

RESEARCH ARTICLE

Agrarian measures in the kingdom of Granada before and after the Castilian conquest: the lands of the Alpujarra

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Abstract

The aim of this article is to broaden our knowledge of the metrological system of the Morisco period in the kingdom of Granada and, more specifically, in the rural area of the Alpujarra. The sources used in the analysis are two inventories of ecclesiastical goods from Islamic origin, drawn up in 1527 and 1530, four decades after the culmination of the Christian conquest of al-Andalus. The article explores the agrarian units of measurement used by the Morisco community of the Alpujarra in their daily lives (measures of surface area and length, weight or mass, volume or capacity, and of water used for irrigation). As far as possible, equivalences are presented for the units discussed. Attempts are made to establish whether these measures were inherited from the Andalusí period or whether, on the contrary, they were the result of the implementation of Castilian legislation on the matter. The data gathered have revealed the existence of a hybrid measurement system, which shows that the ordinances to modify the system of weights and measures of the Muslims and to seek a correspondence with the Castilian system had little effect in the Alpujarra, where, in many cases, the Islamic system of measurement continued in use. This circumstance indicates that the changes and transformations in the daily life of this rural community after the Christian conquest were not as imminent as might have been expected.

Introduction

The issue of metrology is one of the most complex fields of science. The current bibliography contains hardly any researches focusing on the analysis of measurements in the kingdom of Granada during the period of transition between the end of the Middle Ages and the beginning of the Modern Era. This was a time characterised by great complexity as a result of the culmination of the conquest of al-Andalus by the Catholic Monarchs in 1492 and the subsequent conversion to Christianity of the Granadan Moriscos in 1501.¹ It should be pointed out that, after the fall of the Nasrid kingdom of Granada, the last Islamic stronghold in the Iberian Peninsula, the Muslims largely continued with their way of life, but the status quo was soon disrupted: they then faced the dilemma of conversion or exile. The baptism in the Christian faith of the majority of the Muslim population marked the beginning of the Morisco period.²

It was in this historical context that the kingdom of Granada underwent thorough political, social, economic, linguistic, religious and cultural changes. These transformations even affected agricultural management and, consequently, the field of measurement. This article will focus on analysing the metrological system of the Moriscos in the Alpujarra, a rural area located south of the city of Granada,³ in order to elucidate whether this system represented a rupture or a continuity with past practices. To date, particularly scarce are studies dealing with weights and measures in this region; the only works available are the article by Manuel Espinar Moreno published almost four decades

ago,⁴ and a recent contribution by the author of the present study, which reviewed and updated some information on the issue from the data recorded in a book of ecclesiastical *habices*.⁵

The books of ecclesiastical *habices* are inventories or cadastres written in the Castilian language and containing exhaustive accounts of the pious endowments (*habices*)⁶ assigned to the old Islamic places of worship. After the conversion of the Moriscos, these assets were seized and transferred to Christian churches. In order for all these possessions to be properly registered, the Christian authorities commissioned officials to go to the localities in which these properties existed and to write down all the information they could gather about them. With the collaboration of the locals, the Castilian scribes listed and described in detail the various types of real estate (both urban and rural). In the case of rural assets, these descriptions included information on the surface area covered and the agricultural produce, as well as water resources and irrigation schedules.⁷ Written on the confluence of two eras, these documentary sources allow us insights into the Islamic past and its legacy in the area that concerns us here, that is, the traces of Nasrid Granada in the field of metrology, due to the presence of quite a few Arabisms.⁸ They also shed light on the use made by the Alpujarran Moriscos of Castilian weights and measures in their daily lives. In a broader sense, another merit of these documents is to reflect the changing nature of this rural society and to note the pace at which these changes are taking place.

My first analysis of part of this documentary material took as its starting point the book of *habices* of the Alpujarran *tahas* or districts⁹ of Ugijar and Andarax written in 1530. That work not only revealed the existence of units of measurement that had not previously come to light, but also highlighted several hitherto unpublished equivalents, and drew attention to the value of the data preserved in the documentation of *habices* to the study of metrology. In this regard, the objective of the present study is to further deepen our knowledge of the metrological system of the Morisco era in the kingdom of Granada in general, and in the Alpujarra in particular. For this reason, I propose to extend the geographical framework of the research to the districts of Poqueira, Ferreira, and Jubiles via an analysis of the earlier book of *habices* referring to the Alpujarra, dating from 1527. The results of my previous study will be incorporated into this new work, since the comparison and contrast of the two manuscripts will shed light on the differences and similarities between the different *tahas* and will help to offer as complete a vision of the subject as possible.¹⁰

In this context, the books of *habices* of 1527 and 1530 provide abundant information on measures related to agricultural activity: surface areas or lengths of plots of land, weight or volume relative to arboricultural produce, as well as irrigation. By examining the data in these sources on the measurements in use in five districts in the Alpujarra, it will be possible to determine the extent to which Castilian legislation on this subject had been implemented at that time. It must be borne in mind that, after the conquest of Granada, the Catholic Monarchs tried to modify the system of weights and measures used by the Muslims, seeking a correspondence with the Castilian system as a way to avoid fraud and to facilitate commercial transactions between the two communities or between neighbouring regions. Indeed, from the thirteenth century onwards, successive monarchs issued decrees on the standardisation of weights and measures throughout the territory under their rule.¹¹ It can be assumed that the different decrees enacted in this regard in other areas of the Crown of Castile with an Islamic past were not very successful, but this aspect should be studied in depth. It would also be interesting to extrapolate this analysis to other Iberian Christian kingdoms that had remained under Islamic rule, such as the Crown of Aragon. As we will see below, the study of the field of metrology in geographical-temporal coordinates of thorough historical transformations is relevant for the clues it can give us about broader trends in the socio-economic sphere. It should therefore also be taken into account by specialists of other late medieval or early modern contexts beyond the Iberian framework.

Before starting the analysis, it should be noted that the same measurement might be expressed in different units; similarly, a certain measure may not present an exact equivalence in all places of the kingdom of Granada, but may have a regional or even a local value. This is due to the fact that

the units of measurement were adapted to the characteristics of each geographical area; hence, attempting to establish the metrology is often a fruitless task. One must take into consideration that all the units discussed here have been contrasted and verified as far as possible, although in some cases the variations within the same unit are so great from one area to another (or from one era to another) that the value indicated should be regarded as orientative rather than absolute. Finally, one must mention that in this work the original metrological terms are always provided as recorded in the books of *habices*; in the specific case of Arabisms, the Arabic word from which each term originates is also indicated.

