

# The Wonderful World of Cuban Orchids: Their Importance and Conservation from An Early Age

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## ABSTRACT

One of the most species-rich groups of plants in Cuba and the Caribbean is the orchids. The Orchidaceae family is one of the first in the list of plants that have intrigued naturalists for centuries. The objective of the research was to propose a system of activities that contribute to the knowledge of orchids present in the flora of Cuba in the group of the 7th grade III of the "Rubén Martínez Villena" Urban Basic Secondary School located in the village of Vega de Palma, of the Vueltas Popular Council, in the municipality of Camajuani, Villa Clara, Cuba. In carrying out the research, information collection methods were used, as well as methods for processing the information collected, such as participatory observation, document review, survey, interview, expert criteria, historical-logical, and modeling, among others. The application of the methods of information collection resulted in the insufficient knowledge of the respondents about orchids present in the Cuban flora. The sample consisted of 26 schoolchildren and 5 teachers. The evaluation made by the experts was very pertinent. Its validation contributed to acquiring new knowledge about Cuban orchids.

**Keywords:** activities, endemism, flora, orchid, Orquidiaceae, system.

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## INTRODUCTION

Since its origin, the human species has managed to survive through the constant use of the wild species found around it [1,2,3]. The utilization of flora populations by these human groups includes not only sporadic extraction but also sustainable use [1,3,4].

In recent times, over exploitation has led to the deterioration or local or global disappearance of the most vulnerable or overexploited species. This is particularly evident from information derived from the study of some plant species such as cacti and orchids. Overall, the evidence suggests that extraction represents, after habitat destruction, the second highest impact factor on wild biodiversity [5,6,7].

One of the greatest examples of Caribbean biodiversity is in Cuba and much of it is unique to the island. One of the most species-rich groups of plants in Cuba and the Caribbean is the orchids. The Orchidaceae family is at the top of the list of plants that have intrigued naturalists for centuries. Some of the first tropical plants described by Linnaeus in the 18th century were

orchids from the Caribbean [8].

Orchids are among the oldest floral species, dating back more than 65 million years. In ancient times the orchid was believed to have medicinal and aphrodisiac properties. In Greek mythology, the orchid represents the transformation of Orchis, the libidinous son of a nymph who gave him his grace and a satyr who gave him his penchant for lust. Fierce and violent, he was transformed into a delicate flower by the gods of Olympus [8,9].

The Orchidaceae family is one of the richest and most diverse, distributed around the planet in tropical and subtropical environments, with approximately 20,000 to 30,000 species. Placing them in the family with the highest diversity, absent in true deserts and areas with extreme cold, only a few are adapted in cold environments [10,11]

Cuba has a privileged position in the center of the Caribbean and a climate conducive to the flowering of several species, which is why it has a great biodiversity of orchids. There are about 130 varieties of orchids endemic to the country, which

can be found in various places in the wild, such as in the homes of the inhabitants, and are sometimes accompanied by others from the Caribbean and South America who feel completely at home in the country. This makes a total of 308 orchid species found in the wild [12,13,14].

Although the Orchidiaceae family is very well represented on the island of Cuba, with great variability in its distribution, from species that are found throughout the country or are common to the Caribbean region, to species that only appear in one region or that are even local endemics, in critical danger of extinction, the authors of this research have been able to confirm through the methods of information gathering that there is a marked lack of knowledge on the part of the schoolchildren of the 7th grade III of the Basic Secondary School (ESBU) "Rubén Martínez Villena". The authors of this research have been able to confirm through the methods of information gathering that there is a marked lack of knowledge on the part of the students of the 7th grade III of the Basic Secondary School (ESBU) "Rubén Martínez Villena", located in the village of Vega de Palma, belonging to the Popular Council Vueltas in the municipality of Camajuaní, Villa Clara province, Cuba, about the orchids present in the flora of Cuba, and not only the students but also the teachers who teach the grade in this study center. However, it was also found that there is insufficient information on this important group of plants in the Biology I textbook.

