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Ethno botanical study and socio-economic role of *Anacyclus pyrethrum* L. and *Thymus zygis* subsp. gracilis (Boiss.), in the Timahdite town, province of Ifrane-Morocco

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ABSTRACT

Within the framework of the valorization of the aromatic and medicinal plants of the Moroccan flora, we were interested in Anacyclus pyrethrum Link and Thymus zygis subsp. gracilis (Boiss.), in the area of Timahdite province of Ifrane, Morocco. An ethnobotanic and socio-economic surveys were conducted, using the data sheets, in the rural district of Timahdite in May, June and July 2013 with the help of the collectors, intermediaries, cooperatives, herbalists and exporting companies in order to know the use of these two species, their distribution channels, their economic value as well as the factors of degradation caused by the local population. The results of this study showed that the two sexes, men and women are concerned with the collection of these plants whose majority are illiterates. In addition, Anacyclus pyrethrum and Thymus zygis are used for their therapeutic, industrial and cosmetic virtues. The part most used for Anacyclus pyrethrum is the root whereas for Thymus zygis it is the leaves. On the other side, the interviews made it possible to describe the commercial outlets of these two species since the collection until their exports. This study enabled us to conclude that Anacyclus pyrethrum and Thymus zygis are medicinal herbs by excellence; they are used in the Moroccan pharmacopeia for the treatment of various diseases. The weakness of the incomes, the elevated level of poverty and the prices relatively high of these two plants are the essential factors which push the bordering population to use or exploit commercially largely these species in their territory.

Keywords: Ethnobotanic Survey, socioeconomic, *Anacyclus pyrethrum*, *Thymus zygis*, Timahdite.

INTRODUCTION

Morocco has a rich and varied biodiversity made up of 4200 species, with a high rate of endemism [1], of which 800 species are indexed like aromatic plants and medicinal [2], which enables it to occupy a place privileged among the Mediterranean countries which have a medical long tradition and a traditional know-how of the use of these plants [3], Most these plants are spontaneous and rest on the natural potential, which poses a threat for the safeguarding of the natural resources. Their collection is often carried out in a not controlled and anarchistic way [4], this led to the regression of several species of which some are even considered threatened of disappearance, case of *Anacyclus pyrethrum* and *Thymus zygis* [5].

Indeed, nowadays, one witnesses a strong increase in the world demand for these two species because of the diversity of the fields of their use. The national market research through the export of these species over the ten last years affirm that exports of *Anacyclus pyrethrum* passed from 72 ton with a price 4271 million Dh during the year 2000-2001 to 108 tons with a price of 6909 million Dh during the years 2012-2013 [6],

Anacyclus pyrethrum is a species of the family of Asteraceae [7] locally named in Tamazight, Tigentest, Igentest Arabic "Aud el-attas" [8] endemic of Morocco and Algeria [9], very represented in the Middle Atlas and in particular in the area of Timahdite [10], very required for the treatment of the diseases of the liver, rheumatisms, the colds and for the paralysis [11] evils of the teeth and the problems involved in salivary secretion [12]. Moreover it has an activity aphrodisiac [11] is also used in the manufacturing of the toothpastes [13].

As for *Thymus zygis*, this is a very required species for its antibiotic and antiseptic properties [2]. In Morocco, export knew an important progression during the last decades while passing from 1038 tons during the years 2000-2001 to 2457 Tons during the year 2013 with sales in tune of 20,000 million Dh during the years 2000-2001 to 58,000 million Dh during the years 2012-2013 [6]. These species are exported in dry state like the case of *Anacyclus pyrethrum* or in the form of essential oils as the case of *Thymus zygis*.

The objective of this work consists of contributing to the valorization of *Anacyclus pyrethrum* and *Thymus zygis* in the area of Timahdite by an ethnobotanic and socio-economic investigation of the local population.

EXPERIMENTAL SECTION

1.1 Presentation of the zone of study

The rural district of Timahdite is located at center- east the Middle Atlas (33 ° 14 '13 "North 5 ° 03' 36" West) at an altitude of 1900 m and is part of Azrou, province of Ifrane. It covers superficies of 64,000 ha and is to nearly 30 km far from the town of Azrou and to 50 km far from the province of Ifrane (fig. 1) [14].

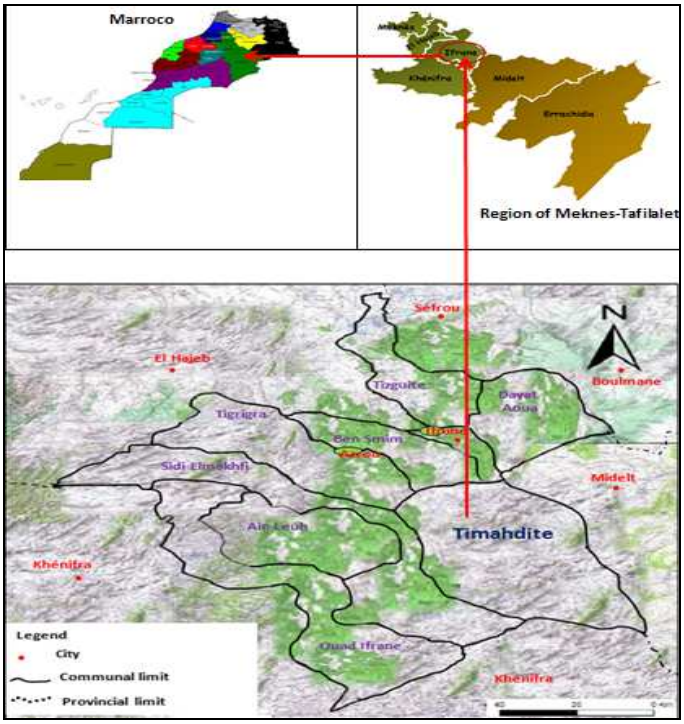

Fig. 1. Localization of the zone of study(Timahdite, Morocco)