Agrarian measures of surface area and length

The books of *habices* of 1527 and 1530 provide an insight into the organisation of the productive activities in the Alpujarran districts of Poqueira, Ferreira, Jubiles, Ugíjar and Andarax, where agriculture was the foundation of the economy. Despite the existence of dryland farming, most of the agricultural activity was based on horticulture and arboriculture, and depended on irrigation; it is in this field where much of the metrological terminology is found. Among other things, these inventories frequently collect information on the extension of the farmlands corresponding to ecclesiastical *habices*. There are six measures that refer to the surface area of plots of land: *marjal* (from the Arabic *marġa* ‘agricultural measure’); *fanega* (from the Arabic *faniqa* ‘sack for carrying earth or another substance’); *arroba* (from the Arabic *al-rub* ‘quarter part’); *celemín* (from the Arabic *tumn* ‘eighth part’); *cuartilla* and *barchilla* (or its variant *barchila*). The first four are words of Arabic origin, so there is no doubt that they had been in common use in al-Andalus for measuring area.¹²

Although it was usual for these lands to be measured in units of area, in some cases Castilian measurements of length, that is, feet and paces, are documented in the five *tahas*, when the plots had an elongated shape. In farmland, the length and width of the plots are usually provided; on occasions, the highest and the lowest point also appear in areas with a marked slope. Very rarely, both the area and the length are recorded in a hybrid form.

Agrarian measures of area

Irrigated land

These inventories of *habices* express the measurement of irrigated lands in *marjales*, except for a couple of references to the *barchilla* in the village of Laujar (*taha* of Andarax)¹³ and one to the *fanega* in the locality of Atalbéitar (*taha* de Ferreira).¹⁴ The *marjal* was generally equivalent to 525 sq m, although in the district of Ugíjar it corresponded to 436 sq m.¹⁵ The *barchilla* was equal to half a *cuartilla*, that is, 200 sq m.¹⁶ As for the *fanega*, the reference to its use in irrigated land is surprising, since it was a characteristic measure of dryland, as we shall see below.

Dryland

Indeed, the *fanega* was employed above all to measure the extent of land devoted to dryland farming. In the districts of Jubiles and Andarax it was the most frequently used unit of area to refer to unirrigated land. In all cases, it is defined as the surface of land necessary to sow a *fanega* of grain. In general, in the kingdom of Granada the *fanega* was equivalent to 4,697 sq m,¹⁷ although in Ugíjar it corresponded to 3,972 sq m¹⁸ and in Andarax to 3,300 sq m.¹⁹ In the *tahas* of Ferreira and Ugíjar, the *marjal* is the most frequent measurement of area in plots of dryland.²⁰ Another surface measure used in dryland, specifically in the districts of Jubiles, Ugíjar and Andarax, was the *celemín*, which represented one-twelfth of a *fanega*; in this case it is the land corresponding to the sowing of a *celemín* of grain.²¹

The *arroba* and the *cuartilla* appear only very rarely. The sole reference to the latter is found in the village of *Sopron* (*taha* of Ugíjar); curiously, its equivalence is given in *celemines*, as it is stated that one *cuartilla* is equal to four *celemines*.²² The *arroba* is recorded in the localities of *Anqueyra*, *Nechite* and *Escariantes* (*taha* of Ugíjar) and in *Yniça* and *Paterna* (*taha* of Andarax). We know that this measurement refers to the area of land where an *arroba* of grain is sown, but we ignore the exact equivalence of the *arroba* in this context.²³ In the district of Poqueira, there is evidence that dryland agriculture was practised, but it is not documented in the farmland linked to the ecclesiastical *habices*.

Agrarian measures of length

The foot is an anthropometric measure of length, which has been employed by all cultures, and which over time has become a standard measurement.²⁴ In both books of *habices*, the foot is almost always documented in urban settings, but on occasion it also appears used to measure farmland – and even rocks – in the villages of Pampaneira (*taha* of Poqueira), Fondales, Mecina (*taha* of Ferreira), Jubiles and Notáz (*taha* of Jubiles).²⁵ It was not employed in the districts of Ugíjar or Andarax. In general, the foot has an approximate equivalence of 0.2786 metres.²⁶

Longitudinal measurements are rarely presented in paces. The pace is another anthropometric measurement obtained with the successive movement of both feet when walking. The ordinary pace is the distance between the heel of one foot and the toe of the other when making a step, while the geometric pace is the distance of a full stride from the position of one foot to its position where it sets down again at the end of the step. In the case that concerns us here, it is not specified whether the ordinary pace is used, which measures 0.69 metres – equivalent to two and a half feet – or whether, on the contrary, it is the geometric pace, which is twice as long.²⁷ The only reference in which a property is measured in paces refers to an orchard in the village of Bubión (*taha* of Poqueira).²⁸ The pace was also employed to mark distances; the only case recorded here appears in the book of *habices* of 1527, where it is used to measure the distance between two mulberry trees in the locality of Pampaneira (*taha* of Poqueira).²⁹

Agrarian measures of weight and volume

The information registered in the books of the Alpujarran *habices* of 1527 and 1530 shows that both the irrigated and rainfed farmland in the districts of Poqueira, Ferreira, Jubiles, Ugíjar and Andarax contained large numbers of trees, especially the irrigated areas. The trees and plants common to the five districts were mulberry trees, chestnut trees, fig trees, hackberry trees, cherry trees and grapevines, while olive trees, holm oaks, poplars, pomegranate trees, ash trees, plum trees, pear trees, wild olive trees, rowan trees, apple trees, apricot trees, oleanders, almond trees, willows, tarays, walnut trees, carob trees and brambles are also documented in some *tahas*. Among this wide range of species, mulberry trees were the most abundant; their links to the silk industry meant that their cultivation was a profitable business for the villagers. In the book of *habices* of 1530, mulberry trees were followed in terms of numbers by olive trees and, in the inventory of 1527, by chestnut trees. The mulberry trees and the olive trees produced high yields, thus in both documentary sources their productivity is thoroughly accounted. The leaves of the mulberry tree were highly valued, since they served as food for silkworms, while olives were used mainly to produce oil and, to a lesser degree, for direct consumption; likewise, the production of olive leaves had various agricultural, culinary, medical-pharmacological and veterinary applications.³⁰ In addition to mulberry and olive trees, metrological values are also provided for the production of chestnut and walnut trees in the districts of Poqueira, Ferreira and Jubiles, due to the value of their fruit. The quantification of the agrarian production of some species is a clear evidence of the importance they continued to have in the agricultural economy of the Morisco period.³¹

In this context, both inventories of *habices* provide information of interest on measurements of weight or mass, and volume or capacity, in relation to the produce of these trees. The units used to measure weight included *arrobas*, pounds, *güeznas* and *quintales*; the volume of liquids was measured in *colas*, *arrobas*, pounds and ounces, while for solids³² the units were *fanegas*, *cadahes* and *arrobas*. As we shall see below, some of these terms, in addition to the ones already mentioned, were of Arabic origin.