Taking into consideration the insufficient knowledge that 7th-grade III students and teachers have about orchids, the authors of this research work proposed the following problematic situation: There is a lack of a didactic proposal that contributes to the knowledge of orchids by 7th-grade III students and teachers at the ESBU "Rubén Martínez Villena".

This problematic situation led to the research objective: to propose a system of activities that would contribute to the knowledge of orchids present in Cuba.

## MATERIALS AND METHODS

The research was carried out in the ESBU "Rubén Martínez Villena", located in the village of Vega de Palma, Consejo Popular Vueltas, belonging to Camajuaní municipality, Villa Clara province, Cuba (Figure 1).

Vega de Palma (Vega de Palma) is a populated place (class P-Place) in Villa Clara province (Villa Clara), Cuba (North America) with a region code of Americas/Western Europe. It is located at an altitude of 68 meters above sea level.

Its coordinates are 22°29'25" N and 79°41'37" W in DMS format (degrees, minutes, seconds) or 22.4903 and -79.6936 (in decimal degrees). Its UTM position is PE38 and its Joint Operation Graphics reference is NF17-07 [15].



**Fig 1: Satellite map of the town of Vega de Palma**

**Source: taken from Google Maps**

The materials used in the research were: mobile phone, Data Show, projection screen, laptop, 7th-grade Biology book, 7th-grade Biology I syllabus, 7th grade Methodological Guidelines, specialized literature such as books and various scientific articles.

For the development of this research, we relied on the following data collection and processing methods [18].

The data collection methods used were:

Participatory observation: to identify gaps in the selected sample.

Document review: to provide accurate information on the current state of the object of research, considering various authors who have worked on the subject and their results. In addition to the review of other normative documents such as: the Biology 1 Programme, seventh grade [16,17], the Methodological Guidelines [17,18], Biology I textbook [18,19]. In addition, the protocol of the subject and the schoolchildren's notebooks.

Survey: to find out from the schoolchildren and teachers who teach or taught the subject Biology I, about the knowledge they have about the orchids present in the Cuban flora, their importance and protection. In addition, to evaluate in practice the tribute of the system of activities.

The survey or pedagogical test applied to the schoolchildren and the interview with the teachers are shown below.

### Pedagogical test

#### Slogan

Dear schoolchildren, here is a questionnaire for you to answer as part of a research project that is being carried out at your school.

Thank you very much

#### Questionnaire

1. What are the main characteristics to look for in order to recognize an orchid?
2. In which habitat can orchids grow?
3. What care should be taken when cultivating an orchid?
4. Where is the largest orchid garden in Cuba?
5. Which countries have the greatest diversity of orchids?
6. Cuba has endemic species of orchids, could you mention some of them?
7. Do you consider orchids to be parasitic plants or not, please give your answer.
8. When do orchids bloom?
9. Mention some species of orchids present in the Cuban flora.

Survey of 5 teachers who have taught Natural Sciences or Biology 1 at the ESBU "Rubén Martínez Villena".

### Survey

#### Slogan

Dear teachers, below is a questionnaire, which you are asked to answer as part of a research project that is being carried out in the centre where you work as an education professional.

Thank you very much

### Questionnaire

1. Has any extracurricular activity related to the study of orchids present in the flora of Cuba been carried out at the ESBU?

2. Do you have the necessary knowledge to carry out extracurricular activities concerning the presence of orchids living in Cuba, their diversity and endemism?

3. In the teaching-learning process of Biology 1, you have dealt with orchids at some point.

4. Do you know if in the village of Vega de Palma there is any inhabitant who has an orchid garden?

5. At ESBU is there any book in digital or printed format that deals with the subject of orchids?

6. Would you like to carry out extracurricular activities with 7th grade students to contribute to the knowledge of orchids found in Cuba, why?

Expert criteria: to evaluate the proposal and improve it according to the indications mentioned by the experts in order to achieve the proposed objective. The evaluation criteria used to determine the level of competence of the experts were: high competence (0.8 to 1); medium competence (0.5 to 0.7) and low competence below 0.5. The use of the competence coefficient made it possible to select 2 highly competent experts.