The zone under study (Timahdite) is located in the folded part of the Middle Atlas chain [15]. According to the pedological studies carried out in the area, the grounds coming from the bed rock is rich with variations as the deep soil is richer than the rocky surface [16]. On the hydrological level, the Oued Guigou, is the main artery of the area of Timahdite in addition to this Oued there is a number of lakes and sources which are used to watering the cattle of the commune or irrigation. The area is boasting important vegetation and a forest [17]. The climate of the area is of Mediterranean. It is influenced by altitude and the continentality [14].

The area under study has a population of 10 080 inhabitant according to the census of 2004, the population density in the commune is very weak since 1982 (11 habitants/km²), until 2004 (16 habitants/km²). This weakness of settlement is due mainly to the hardness of the climate. Indeed, the activity ratio is of 57.3% for the men, whereas it is only of 7.95% for the women. Wage-earning reaches 18.6% where home helps are strongly represented with

41.2% [18]. The rate of illiteracy of the zone (61.7%) is higher than the average of the province which is of 47.7%, the female are the most suffering (74.7%) [19].

Agriculture and husbandry constitute the main activities for the population in the area under study. The arable land accounts for 20% of the total surface area [20]. The agricultural production in the area under study is dominated by cereals. The irrigated land grows fodder, fruits and arboriculture which are widely used by peasants. The average outputs of cereals are about 10 quintals /ha into rain and 16 quintals /ha irrigated. For arboriculture, the average outputs are about 1.5 T/ha for the olive-tree and 18 T/ha for the apple tree [20]. Husbandry is regarded as a second activity in terms of occupation in time after agriculture, indeed, the commune of Timahdite is very known nationally for its sheep (Timahdite race) and the quality of its meat. For the exploitation of the aromatic and medicinal plants (MAP). This sector represents an important marketing activity in the area. According to our discussions with the various actors in the commune, in general, the local population is interested enormously in its exploitation.

1.2 Preparation of the investigations

To know the various uses of *Anacyclus pyrethrum* and *Thymus zygis*, their Place in the sector of the aromatic and medicinal plants on the level of the commune of Timahdite and their distribution channels. Visits were carried out on the ground during June, July and August 2013 to collect reliable data, using 41fiches of questionnaires which were prepared and rectified: 13 collectors, 06 intermediaries, 06 cooperatives, 12 herbalists and 04 industries were surveyed. The selection of the collectors to the interviewer in each Douar was done randomly [21]. Their existence in the Douar is indicated in figure 2 above.

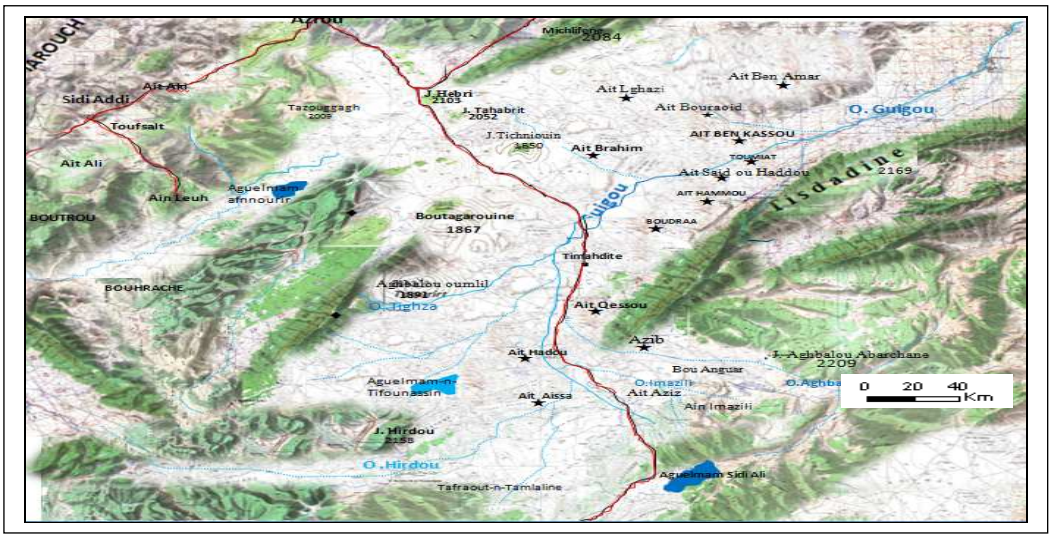

Fig. 2. Distribution of the points of ethnobotanic surveys conducted in the studied area
Source: map of Morocco (Timahdite) 1: 25000

1.3 Data processing of the investigation

Eventually, the data of the ethnobotanic and socio-economic investigations collected were registered as data then transferred in a database, were procession and analysis, statistically, using the software of Microsoft Office Excel 2010 were taking place.

RESULTS AND DISCUSSION

1.4 Data on the sex of surveyed

In this area, the gathering of these plants is practiced by the women and the men, with a high rate for the men (77%) compared to the women (23%), (Table 1 and Figure 1).