Agrarian measures of weight or mass

The production of mulberry leaves was mainly measured in *arrobas*, a unit present in all the villages of the districts under study. The most common weight for the *arroba* of the mulberry leaf was 11.50 kg.³³ Very occasionally, it was measured in pounds, *güeznas* and *quintales*. The weight of the mulberry leaf in pounds (0.460095 kg)³⁴ is documented in the localities of Fondales, Mecina (*taha* of Ferreira), Notáez (*taha* of Jubiles), and Cherín and Júbar (*taha* of Ugíjar).³⁵ As for *güezna* (from the Arabic term *wazna* ‘weight’), recorded in the villages of Pampaneira (*taha* of Poqueira) and *Yniça* (*taha* of Andarax), the text itself indicates that it is equivalent to a quarter of an *arroba*.³⁶ For its part, the *quintal* (from the Arabic term *qintār* ‘containing a hundred’) was a larger unit of weight equivalent to four *arrobas* or one hundred pounds (46 kg), although its value could vary from one area to another;³⁷ in the documentation consulted, its use to measure the production of mulberry leaves is limited to the locality of Capileira (*taha* of Poqueira).³⁸

With regard to the measurement of olive leaves, three instances are only recorded in the villages of Lobras, Notáez (*taha* of Jubiles) and *Torrillas* (*taha* of Ugíjar). The measure is expressed in *arrobas*, though no data are provided on the equivalence.³⁹ It is possible that the same criteria were applied as for mulberry leaves.

The documentary sources analysed barely quantify the harvest of the numerous fruit trees that made up the Alpujarran landscape. Silence is almost always the general trend; in fact, there is only one reference to the crop of pears in the locality of Cástaras (*taha* of Jubiles), which were measured in pounds.⁴⁰ There exists another isolated mention to the production of grapes in the village of Laroles (*taha* of Ugíjar), which is referred to by the expression ‘a load of grapes’.⁴¹ It should be borne in mind that in al-Andalus the maximum unit of weight and volume had received the generic name of load (*himi*), in reference, respectively, to the weight of two or three bales, or the amount a packhorse could carry.⁴²

Agrarian measures of volume or capacity

Liquids

The book of *habices* of 1527 shows that the main unit employed to measure the oil harvest was the *arroba*; the use of pounds and *colas* (from the Arabic term *qulla*)⁴³ was much less frequent. This information refers mainly to the district of Jubiles, since in the *taha* of Poqueira the presence of olive trees is documented, although the amount of the oil yield is not; conversely, in the district of Ferreira, the existence of olive trees is not recorded, but there is a reference to the measurement of oil in *colas*.⁴⁴ The inventory of *habices* of 1530 states that in the easternmost *tahas* of Ugíjar and Andarax the oil harvested is usually measured in *colas*, and much less frequently in *arrobas*, pounds and ounces.

Thus, the *cola* is a measure of capacity for liquids, especially for oil. Its equivalence varies from place to place. This documentation indicates that the *cola* of oil in Lobras (*taha* of Jubiles) was equivalent to an *arroba* and a half,⁴⁵ while in the locality of Alcolea (*taha* of Andarax) it corresponded to an *arroba*.⁴⁶ No record exists of its value in the districts of Poqueira, Ferreira and Ugíjar. Likewise, there is evidence that an *arroba* of oil corresponded to 25 pounds, that is, to 12.56 litres, while a pound of the same liquid had a equivalence of 0.503 litres (1/25 of an *arroba*), the ounce being one-sixteenth of a pound.⁴⁷

In the inventory of *habices* of 1527, the pound of oil appears only registered in the villages of Notáez, Cástaras and Yátor (*taha* of Jubiles),⁴⁸ while the use of the *cola* is solely attested in the localities of Pitres (*taha* of Ferreira) and Lobras (*taha* of Jubiles).⁴⁹ No references are made to measuring oil in ounces. On the other hand, in the manuscript of 1530 the *arroba* of oil is only documented in some villages in the districts of Ugíjar (*Anqueyra*, Laroles, *Torrillas*, *Escariantes*) and Andarax (Alcolea, Paterna, Benecid, Fondón).⁵⁰ The localities in which the pound was used as a unit of measurement are less numerous: Cherín, *Vnqueyar*, *Sopron* and Picena (*taha* of Ugíjar) and Alcolea (*taha* of Andarax).⁵¹ The use of the ounce in this text is merely anecdotal, with only one mention in Picena in relation to the measurement of oil.⁵²

Solids⁵³

The abundance of references in relation to the production of olive oil is in stark contrast to the scarcity of information on the harvesting of olives for direct consumption. In these documentary sources, the fruit of the olive tree is measured in *cadahes* (from the Arabic term *qadah*, 'measurement of capacity for solids'),⁵⁴ *fanegas* and *arrobos*. The book of *habices* of 1527 has little to say on this matter, since it only registers a couple of mentions in the villages of Notáez and Nielez (*taha* of Jubiles); olive production was measured in *fanegas* in the former, and in *arrobos* in the latter. The *fanega* of olives had a volume equivalent to 60 kg in weight;⁵⁵ in turn, converting measurements of volume into measures of weight, an *arroba* of olives might reach a value equal to 11.502 kg.⁵⁶ In this regard, the manuscript of 1530 contains more information, since the olive yield is measured in *cadahes*, *fanegas* and, to a lesser extent, *arrobos*. The first two measurements are only found in the locality of Darrícal (*taha* of Ugíjar),⁵⁷ which was the centre of most of the production of olives for direct consumption in the area, while the *arroba* was recorded in the villages of Cherín, *El Fex* and *Torrillas* (*taha* of Ugíjar), as well as in Fondón (*taha* of Andarax).⁵⁸ The text itself reports the equivalence between *cadahes* and *fanegas* of olives in Darrícal, as on two occasions it is registered that eight *cadahes* are equal to four *fanegas*.⁵⁹