### Survey of selected experts

#### Slogan

A system of activities has been elaborated to contribute to the knowledge of the orchids present in the flora of Cuba, and in particular in the 7th grade III of the ESBU "Rubén Martínez Villena". We would like to know what you think of the system presented to you.

#### I. General data:

Name and surname:

Years of experience:

Place of work:

Position:

Teaching Category:

Scientific Degree:

#### II. Give your views on the proposal

- Necessity of the proposal.

Very necessary () Necessary () Not very necessary ()

Not necessary ()

- Relevance of the proposal.

Very relevant () Relevant () Not very relevant ()

Not relevant ()

Novelty and originality of the proposal.

Very new and original () New and original ()

Not very novel and original () Not novel and original ()

- If generalizable.

Very generalizable () Generalizable ()

Not very generalizable () Not generalizable ()

III. Express the deficiencies detected in the proposed set of activities and offer suggestions for activities to be proposed and provide suggestions for the same

IV.- Do you consider the implementation of this proposal feasible?

feasible?

Yes \_\_\_\_\_ No \_\_\_\_\_ Why?

In addition, statistical and mathematical methods are used, including descriptive statistics for the elaboration of the graphs, and percentage analysis is also used as a procedure.

The following methods were used to process the information collected (intellectual):

Analytical-synthetic, to evaluate the main contributions of Cuban and foreign scholars to the research topic. In addition, the arguments derived from the sources consulted and in the examination of the results of the diagnosis are stipulated and contrasted to orient the requirements, structure and organization of the system of activities.

Historical-logical: to explore the behaviour of the research problem in other studied directions, the progress of the proposed solutions, and to establish the particularities of the theory in the elaboration of the activities.

Deductive-demonstrative: it allowed, on the basis of the instruments used and the bibliographical consultations carried out, deductions to be made about the real situation regarding the knowledge of the 7th grade B students of the ESBU "Rubén Martínez Villena" about the orchids present in the flora of Cuba, arriving at conclusions about how to provide answers, through the system of activities, to the problem being investigated.

Ascension from the abstract to the concrete: to state the theoretical and practical elements necessary for the construction of the system of activities.

Modelling: to theoretically represent the system of activities, which supports its design, the correspondence between the conceptual, the theoretical, the methodological and the practical, as well as the integral construction of these.

The sample is made up of 26 schoolchildren who make up the 7th grade III enrolment of the ESBU "Rubén Martínez Villena", and 5 teachers who have taught or teach Natural Sciences or Biology I.

### Ethical aspects

The research was subject to ethical standards that made it possible to promote and ensure respect for all participants in the study, so that their individual criteria/ opinions and rights were respected, in order to generate new knowledge without violating the ethical principles of privacy and confidentiality of personal information of all research participants [20].

### RESULTS AND DISCUSSION

Results of the analysis of the normative and methodological documents for lower secondary education.

The following is an analysis of the aspects assessed in the review of the normative and methodological documents. This included: the Biology 1 Programme, seventh grade [18], the Methodological Orientations [17], Biology I textbook [19], subject protocol and students' notebooks.

In the Methodological Orientations for 7th grade, there is absolutely nothing about orchids, and the same is true for the grade syllabus.

In the revision of the Biology I textbook, in Chapter 5: Plants: food producers and air purifiers, and specifically in section 5.6.1 Diversity and distribution of angiosperms. Endemic plants and invasive introduced plants, orchids are mentioned, but do not really provide any content of importance in the opinion of this author. The text extracted from this book is shown below:

Angiosperms predominate in terrestrial plant groupings almost everywhere on the planet. In addition to terrestrial, they are aquatic, such as the elodea, or live on other plants, such as the curujeyes and orchids, and even parasitic, such as the orobanche, which affects the tobacco plant; they can be as small as the duckweed, barely 1.5 mm, or as large as the eucalyptus of Australia, which can exceed 100 m [19].