Table 1. Data on the sex of surveyed

The Sex	Frequency	Percentage
Male	10	77%
Female	03	23%
Total	13	100%

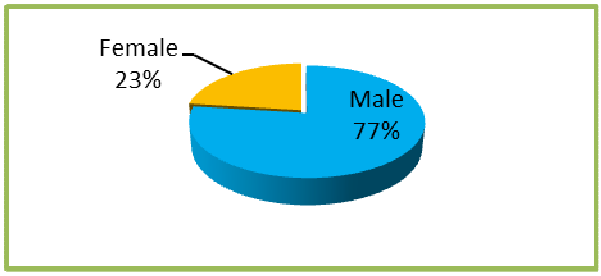

Fig. 3. Distribution according to the sex

These results confirm those of others ethnobotanic research carried out with nationally [22], but a dissimilar conclusion was also found out in other works [23, 24, 25, 26].On the ground we learned that even if the man undertake the collection of the medicinal herbs, drying, packaging and preparation of the receipts is carried out by the woman.

Table 2. Data on the academic level

	Frequency	Percentage
Illiterate	08	62%
Primary	03	23%
Secondary	02	15%
Total	13	100%

1.5 Data on the level of schooling

According to the investigations, the majority of the collectors of *Anacyclus pyrethrum* and *Thymus zygis* are illiterate with a percentage of 62%. The people who have a primary education level account for approximately 23%, and those which have a secondary level account for 15% (Table 2 and Figure 2).

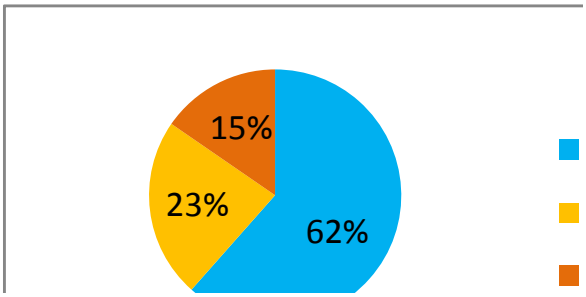

Fig. 4. Distribution according to the academic level

1.6 Data on the family situation

According to our investigation, the majority of the collectors of *Anacyclus pyrethrum* and *Thymus zygis* is made up of mainly married people (62%), widows (15%), divorced (15%) or single people 8 %.(Table 2 and Figure 2).

Table 3. Data on the marital status

	Frequency	Percentage
Married	08	62%
Single	01	08%
Widowed	02	15%
Divorcee	02	15%
Total	13	100%

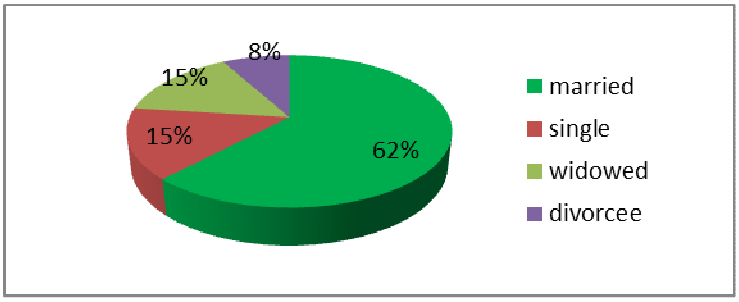

Fig. 5. Distribution according to the marital status

1.7 Therapeutic benefits of *Anacyclus pyrethrum* and *Thymus zygis*

All the surveyed herbalists confirmed that *Anacyclus pyrethrum* is a medicinal herb par excellence.

- The flowers of *Anacyclus pyrethrum* are regarded as source of natural insecticide.
- Its rhizome is also used in gargling
- The powder of the roots is used in several treatments against the diseases of liver, rheumatisms, colds and paralysis.
- The root is used as a drinkable infusion, by the women, for warming, and for boosting the fertility.
- The sheets mixed with the henna are used for the treatment and the care of the hair.
- The root of *Anacyclus pyrethrum* purifies blood, fights anemia thanks to its wealth of B12 vitamin and Iron, invigorating and helps with sight.
- *Anacyclus pyrethrum* fight also against the digestive disorders, cholesterol and the mucosities.
- The plant is also used in the industrial field for the preparation of the bio pesticides.

The various therapeutic virtues reported by the surveyed herbalists are presented in figure 6.

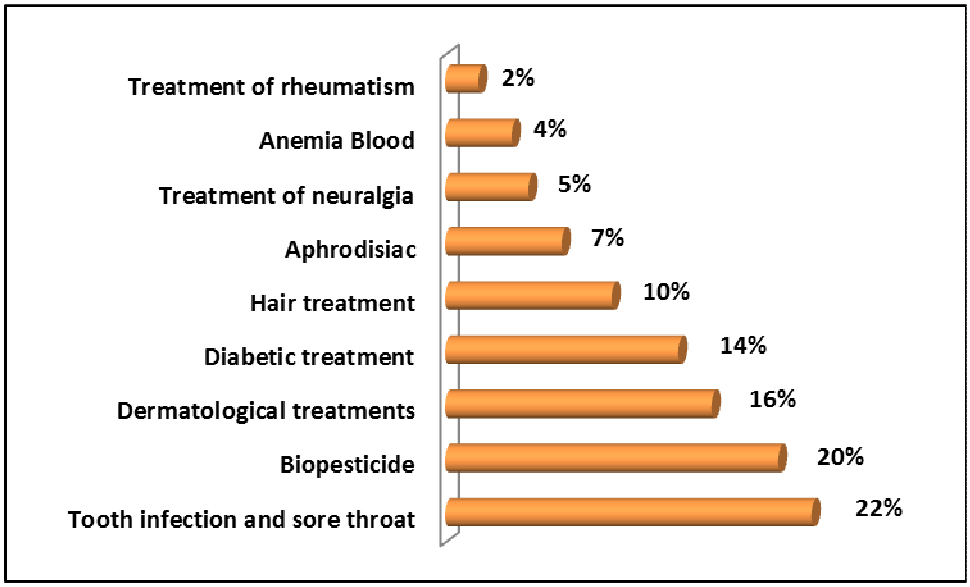

Fig. 6. Pathologies treated by Anacyclus pyrethrum according to the surveyed herbalists