According to both books of *habices*, chestnut production was especially important in the westernmost districts of the Alpujarra: Poqueira, Ferreira and, to a lesser degree, Jubiles. In Ugíjar and Andarax, very few chestnut trees are documented, and the crop harvested is not quantified. The volume of this type of nuts is measured in *fanegas*, *cadahes* and *celemines*. The former is the most widely used; by contrast, the *cadahe* and the *celemín* are employed much less frequently, though roughly to the same extent as each other: while all the references to the *cadahe* are located in the village of Pitres (*taha* of Jubiles),⁶⁰ the *celemín* was used in the localities of Capileira (*taha* of Poqueira), Capileira, *Aylaçar*, Pórtugos (*taha* of Ferreira) and Trevélez (*taha* of Jubiles).⁶¹ The inventory of 1527 does not contain the equivalences of these three units measuring chestnuts, but it is known that, in general, a *fanega* of these types of products corresponded to 55.501 litres⁶² and a *celemín* of these crops to 4.625 litres,⁶³ so that 12 *celemines* make up a *fanega*. It may well be that the value of the *cadahe* for chestnuts was equal or similar to that of the *cadahe* for walnuts, whose exact correspondence appears elsewhere in this documentation, as we shall see below.

The walnut harvest was smaller than that of chestnuts, and was concentrated mainly in the district of Poqueira, with some isolated references in that of Jubiles; in the *tahas* of Ferreira and Andarax there are hardly any allusions to walnut trees, and none at all in Ugíjar. Like the chestnut harvest, the walnut crop is expressed mainly in *fanegas*, and also in *cadahes* and *celemines*. In fact, only one reference to the *celemín* is recorded in the village of *Alguazta* (*taha* of Poqueira)⁶⁴ and another to the *cadahe* in the locality of Capileira (*taha* of Poqueira).⁶⁵ In the latter, the correspondence mentioned between these two measures is found; thus, it appears that four *cadahes* are equal to 14 *celemines*,⁶⁶ that is, a *cadahe* of walnuts is equivalent to 3.5 *celemines*. It should be emphasised that the similarity of the process of measuring chestnuts and walnuts is reflected in the similitude of the values of their measurements.

Measures of irrigation

In the Alpujarra, water was a scarce commodity that had to be strictly regulated. Its use in irrigation in pre-conquest times had been governed by a kind of customary law, so that the practices among the Moriscos had undergone few modifications since the Islamic period. A characteristic of this irrigation system was the complexity of the distribution of water, which differed in each village; it depended on the amount of water available, the irrigated area, the characteristics of the crops, and the hydraulic infrastructure already in place.

The books of *habices* of 1527 and 1530 mention the right to water and indicate the measurements used in the irrigation of the properties linked to the ecclesiastical *habices* of the districts of Ferreira, Jubiles, Ugíjar and Andarax. Both manuscripts reveal that abundant waterways could be used freely; however, when water was scarce, it had to be regulated at local level.⁶⁷ In the district of Poqueira and in some villages in other *tahas*, there are no references to its distribution, presumably due to its abundance there; these villages include Pitres, Capileira, *Aylaçar*, Mecina (*taha* of Ferreira), Trevélez, Cástaras (*taha* of Jubiles), Picena, *Tarchelina*, Nechite, Mecina Alfahar, *Torrillas*, *Escariantes* and Darrícal (*taha* of Ugíjar).

In these documentary sources, while some measurements of irrigation refer to the volume of water used, others deal with the length of time of irrigation, or even to a combination of both of them. Measurements of Andalusí origin abound. In general, it was the length of time during which the water entered the irrigated farmland that was measured rather than the flow rate; measuring the flow of water through the river or through the irrigation canal would have been particularly difficult and would have had to rely on subjective criteria such as visual inspection.

Regarding the measurement of the volume of water, it was distributed to users by means of a wooden board with a series of apertures, which allowed the amount corresponding to each farmer to pass through.⁶⁸ The measures recorded in both inventories concern the part of the water contained in ponds or deposits, either making explicit reference to them ('half a pool of water', 'the entire font of water'), or referring to fractions of water: 1/2, 1/3, 1/4, 1/5, 1/6, 1/8, 2/3, 3/4, and so on.

In relation to the length of time of irrigation, a rotational system was used. If there were few turns, they might last all day,⁶⁹ but if there were many, they were divided into time slots that usually ran from dawn to dusk. The time limits were often dawn,⁷⁰ noon,⁷¹ early afternoon (around 3 or 4 pm)⁷² and sunset,⁷³ so they seem to have matched the times of Islamic prayers.⁷⁴ The fact that these time limits can be identified in the two books of *habices* under study suggests that this division survived, to some extent, after the Castilian conquest. However, this documentation also shows that there were other times of the day that might mark the beginning and the end of a turn, since over time the distribution of water was gradually divided still further into a quarter of an hour of water, half an hour, an hour, an hour and a quarter, an hour and a half, two hours, half a day minus a quarter, a third of half a day, and so on.

The most recurrent measure of irrigation in the book of *habices* of 1527 is the *arroba* of water, which was also the second most frequent in the inventory of 1530. In this context, the equivalence of this well-known term presents certain variations. On the one hand, some passages in the manuscript of 1530 relating to the villages of Fondón and *Yniça* (*taha* of Andarax) define the *arroba* as a quarter (understood to be a quarter of the day of irrigation).⁷⁵ However, the manuscript of 1527 is more precise, clarifying that in the locality of Mecina Bombarón (*taha* of Jubiles) the *arroba* constitutes a quarter of a quarter of the day, that is, an hour of water.⁷⁶ Likewise, a reference to the village of Júbar (*taha* of Ugíjar) specifies that four *arrobas* are equal to a whole day, from sunrise to sunset.⁷⁷ On the other hand, in the locality of Paterna (*taha* of Andarax) there exists a variant that receives the name of *arroba minmi*, a measure of time that is equivalent to 1/16 of a day.⁷⁸

In the book of *habices* of 1530, the most frequent unit of measurement of irrigation is the *çumen*, which had been the second most cited in the inventory of 1527. The exact equivalence of this measure is unknown, and several hypotheses have been proposed in relation to its meaning.