On page 129, we can see the poor quality and distorted black-and-white photos of two orchids present in the Cuban flora, with an engraved caption showing some characteristics of the Mariposa orchid and the black orchid, both endemic to the Guanahacabibes peninsula.

In this sense, and as is logical, neither in the subject protocol nor in the student's notebook does any content related to orchids appear.

### Results obtained after applying the initial pedagogical test

An initial survey (pedagogical test) was carried out with the pupils of group 7 III of the ESBU "Rubén Martínez Villena", with the aim of verifying their knowledge of the orchids present in the flora of Cuba and the need for their protection; the results are shown below:

To the question related to the main characteristics that should be taken into account to recognize an orchid, 100% assert that the shape of the flower, the color, because they hang; but they do not detail the structural characteristics of the flower.

Concerning the question related to the habitat where orchids can develop, 100% of the schoolchildren did not give correct answers.

The schoolchildren do not know the care to be taken into account when growing an orchid, for 100%.

Of the schoolchildren surveyed, only three mentioned Soroa, where the largest orchid farm in Cuba is located, which represents 12.0%.

100% of the schoolchildren mentioned Cuba as one of the countries with the greatest diversity of orchids, but the other examples are deserted, and do not mention Colombia, Ecuador, Mexico, Costa Rica and others.

Of the 26 schoolchildren surveyed, 100%, do not know of any endemic species present in the flora of Cuba.

On whether orchids are parasitic plants or not, 100% of the schoolchildren did not answer the question appropriately, so they could not substantiate the answer.

100% of the schoolchildren do not know when orchids bloom, and the question concerning the schoolchildren mentioning some species of orchids present in the flora of Cuba, 100% do not mention any.

### Results of the teacher interviews

In the interview with the teachers who have taught Natural Sciences or Biology 1 in the 7th grade, the following was found: According to the teachers at ESBU, no extracurricular activity related to the study of Orchids present in the flora of Cuba has been carried out.

The teachers do not have the necessary knowledge to carry out extracurricular activities concerning the presence of orchids that live in Cuba, their diversity and endemism, and this is what they expressed, so no content related to this subject has been addressed, and they do not know if in the village of Vega de Palma, where the ESBU is located, there is any inhabitant who is dedicated to the cultivation of orchids.

During the interview it was found that there is no book or material at the ESBU that deals with orchids, neither in print nor in digital format.

All interviewees agreed that they would like to carry out extracurricular activities with 7th grade students to contribute to the knowledge of orchids found in Cuba.

As a result of this needs assessment, the following gaps and potentialities were established:

Shortcomings

- Poor content related to the presence of orchids in the flora of Cuba in the normative documents, i.e., syllabus and textbook.
- Insufficient knowledge of 7th grade B students and teachers of the ESBU "Rubén Martínez Villena" about orchids in Cuba.
- Absence of literature, either in printed or digital format, in the school that deals with the subject of Cuban orchids.
- Schoolchildren and teachers do not know if there are any people in the locality where they live who are dedicated to the cultivation and care of orchids.
- Teachers do not have the necessary knowledge to carry out extracurricular activities concerning the presence of orchids that live in Cuba, their diversity and endemism.

### Potentialities

- The author of the research has a good knowledge of the orchids present in the Cuban flora, as he is dedicated to the cultivation and care of them.
- Motivation on the part of the selected 7th B students to participate in the activities to be developed.
- Logistical support from the directors of the ESBU and the People's Council of Vueltas to carry out the research.

### Evaluation of the proposal by expert criteria

Before validating the system of activities in the teaching-learning process of Biology I in the 7th grade III of the ESBU "Rubén Martínez Villena", the proposal was subjected to evaluation by expert criteria. Figure 2 shows the graphic model of the system of activities.