Moreover, *Thymus zygis* is used mainly according to the investigations against digestive diseases, belly pains, breathing issues, colds, influenza, cough, and asthma; it invigorates the nervous system when used with tea or fumigation against the stress, tiredness and mental rigidity (Figure 7)

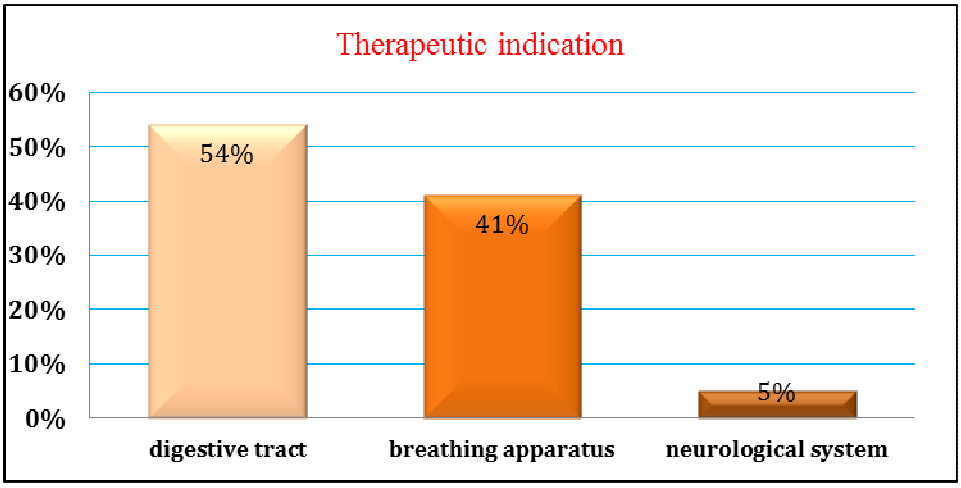

Fig. 7. Pathologies treated by Thymus zygis according to the surveyed herbalists

1.8 Parts collected

For *Anacyclus pyrethrum*, the three parts of the plant are collected; in particular roots, stems – leaves and flowers. The part most used is the roots which represents the part most collected with a percentage de77%, followed by the stems and sheets (15%), and then the flowers with a percentage of 8% (Table 4 and Figure 6). It should be noted that *Anacyclus pyrethrum* of the area of Timahdite is degrading, on the ecological level; its safeguarding is a must, because its regression will not be without consequences.

Table 4. Data on the part collected of Anacyclus pyrethrum

	Frequency	Percentage
Root	10	77%
Leaf / Stem	02	15%
Fleure	01	08%
Total	13	100%

In the same way for *Thymus zygis*, the three parts of the plant are collected. The leaves are used the 55%, the stems and the flowers occupy the second place with respective percentages of 14.5% and 30%. They are thus the flowers and the leaves which are exploited because they are at the same time the essence of the photochemical reactions and an organic reservoir from which it derives [27]. And sometimes they store secondary metabolites responsible for the biological properties of the plant. [28] (Table 5 and Figure 7).These results go in the same direction as those indexed by Bellakhdar (1997).

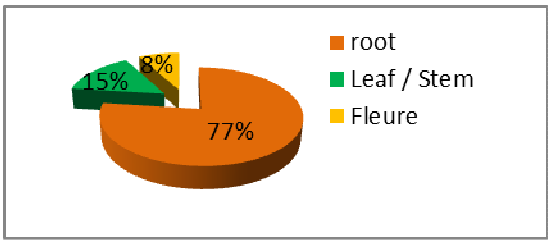

Fig. 8. Distribution of surveyed according to the part collected of Anacyclus pyrethrum

Table 5. Data on the part collected of Thymus zygis

	Frequency	Percentage
Leaf	7	55%
Stem	2	15%
Flower	4	30%
Total	13	100%

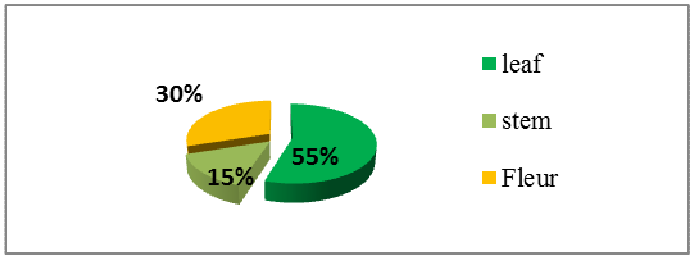

Fig. 9. Distribution of surveyed according to the collected part of Thymus zygis

1.9 Adhesion of the actors in the professional organizations

The collectors are not strongly affiliated to cooperatives or groupings of organization. Indeed, 23% of the actors are adherents in associations and cooperatives whereas 77% of the interviewed are not (Table 6 and Figure 8).

The surveyed people generate annually roughly an income released by of between 250 and 2140 DH a year per collector. Within a cooperative, the income can go up to 1250 DH per month by individual, which justifies the importance and the need for the organization of sector and the adhesion of the collectors within the cooperatives and associations.

Currently, the population refuses that their plant resources continue to be exploited by other institutions (foreigners or private). On the other hand, it is important to safeguarding natural resources in the environment, landscapes and human settlements need be organized around the cooperatives to draw the essence of the added-value locally and to contribute to the development and the valorization of this biodiversity.