Some define it as the amount of water corresponding to an *azumbre* (from the Arabic term *al-tumn* ‘eighth part’) needed to irrigate the area of a *marjal*,⁷⁹ the *azumbre* being one eighth of an *arroba* of liquid, equivalent to 2.16 litres.⁸⁰ Others relate it to the time of irrigation, proposing an etymological link to the Arabic *tumn*.⁸¹ The manuscript of 1530 sheds light on this issue by mentioning the existence of a variant *çumenguanoz*, used only in the village of Laroles (*taha* of Ugijar) and equivalent to an hour and a half of irrigation.⁸² The fact that *çumenguanoz* is associated with a turn of irrigation is significant, since it suggests that the etymology of the term *çumen* is to be found in the Arabic word *zaman* (‘time’, ‘moment’); in turn, the variant *çumenguanoz* appears to correspond to an Arabic expression composed of three elements: *zaman wa-nusf*, whose literal translation would be ‘a time and a half’, very close to the meaning of ‘hour and a half’ that it presents in the text. If we accept this meaning for this variant, we can deduce that the *çumen* is equivalent to one hour of irrigation.⁸³

Finally, it should be noted that the book of *habices* of 1530 records other measurements of irrigation that were only employed in local contexts. Thus, the term *farha* (perhaps from the Arabic *farga* ‘emptying, measure of grain’) is attested in the village of Guarros (*taha* of Andarax), where it represents the equivalent of a day or a night of water every nine days.⁸⁴ The word *haba* or its variant *hapa* (from the Arabic *habba* ‘grain, small part of something’), equal to one hour of watering, is also registered only in a couple of references in the locality of Bayárcal (*taha* of Andarax).⁸⁵ Likewise, in a case documented in the village of Ugijar, there is evidence of a measure called *humuz*,⁸⁶ whose equivalence is not specified, although its meaning can perhaps be deduced from its probable etymological connection to the Arabic *jumus* (‘fifth part’).⁸⁷

Therefore, the survival of certain lexical terms with etymological links to Arabic suggests that the Moriscos from the Alpujarran districts of Poqueira, Ferreira, Jubiles, Ugijar and Andarax maintained, to some extent at least, the Islamic system of distribution of irrigation. Some measures of irrigation and their variants are attested in the documentation under study. Among the commonly used units of measurement, the data preserved suggest that the *arroba* was predominant in the westernmost *tahas* of Poqueira, Ferreira and Jubiles, while the *çumen* was the most frequent to the east, in Ugijar and Andarax. Curiously, the measures and variants of more restricted and local use are only documented in the districts of Ugijar and Andarax. Of course, the units of measurement of water varied widely from area to area and sometimes corresponded to quantities that only locals knew.⁸⁸

Conclusions

The books of the Alpujarran *habices* of 1527 and 1530 offer valuable clues for the reconstruction of the measurement system used by the Moriscos of the districts of Poqueira, Ferreira, Jubiles, Ugijar and Andarax, which can be broadly extrapolated to other parts of the same region and, in chronological terms, to almost the entire first half of the sixteenth century and possibly earlier. In general, both inventories provide us a glimpse of the dynamics of this rural and mountainous area, supplying a notable body of documentation on the agricultural measures employed by the Morisco community. However scarce the material studied may seem, it is more than enough to illustrate the coexistence of two measurement systems, Islamic and Castilian, in the area at this time.

In contrast to the traditional Castilian concepts of measurement (feet, paces, *cuartillas*, *barchillas*, pounds and ounces), the data extracted from these documentary sources confirms the inheritance of al-Andalus reflected in the use of other measures (*marjal*, *fanega*, *arroba*, *celemin*, *quintal*, *cola*, *cadahe*, *güezna*, *çumen*, *çumenguanoz*, *arroba minmi*, *farha*, *haba/hapa* and *humuz*). The information compiled leaves no doubt that, four decades after the Christian conquest, the Alpujarra continued to employ measurements of Islamic origin, showing that compliance with

Castilian legislation on weights and measures was only relative despite attempts by Castilian authorities to render the earlier system inoperative. On the one hand, the continuity in the use of the Islamic measurement system had an impact on the linguistic level with the preservation of Arabisms in the Castilian language. On the other hand, these documents constitute valuable testimonies of how the Islamic systems of agricultural production management survived *de facto* the Christian conquest and the subsequent imposition of new measurement systems. If we locate the data offered here in a broader context, evidence suggests that the transformations in the multiple aspects of the rural life of the Alpujarran Moriscos were not always immediate and in many cases the socio-economic structures inherited from the previous period continued. It is possible that in this particular area these changes were not as evident as they probably were in other regions of the kingdom of Granada. The reason for this survival in a region like the Alpujarra is perhaps the fact that its conquest had been negotiated rather than achieved by force of arms; therefore, the status quo was maintained, with minimal repopulation by Christian settlers, so that some traditional practices of the Morisco community endured until its definitive expulsion after the war of 1568.

In the books of *habices* many measures are expressed in different units. The study of this material makes it possible to identify the units of measurement that were the most used, while others are mentioned very rarely, perhaps due to their strongly local character. Likewise, some units bearing the same name present variations in their value, even in locations that are close to each other. The comparison of these five districts reveals a greater use of certain units of measurement in some areas than in others. Among the units used to measure the area of farmland, the *marjal* is the most frequently recorded in irrigated agriculture; the *marjal* is also the most referenced in dryland in the *tahas* of Ferreira and Ugíjar, although the *fanega* is prevalent in Jubiles and Andarax. For their part, the foot and the pace, as longitudinal agrarian measures, appear only in the manuscript of 1527. Regarding agricultural measurements of weight or mass, in all the districts under study the *arroba* is the most common for measuring mulberry leaves and the only one used to measure olive leaves. With regard to measurements of volume, the oil harvest is expressed above all in *arrobas* in the inventory of 1527 and in *colas* in the list of 1530. In the production of olives, mostly documented in the *tahas* of Ugíjar and Andarax, the *cadahe* is the most frequently used measure. In contrast, the chestnut and walnut harvests are quantified only in the districts of Poqueira, Ferreira and Jubiles, and in both cases are usually measured in *fanegas*. And as for the water used for irrigation, the most cited unit of measurement is the *arroba* in the inventory of 1527 and the *çumen* in that of 1530.