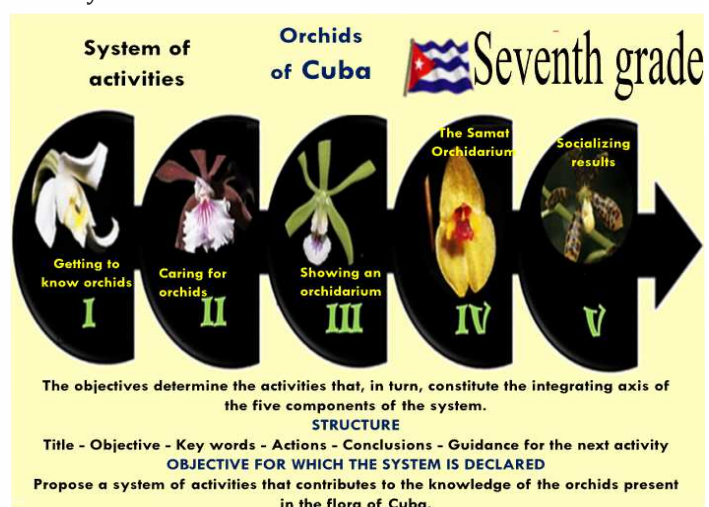


Fig 2: Model of the system of activities for the validating the system

100% of the experts consider the proposal to be very: necessary, relevant, novel, original and generalizable. Some considerations made by the experts are:

- With the activities, schoolchildren can gain a broader knowledge of the orchids found in the Cuban flora, their endemism, and the care that should be taken with them, whose contents are not addressed in the teaching-learning process of Biology I of 7th grade with the depth that this topic requires.
- The proposed activities facilitate the knowledge of Cuban orchids in Cuba, such as: endemism, protection, cultivation, setting up an orchid garden, pests, and diseases that attack them, among other aspects of interest.
- The system of activities is very well conceived, very interesting and motivating.

As the content of Environmental Education, these activities enable schoolchildren to acquire knowledge, skills and ways of acting that can be applied in their actions.

Taking into account the transformations that are taking place in basic secondary education, the organisation of the activities took into account the current state of knowledge of the schoolchildren, as well as their individual and collective potential, with the aim of continuously influencing cultural enrichment based on what is known and the relationship with what they can achieve or know, in order to contribute to the individual and collective benefit of the participants.

The activities were structured in a systemic way, and special attention was given to the cognitive aspect.

### Proposal for a solution to the problems detected

The proposal consists of 5 interconnected activities, where learning by doing, the link between theory and practice and experiential learning takes precedence.

The system of activities is set out below, once the relevant adjustments have been made in accordance with the experts' criteria.

#### Activity I

Title: Getting to know orchids

Objective: to characterise orchids, using pictures, slides and flowering plants.

Keywords: flower, inflorescence, lobello, orchid, petal, monopodial plant, pseudobulb, sepal

Actions

- After coordination with the biology teachers and school leaders, the relevant arrangements were made to carry out the first activity in the ESBU, after school, and at a feasible time, preferably in the morning session, where the time and place for the activity were fixed.
- The specialist, the students involved and the selected teachers set up the premises with the necessary teaching and learning resources for the activity, namely a television and a laptop.
- The specialist, with the use of Information and Communication Technologies (ICT) and natural objects, addressed in an entertaining way in a popular scientific language interesting aspect about the characteristics of orchids. He said that orchids are easy to recognize because they are from tropical habitats and are characterised by their popular flowers, with three sepals: two petals and a lobelet, where the pollinating insect lands, among other aspects.
- He stressed that the plant is monopodial, which means that it develops on a single axis.

The duration of this activity was 60 minutes, including questions asked by the schoolchildren.

**Conclusions:** The activity enabled an approach to the knowledge of orchids. The schoolchildren expressed their opinions about the activity and a participatory technique was applied in which their evaluations of the activity were defined in one word.

**Guidance for the next activity:** For the next activity, it was suggested to collect as much information as possible about how to take care of orchids at home.

#### Activity II

Title: Caring for Orchids

Objective: To explain how to proceed with the care of orchids, within the tropical plants, with emphasis on lighting, watering, substrate and main pests.