Table 6. Data on the membership of organizations

	Frequency	% Of collectors in the organizations
Member	3	23
No member	10	77
Total	13	100%

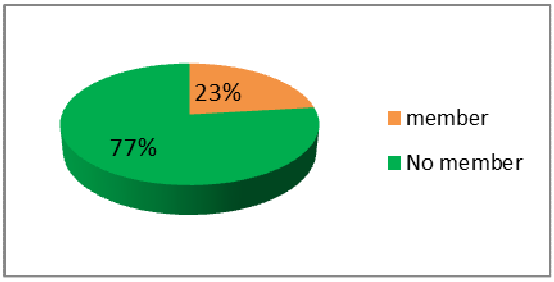

Fig. 10. percentage of the collectors in the organizations

1.10 Frequency of the gathering according to the income

According to our investigations, the peasants who gain more than 1500 DH per month, the percentage of gathering of these plants is weak is 15%, whereas those which gain between 500 and 1000 DH per month, the average percentage of gathering is about 23%. On the other hand, the individuals who gain less 500 DH per month, the percentage of gathering is more acute, that is to say 62% (Table 7 and Figure 9). Thus we can note that the increase in poverty pushed the population to search additional incomes for the daily life, from where the need to have important levies on the natural resources.

Table 7. Data on the income of population

	Frequency	Percentage
<500	08	62%
500<<1000	03	23%
1000<	02	15%
Total	13	100%

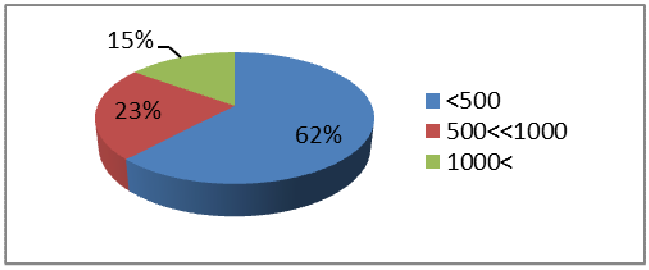

Fig. 11. Distribution according to the income

1.11Socio-economic characteristics of the collectors

The interviews made it possible to note that there exist other activities carried out by the gatherers (Table 8, Figure 10). The people who do not have work represent a percentage of 38%, followed by the daily workers with a percentage of 30%, the shepherds account for 23% and in the end the farmers 9%. This result is completely normal then that the unemployed always seek employment to satisfy their needs for livelihood

Table 8. Data on the distribution of the various types of gatherers

	Frequency	% of the collectors
Farmer	01	09%
Shepherd	03	23%
Daily laborer	04	30%
Unemployed	05	38%
Total	13	100%

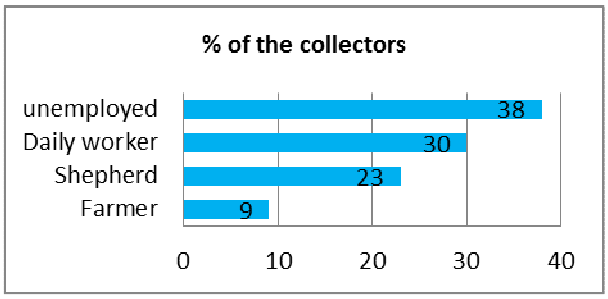

Fig. 12. Graph of the various types of gatherers met at the time as of interviews

1.12Selling price of *Anacyclus pyrethrum* and *Thymus zygis*

According to our interviews the value of one kilograms of the plant in a dry state is largely higher than that of one kilograms of the plant in a wet state. The collectors sell *Anacyclus pyrethrum* at the fresh state on ground at a price of 70 DH per kg whereas in the dry state, it costs 200DH per kg. For *Thymus zygis*, the price varies between 40 DH per kg in a fresh state and 70 DH per kg in a dry state (Table 9 and Figure 11).

Table 9. Data on the variation of the prices of the plants

	Price in dh / kg	
	wet	**dry**
Anacyclus pyrethrum	70	200
Thymus zygis	40	60

The majority of the gatherers sell their harvest in wet form because of lack of means of treatment and conditioning of the plants (sampling, packing, transport, drying. These stages require spaces well-equipped, adequate equipment and one week duration, according to the climatic conditions (sunning available).

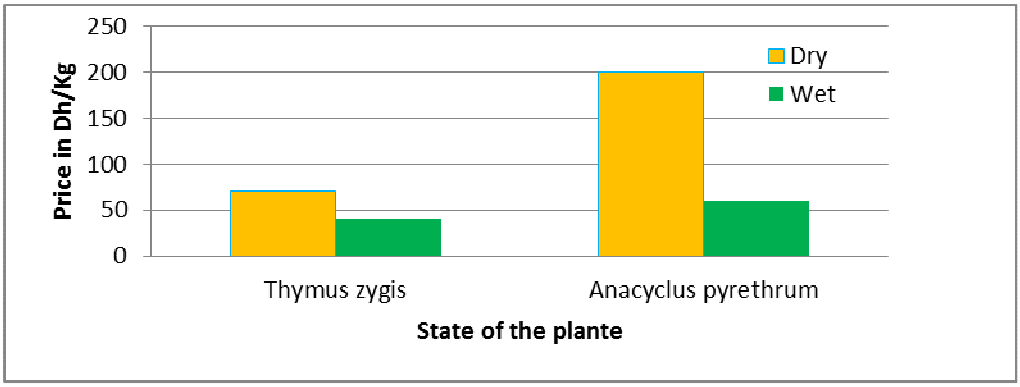

Fig. 13. Prize giving according to the state of plant

1.13Organization of the distribution channels of *Anacyclus pyrethrum* and Thymus zygis

Ethnobotanic, socio-economic and work of diagnosis of the sector of *Anacyclus pyrethrum* and *Thymus zygis* investigation on the level of the area of study made it possible to establish the links between the principal links of the sector starting from the collector to the consumer (Figure 12).