Trying to find exact modern-day equivalents for historical measurements may be frustrating. In some of the cases discussed here, the data cannot be reliably confirmed and so for the moment they are still working hypotheses. However, what the present study shows is that the documentation of *habices* is a fundamental reference point for expanding our knowledge of the agrarian measures used in the Morisco period. Nevertheless, the range of measurements used in the Alpujarra was probably even wider than the sources analysed here have suggested, and so the conclusions of this study are by no means the final word on the subject.

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Notes

1 See, for instance, Manuel Barrios Aguilera, *Granada morisca: La convivencia negada* (Granada, 2002), pp. 67–82.

2 The Moriscos were, thus, recently converted Christians, formerly subjects of the Muslim Nasrid kingdom or their near descendants.

3 The region of the Alpujarra is situated on the southern slopes of the Sierra Nevada, covering parts of the modern-day provinces of Granada and Almería. This large territory is limited by the mountain range of the same name and the Mediterranean Sea.

4 See Manuel Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras según los Libros de Habices', *Cuadernos Geográficos de la Universidad de Granada*, 11 (1981), 309–18.

5 See Ana María Carballeira Debasa, 'Nuevos datos sobre metrología morisca en el reino de Granada a partir de un manuscrito de habices alpujarreños', in Julia María Carabaza Bravo and Montserrat Benítez Fernández, eds, *Ciencias de la Naturaleza en al-Andalus. Textos y estudios X: Homenaje a Expiración García Sánchez* (Madrid, 2019), pp. 219–38.

6 In Islamic times, the *habices* (from the Arabic term *hubs*) consisted of donations made for the benefit of some pious work: support of institutions or buildings with a clearly religious vocation (mosques, cemeteries . . .), maintenance of public infrastructures (fortresses, walls, roads, bridges, fountains, springs, wells . . .) and financing of charity (aid to the poor and infirm, rescue of captives, manumission of slaves . . .). See Ana María Carballeira Debasa, *Legados píos y fundaciones familiares en al-Andalus (siglos IV/X–VI/XII)* (Madrid, 2002), pp. 67–102; Alejandro García Sanjuán, *Hasta que Dios herede la tierra: Los bienes habices en Al-Andalus (siglos X–XV)* (Huelva, 2002), pp. 169–254; Alejandro García Sanjuán, *Till God Inherits the Earth: Islamic Pious Endowments in al-Andalus (9–15th Centuries)* (Leiden, 2007), pp. 184–292.

7 Regarding the books of *habices*, see Camilo Álvarez de Morales, 'Romanced Documents, Bilingual Documents and Books of *habices*', in Petra M. Sijpesteijn, ed., *From al-Andalus to Khurasan: Documents from the Medieval Muslim World* (Leiden and Boston, MA, 2006), pp. 9–12; Ana María Carballeira Debasa and Camilo Álvarez de Morales, 'Some Remarks on the Books of *habices* and Islamic Granada', in Agostino Cilardo, ed., *Islam and Globalisation. Historical and Contemporary Perspectives: Proceedings of the 25th Congress of L'Union Européenne des Arabisants et Islamisants* (Louvain, Paris and Walpole, 2013), pp. 155–65.

8 Arabisms are words of Arabic origin.

9 In the Morisco period, the Alpujarra was divided into a series of demarcations or administrative areas created in Nasrid times, called *tahas*. The Alpujarra Alta comprised the *tahas* of Órgiva, Poqueira, Ferreira, Jubiles, Ugijar, Andarax, Lúchar, Alboloduy and Marchena, while the Alpujarra Baja comprised the *tahas* of Los Céjeles, Berja and Dalías. See Carmen Trillo San José, *La Alpujarra antes y después de la conquista castellana* (Granada, 1994), pp. 15, 132, 140, 236, 238. Each *taha* was made up of several small villages. In this study, localities that no longer exist as such today appear in italics.

10 Both manuscripts are kept in the Diocesan Historical Archive of Granada; see the catalogue made by Carmen Villanueva and Andrés Soria, 'Fuentes toponímicas granadinas: Los Libros de bienes habices', *Al-Andalus: Revista de las Escuelas de Estudios Árabes de Madrid y Granada*, 19 (1954), 460–1. They were both edited very recently: Lorenzo L. Padilla Mellado, *Libro del apeamiento de los habices del Alpujarra: Tahas de Ferreyra, Poqueyera y Jubiles, que los apeó Benito de Carrión. Año 1527* (Granada, 2019) (henceforth, *Libro de habices de 1527*); Ana María Carballeira Debasa, *Libro de los habices de la Alpujarra de 1530: Edición, estudio e índices de un manuscrito del Archivo Histórico Diocesano de Granada* (Helsinki, 2018) (henceforth, *Libro de habices de 1530*). The book of *habices* of 1527 comprises 305 folios and the book of 1530 contains 356 folios.

11 The Castilian legislation on weights and measures can be traced without interruption from Alfonso X (r. 1252–1284) to Carlos IV (r. 1788–1808). The Law of Weights and Measures of 19th July 1848 established the Decimal Metric System, although it was not fully implemented until well into the twentieth century. See José Castaño, *El libro de los pesos y medidas: Celemín, arroba, docena, haz . . . Una completa historia de los instrumentos tradicionales para medir, pesar, contar y agrupar* (Madrid, 2015), pp. 22, 29.

12 By contrast, *cuartilla* and *barchilla* are units of the Castilian metrological system.

13 See *Libro de habices de 1530*, fol. 309r.

14 See *Libro de habices de 1527*, fol. 114v.

15 On the size of the *marjal*, see Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 311; Luis Morell y Terry, *Equivalencias métricas de la provincia de Granada* (Granada, 1909), pp. 13–14.

16 Regarding the size of the *barchilla*, see Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 312; José Manuel Pérez-Prendes, 'El derecho municipal del reino de Granada (Consideraciones para su investigación)', *Revista de Historia del Derecho*, 2:1 (1978), 422.

17 See Morell y Terry, *Equivalencias métricas de la provincia de Granada*, p. 26. Espinar Moreno establishes the area of the *fanega* in the kingdom of Granada to be 6.439 sq m; see 'Medidas de peso, capacidad y otras en las Alpujarras', p. 311. This is also the area assigned to the *fanega* in Castile by Castaño, *El libro de los pesos y medidas*, p. 330.

18 On the size of the *fanega* in the district of Ugijar, see Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 311; Morell y Terry, *Equivalencias métricas de la provincia de Granada*, p. 24.

19 Concerning the size of the *fanega* in the *taha* of Andarax, see Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 311.

