % Afrikanisierten und 40 % europäischen Bienen aus einem Volk nahe Cinco Saltos, Rio Negro. Unseres Wissens nach ist diese Fundstelle von Afrikanisierten Bienen nahe dem 39. Breitengrad S die südlichste Fundstelle, die bisher bekannt wurde.

Bei Beginn unserer Arbeiten wurde nach den Berichten anderer Untersucher eine Übergangszone von gemischten europäischen und Afrikanisierten Bienenpopulationen entlang der Südgrenze der

Afrikanisierung (32°-34°S) erwartet. Auf Grund der überraschenden Funde Afrikanisierter Bienen in der Nähe des 39. Breitengrades in Rio Negro, in Mendoza und bei Rodeo, San Juan, könnte trotz der kleinen Zahl der bis heute untersuchten Proben eine Revision der früher angenommenen Verbreitungsmöglichkeit Afrikanisierter Bienen in Argentinien und in den USA nötig werden.

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