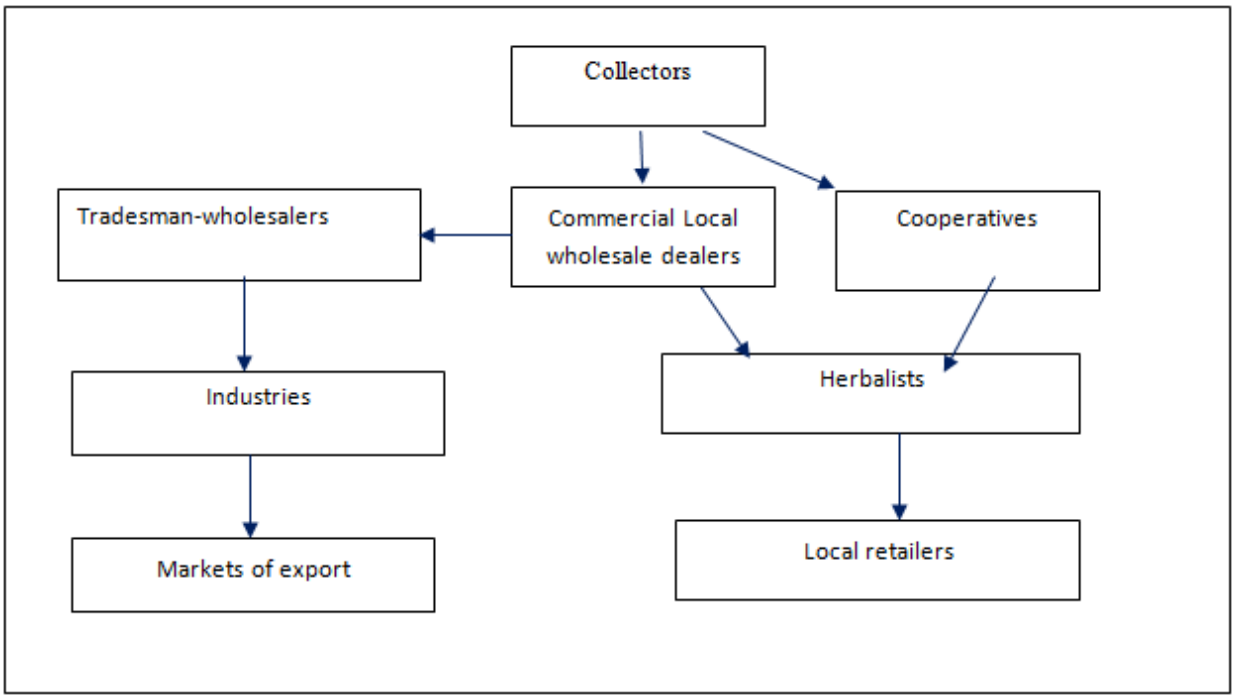

Fig. 14. Channels of distribution of Anacyclus pyrethrum and Thymus zygis in the study area(Source: Surveys conducted in this study)

The distribution Systems of *Anacyclus pyrethrum* and *Thymus zygis* comprise a multiplicity of intermediaries which do not support the transparency and the fluidity of information.

1.14Insertion of the collectors in the market of maps

Almost all the collectors of *Anacyclus pyrethrum* and *Thymus zygis* are weakly integrated into the market of medicinal aromatic plants, 77% of the collectors sell their products directly to intermediaries whereas 23% process their products into essential oils, (Table10 and figure 13). That can be explained by several reasons like lack financial means and logistics of marketing and also lack of information and knowledge of the market of aromatic and medicinal plants.

Table 10. Data on the sale of the products by the collectors

Destination of the market products by the collectors	Frequency	Percentage
Intermediaries	10	77%
The transformation	03	23%
Total	13	100%

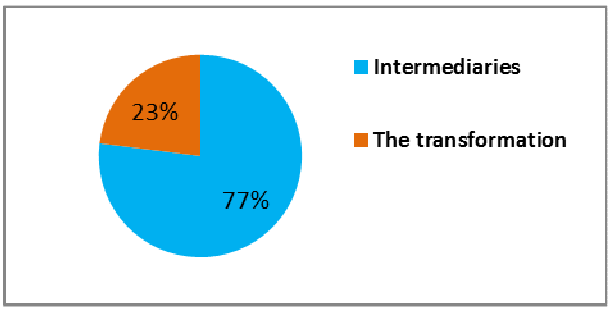

Fig. 15. Distribution according to the destination of the product

1.15Statistics on the export of *Anacyclus pyrethrum* and *Thymus zygis* in morocco

Following the exchanges with the dealers, we could draw up a list of some exporting companies of *Anacyclus pyrethrum* and *Thymus zygis* which operate in Morocco and to which the dealers sell their products. However, it was impossible to licit the information desired on the prices and the quantities of *Anacyclus pyrethrum* and *Thymus zygis* exported by each of these companies. It should be noted that the general data on export and the exterior markets result from the databases of the Autonomous Establishment of Control and Coordination of Exports (EACCE) of 2013, and of PNEUD over the period of 2003 to 2013.