20 It is likely that the *marjal* occupied a smaller area in irrigated than in rainfed land. See note 14.

21 See Castaño, *El libro de los pesos y medidas*, p. 177. According to Espinar Moreno, the *celemín* covered a portion of land of some 537 sq m; see 'Medidas de peso, capacidad y otras en las Alpujarras', p. 311.

- 22 See *Libro de habices de 1530*, fol. 66v. As a unit of area, the *cuartilla*, which indicates the amount of grain required to cultivate a plot, makes up a quarter of a *fanega*, so strictly speaking it should contain three *celemines*. However, some scholars contend that in the district of Andarax the *cuartilla* was equivalent to an area of 400 sq m; see Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 312; Pérez-Prendes, 'El derecho municipal del reino de Granada', p. 422. This equivalence differs notably from the one provided by our text for the *taha* of Ugijar.
- 23 As a reference, in the north-east of the Iberian Peninsula the *arroba* was equivalent to some 1,000 sq m. See: <http://www.encyclopedia-aragonesa.com/voz.asp?voz_id=1372> [3rd November 2021].
- 24 See Castaño, *El libro de los pesos y medidas*, pp. 140, 331.
- 25 See *Libro de habices de 1530*, fols 34v, 75v, 87v, 135r, 166v.
- 26 See Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 311; Morell y Terry, *Equivalencias métricas de la provincia de Granada*, p. 38.
- 27 See Castaño, *El libro de los pesos y medidas*, pp. 142–3. According to Espinar Moreno, the pace is equivalent to 33 cm inside a real estate property, but increases to 1 m and 393 mm outside; see 'Medidas de peso, capacidad y otras en las Alpujarras', p. 310.
- 28 See *Libro de habices de 1527*, fol. 26v.
- 29 See *ibid.*, fols 20r–20v.
- 30 On the applications of the leaves of the olive tree, see Expiración García Sánchez, *Árboles y arbustos de al-Andalus* (Madrid, 2004), pp. 303–06.
- 31 Despite the changes that the Catholic Kings and then their grandson Charles I sought to impose on their new territories, it is natural that they did not want to hinder economic production, which depended heavily on agriculture; local economies continued to be productive and the Crown got the tax revenue. In many ways, the monarchs were more accommodating than might have been expected. This is evidenced by the protests that later, in 1566, the Granadan Moriscos submitted to Philip II against the measures aimed at eliminating all the customs of the New Christians (language, dress, folklore, etc.). This remarkable fact confirms that previous sovereigns had been permissive of Morisco practices, which explains why on the decades of the early sixteenth century some Arabic measurement terms were still used regularly to the economic and fiscal benefit of the kingdom. For further information on those claims set out in a memorial by the Morisco Francisco Núñez Muley, see: <<https://dbe.rah.es/biografias/43086/francisco-nunez-muley>> [10th November 2021].
- 32 The term 'solids' here refers to cereals, pulses, nuts and other small produce measured by volume rather than weight.
- 33 See Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 312. On the *arroba* as a unit of weight in al-Andalus, see Joaquín Vallvé Bermejo, 'Notas de metrología hispano-árabe. III: Pesos y monedas', *Al-Qantara: Revista de Estudios Árabes*, 5 (1984), 167.
- 34 Regarding the equivalence of the pound as a measurement of weight, see Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 313; Morell y Terry, *Equivalencias métricas de la provincia de Granada*, p. 7. In practice, the weight of the pound varied widely from place to place; see Castaño, *El libro de los pesos y medidas*, p. 259. In al-Andalus, there were two classes of pound: one comprising 12 ounces and the other 16. The one equivalent to 16 ounces became more widely adopted, as in Castile; see Vallvé Bermejo, 'Notas de metrología hispano-árabe. III', p. 167.
- 35 See *Libro de habices de 1527*, fols 79r, 80v; *Libro de habices de 1530*, fols 54r, 110v, 117r.
- 36 See *Libro de habices de 1530*, fol. 230v. Some scholars define the *güezna* as a unit of weight equivalent to half a pound; see Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 313.
- 37 See Castaño, *El libro de los pesos y medidas*, pp. 265–7. According to Vallvé, the *quintal* in Castile was equal to 42.464 grams; see 'Notas de metrología hispano-árabe. III', pp. 163, 167. Espinar Moreno does not mention this measurement in his study.
- 38 See *Libro de habices de 1527*, fols 6r, 8v.
- 39 See *ibid.*, fols 137r, 176r; *Libro de habices de 1530*, fol. 171v.
- 40 See *Libro de habices de 1527*, fol. 158v. On the equivalence of the pound, see note 33.
- 41 See *Libro de habices de 1530*, fol. 100r.
- 42 See Joaquín Vallvé Bermejo, 'Notas de metrología hispano-árabe. II', *Al-Andalus: Revista de las Escuelas de Estudios Árabes de Madrid y Granada*, 42:1 (1977), 63.
- 43 The most common containers for liquids generated a unit of measurement of the same name. *Colas* were large glazed earthenware vessels for oil; see Vallvé Bermejo, 'Notas de metrología hispano-árabe. II', pp. 61–2, as well as Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 315.
- 44 See *Libro de habices de 1527*, fol. 54v.
- 45 See *ibid.*, fol. 177r.
- 46 See *Libro de habices de 1530*, fol. 201v.
- 47 See Castaño, *El libro de los pesos y medidas*, pp. 244, 332; Morell y Terry, *Equivalencias métricas de la provincia de Granada*, pp. 7, 45, 48. Espinar Moreno states that these three units are measurements of weight, although he clarifies that the *arroba* is sometimes used to measure volume; see 'Medidas de peso, capacidad y otras en las Alpujarras', pp. 312–13. In

accordance with the royal pragmatics dictated to this effect in Castile, oil was normally weighed, although in the south of the Iberian Peninsula it was still sold by volume. Since oil was measured by weight, the *arroba*, which had began as a measure of weight, was confused with the *cántara* or pitcher, which was a measure of volume for liquids. Hence, from the fifteenth century onwards, the *arroba* was a unit of measurement of both weight and volume. See Castaño, *El libro de los pesos y medidas*, p. 264.