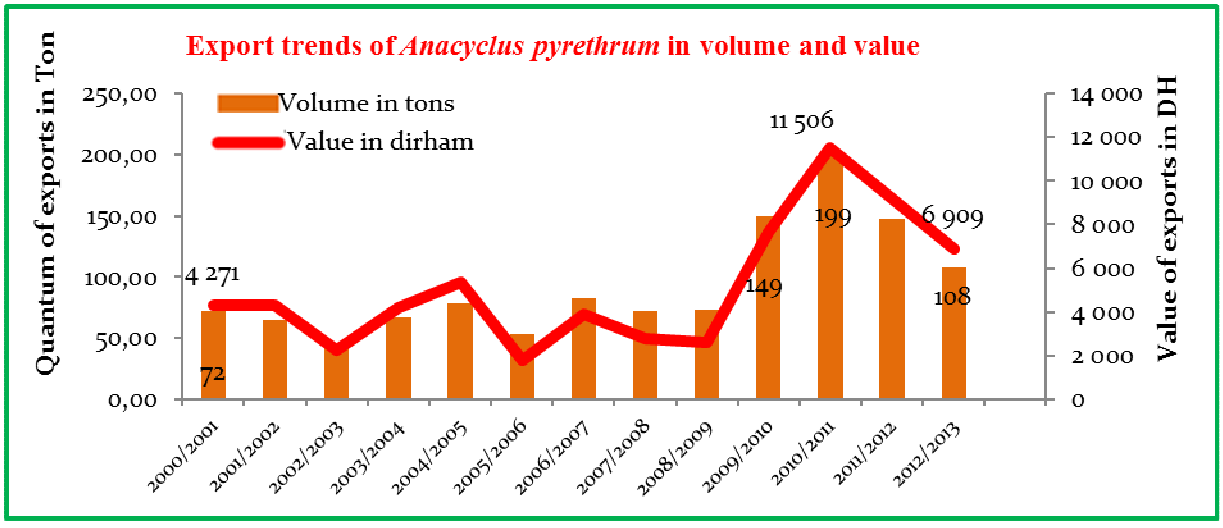

Fig. 16. Fluctuation in price and the quantity of Anacyclus pyrethrum exported according to the years of 2003 to 2013.

Source: Data drawn from (EACCE, 2013)

We observe that over the period of the 2001 to 2013, the quantity of *Anacyclus pyrethrum* exported annually from Morocco as well as the average costs in kilo are not stable. Export knew an important boom in 2011 when the exported quantity practically doubled while comparing with the quantity exported in 2006 and that is due to climatic factors.

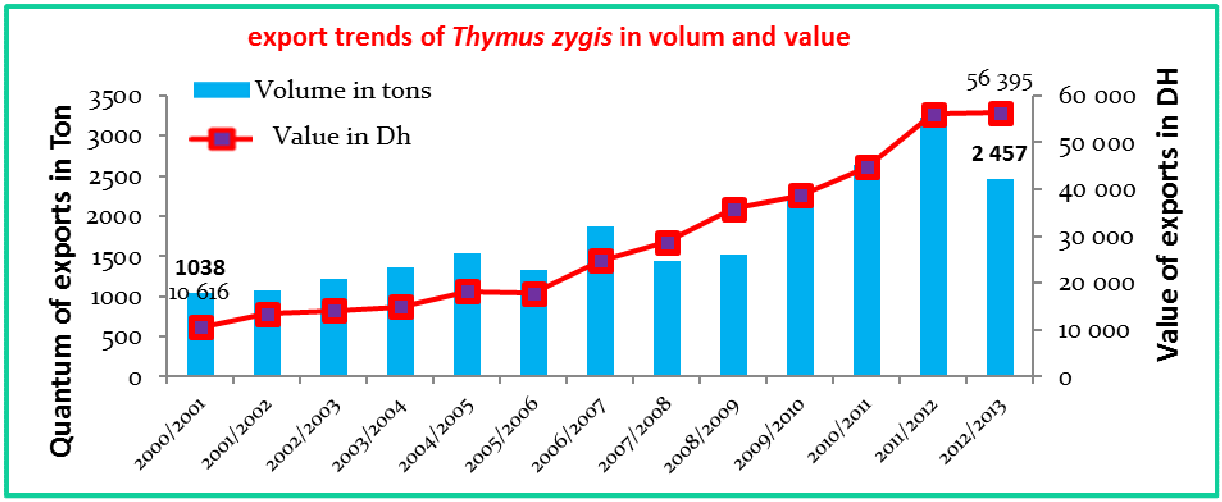

Fig. 17. Fluctuation in price and the quantity of Thymus zygis exported according to the years 2003 to 2013
Source: Data drawn from (EACCE, 2013)

Although the export of thyme proceeds over the period 2001 to 2013, this graph shows an important progression, it passes from 1038 Tons between 2001 to 2002 with a turnover of 10616 DH to 56395 Tons in 2012 with sales in tune of 2500 DH.

1.16Destination of the product

The investigation revealed that the marketing of the two plants can be done in international, local markets, nationals or. According to the study of project (PNEUD, 2011) realized in the region of study, a weak portion of *Anacyclus pyrethrum* is marketed on the national market (10%), while 90% are intended primarily for export. As for thyme, 40% of the product are marketed inside Morocco, it is bought by the herbalists and associations, on the other hand, 60% are intended for foreign countries (Figure 18 and 19).

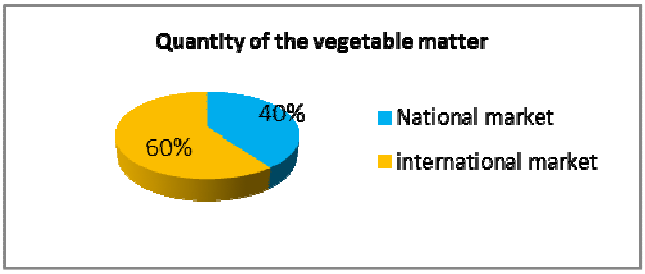

Fig. 18. Destination of the Thymus zygis

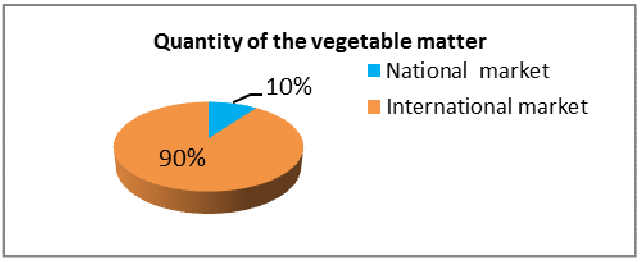

Fig. 19. Destination of Anacyclus pyrethrum

1.17Fluctuation of the prices over the marketing channels

According to our investigations, the average price of *Anacyclus pyrethrum* passes from 70 DH/kg in the gatherers with 200 DH/kg at the intermediaries to reach 500 DH/kg in the herbalists. For the species *Thymus zygis*, the collectors are paid 20 DH for the kilograms of collected thyme. This price increases to 40 DH/kg at the intermediaries and 60 DH/kg in the herbalists. However, for the exporting companies which operate in Morocco, it was impossible to get the information desired on the selling price (Table 11 and Figure 20 and 21)

Table 11. Transmission of the prices along distribution chains

Operators	Selling price (DH/kg)	
	Anacyclus pyrethrum	*Thymus zygis*
Gatherers	70	20
Intermediaries	200	40
Herbalists.	500	60
Exporters	-	-

Source: Our investigation2013

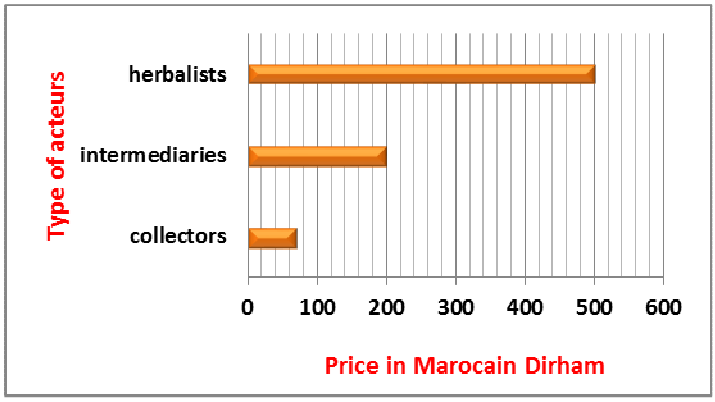

Fig. 20. Trend of the price of Anacyclus pyrethrum along short circuits of marketing

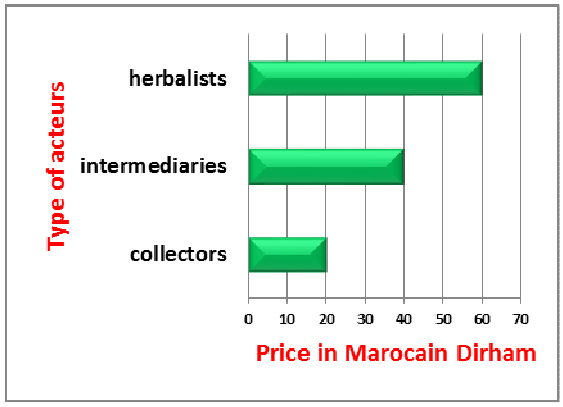

Fig. 21. Trend of the price of Thymus zygis over a short circuits of marketing

The examination of the fluctuation of the prices shows a considerable increase in the prices throughout the marketing channels while passing from one vendor to another. The profit margins earned by collectors are less important in comparison with the intermediaries and the herbalists. This reveals certainly the importance of the income generated by the trade of aromatic and medicinal plants to the profit of one a large number of economic actors. Also, this shows the extent to which the speculative practices which characterize the commercial transactions.

CONCLUSION

The ethnobotanic and socio-economic investigation of the collectors, intermediaries, herbalists, cooperatives and industries enabled us to find out that *Anacyclus pyrethrum* and *Thymus zygis* are medicinal herbs by excellence, they are used by Moroccan pharmacopeia for the treatment of the various diseases such as the digestive system, respiratory and neurology. This explains the very intense use of these plants which are known by their phytotherapeutic effects. The frequency of exploitation of these species in the commune of Timahdite is much related to the profile of the surveyed people. Thus, the young people, compared to the elderly people, generally do not know the names or the utility of these plant species. The women and the men have a shared medicinal knowledge, with a slight advantage going to the men.

The interviews and the visits to the weekly souks of the area also enabled us to elucidate the commercial channels of these plants, starting from the gatherers until export. National Forestry Commission is not in the know of this

exploitation which results in a lack of statistics on the quantities of the plant exploited, sold and on the generated economic value. The examination of the transmission of the prices shows a considerable increase across the channels in marketing while passing from one commercial actor to another. However, it was noted that because of the absence of professional organization, of the lack of framing as well on the production plan as regards marketing. The weakness of the incomes, the elevated level of poverty and the prices relatively high of the plant are the essential factors which push the bordering population to largely use this species in their territory which can constitute a real threat to their existence, and even to lead to the destruction of their habitats, if their management is not rational.

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