48 See *Libro de habices de 1527*, fols 131v, 149r, 266r.

49 See *ibid.*, fols 54v, 177r.

50 See *Libro de habices de 1530*, fols 34r, 92v, 171r, 177r, 194v, 252r, 332r.

51 See *ibid.*, fols 51v, 60v, 69v, 196r.

52 See *ibid.*, fol. 81v.

53 See note 31.

54 In al-Andalus the *cadahe* was a unit of capacity used to measure grain, equivalent to 0.12538 cubic cubits. The *qadah* was a vessel shaped like the trunk of a pyramid, with trapezoidal sides. See Vallvé Bermejo, 'Notas de metrología hispano-árabe. II', p. 95. Federico Corriente assigns it a volume of 2.062 litres; see *Diccionario árabe-español* (Barcelona, 1991), s.v. For his part, Espinar Moreno defines *cadahe* as a measure of weight; see Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 312.

55 See Morell y Terry, *Equivalencias métricas de la provincia de Granada*, p. 61. Espinar Moreno does not specify the capacity of the *fanega* for olives. In general, a *fanega* of solids corresponds to 55.50 litres; see Morell y Terry, *Equivalencias métricas de la provincia de Granada*, p. 42. On the *fanega* as a unit of capacity in al-Andalus, see Vallvé Bermejo, 'Notas de metrología hispano-árabe. II', pp. 100–06.

56 The *arroba* was not often used as a unit of volume for solids. As we have seen, although it was a unit of weight, over time it was mistakenly considered as a unit of volume. See Castaño, *El libro de los pesos y medidas*, p. 252. The equivalence indicated above can be deduced from Morell y Terry, *Equivalencias métricas de la provincia de Granada*, p. 61; Espinar Moreno does not mention this.

57 See *Libro de habices de 1530*, fols 183r, 183v.

58 See *ibid.*, fols 48r, 131v, 175r, 348r.

59 See *ibid.*, fols 187v, 189v.

60 See *Libro de habices de 1527*, fol. 53v.

61 See *ibid.*, fols 10r, 56v, 66r, 97v, 119r.

62 On the *fanega* of solids, see Castaño, *El libro de los pesos y medidas*, pp. 197–9.

63 Concerning the *celemín* of solids, see Castaño, *El libro de los pesos y medidas*, pp. 199–200.

64 See *Libro de habices de 1527*, fol. 23r.

65 See *ibid.*, fol. 5v.

66 See *ibid.*

67 In the Alpujarra in the Islamic era, the irrigation infrastructure had been created through local agreements between the residents of one or several villages; these agreements also covered the distribution of water; see Carmen Trillo San José, *Agua, tierra y hombres en al-Andalus: La dimensión agrícola del mundo nazarí* (Granada, 2004), p. 263. The sources consulted show that later, in the Christian period, the localities continued to act independently from the central power and reached agreements among themselves to determine the distribution of water; see Carballeira Debasa, 'Nuevos datos sobre metrología morisca', p. 231.

68 See Francisco Vidal Castro, 'El agua en el derecho islámico: Introducción a sus orígenes, propiedad y uso', in Tomás Quesada Quesada, ed., *El agua en la agricultura de al-Andalus* (Granada, 1995), p. 106.

69 See *Libro de habices de 1527*, fol. 229v; *Libro de habices de 1530*, fols 327r–327v.

70 See *Libro de habices de 1527*, fols 186r–186v; *Libro de habices de 1530*, fol. 235r.

71 See *Libro de habices de 1527*, fols 172v–173r; *Libro de habices de 1530*, fol. 262v.

72 See *Libro de habices de 1527*, fol. 160v; *Libro de habices de 1530*, fol. 285r.

73 See *Libro de habices de 1527*, fol. 156v; *Libro de habices de 1530*, fol. 215v.

74 Some scholars argue that in the Islamic period the call to prayer from the minaret of the mosque had served to divide the day into parts that were used to organise turns of irrigation, and so some of the turns took the name of the five prayers prescribed by Islam; see Antonio Malpica Cuello and Carmen Trillo San José, 'La hidráulica rural nazarí: Análisis de una agricultura irrigada de origen andalusí', in Carmen Trillo San José, ed., *Asentamientos rurales y territorio en el Mediterráneo Medieval* (Granada, 2002), pp. 254–5; Carmen Trillo San José, *El agua en al-Andalus* (Málaga, 2009), pp. 114–15; Carmen Trillo San José, 'El agua en el reino de Granada: herencia islámica y transformaciones castellanas', in Josep Torró and Enric Guinot, eds, *Hidráulica agraria y sociedad feudal: Prácticas, técnicas, espacios* (Valencia, 2012), pp. 261–85; Carmen Trillo San José, *Agua, tierra y hombres en al-Andalus*, pp. 282–91; Carmen Trillo San José, *Agua y paisaje en Granada: Una herencia de al-Andalus* (Granada, 2003), pp. 123–5.

75 See *Libro de habices de 1530*, fols 348v, 232v.

76 See *Libro de habices de 1527*, fol. 250r. Espinar Moreno proposes a duration of four hours for the *arroba* of water; see 'Medidas de peso, capacidad y otras en las Alpujarras', p. 315. This author reproduces a quotation from the inventory of 1530, which I have been unable to find in the manuscript.

- 77 See *Libro de habices de 1530*, fol. 116r.
- 78 See *ibid.*, fols 252r, 254r. See also Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 314.
- 79 See Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 314.
- 80 This term is located in Aragon in the twelfth century and in Murcia in the sixteenth century; see Castaño, *El libro de los pesos y medidas*, pp. 252–3.
- 81 See Juan Martínez Ruiz, 'Terminología árabe del riego en el antiguo reino de Granada (siglos XV–XVI), según los Libros de Habices', in *El agua en zonas áridas: Historia y Arqueología. Actas del I Coloquio de Historia y medio físico (Almería, 14-15-16 de diciembre de 1989)* (Almería, 1989), pp. 156–8.
- 82 See *Libro de habices de 1530*, fol. 100r.
- 83 See Carballeira Debasa, 'Nuevos datos sobre metrología morisca', p. 233.
- 84 See *Libro de habices de 1530*, fol. 218r.
- 85 See *ibid.*, fols 239v, 235r. See also Espinar Moreno, 'Medidas de peso, capacidad y otras en las Alpujarras', p. 314.
- 86 See *Libro de habices de 1530*, fol. 19v. Espinar Moreno does not mention this measurement in his study.
- 87 On these local measurements of irrigation, see Carballeira Debasa, 'Nuevos datos sobre metrología morisca', pp. 233–4.
- 88 The various official measurement regulations (from 1261 to 1801) do not mention the running water standards; this meant that the administration of water had a local character; see Castaño, *El libro de los pesos y medidas*, p. 322.