Keywords: lighting, pests, watering, substrate, ventilation,

Actions:

- To start the activity, the specialist makes a brief introduction about plant care, to go directly to the care of orchids, which have, within the tropical plants, different ways of living and various forms of care.
- With the help of ICT and some flowering specimens, the influence of lighting and ventilation, which in turn are closely related to the location of the plant, was explained. Afterward, reference was made to the frequency of irrigation and the effect it has on nutrition, highlighting the damage it can cause in early flowering.
- Finally, the specialist, with the help of the teacher in charge of the subject, dealt with everything related to substrate, emphasizing that this refers to the environment in which the plant lives (epiphytes, semi-epiphytes and terrestrial), an issue that influences the aspects that were previously explained.
- It was emphasized that the environment in which the plant lives often determines the appearance of pests, which threaten the health of the plant and which are nothing more than relationships established between organisms for different purposes.

**Conclusions:** The development of this activity made it possible for the schoolchildren to understand, in a pleasant way, the importance of caring for plants and within them, specifically orchids; highlighting essential aspects for this activity (lighting, ventilation, watering, substrate, and pests).

**Guidance for the next activity:** In the final moments, the schoolchildren are encouraged to investigate the creation of an orchid garden.

#### Activity III

Title: Setting up an orchid house

Aim: To explain the setting up of an orchid garden as a natural refuge for species.

Keywords: climatic conditions, cover crop, spatial distribution, environment

Actions:

- After coordination of the specialist with factors of urban agriculture and the Association of Small Farmers (ANAP) in the Popular Council "Vueltas", a visit was made to the area of covered cultivation located at the exit of the village, with the company and support of the teachers who teach the subject in the ESBU: "Rubén Martínez Villena"; there the invariant aspects for setting up covered cultivation and its subsequent dependence on climatic conditions and the changes that can be made in the environment were specified.
- The schoolchildren were able to observe the characteristics of the covering while the specialist explained the different sizes of the covering, which are following the crop to be protected; in the case of orchids, in particular, a very thin covering is required, i.e. one that allows little light to pass through, as they are found in the

broad group of ornamental plants. However, he mentioned the possibility of protecting them under the shade of a tree, preferably an evergreen tree, as long as there are only a few specimens, taking into account the spatial distribution.

Aspects concerning the environment and the combination of other organisms that can be introduced to enrich the orchid garden environment, some to establish symbiotic relationships, while others only add beauty to the landscape, were then analyzed. He referred specifically to other plants that could serve as support and some animals, such as fish, birds, among others that could act as pollinating agents (bees, butterflies, beetles); of the latter, some can be introduced, others converge over time.

- He also explained that, contradictorily, orchids bloom only once a year, but in an orchid garden there are always flowers for beautification, while others have more utilities, be it aromatic spices (vanilla) or perfumed essences.
- The schoolchildren took photos with their mobile phones of this experience.

**Conclusions:** This activity laid the foundations for a future vocational orientation towards specializations in agriculture, while they got deeper and deeper into the ingenious environment of orchids.

**Orientation of the next activity:** The schoolchildren, with the help of their phones, will receive photos and information from the specialist about their orchid garden for a later visit.

#### Activity IV

Title: In search of the Samat Orchidarium

Aim: To know the most significant orchid species present in the Samat orchidarium.

Keywords: orchidarium, endemic, exotic, Samat, Variety

Actions

- After coordination with the schoolchildren, teachers and guests, a guided visit to the Samat orchid house took place.
- The specialist (Samat), before entering the orchid house, informed the students of the measures to be taken into account in the orchid house, which included: not touching any flowers, not manipulating the plant to take photographs, maintaining strict discipline in the orchid house and not separating any schoolchildren from the group.
- Afterwards, a detailed explanation was given on how the orchidarium was built, the materials used, and how to take care of the place in order to keep it in good condition.
- Samat explained to the schoolchildren the most significant species present in his orchidarium, highlighting those endemics to Cuba, with their scientific and common names if they had them, because he pointed out that common names are not very common in orchids, and he also highlighted the exotic species present. He further stated that, for those who wish to see the orchids, the best time to visit the orchidarium is between September and November. During this period, around 150 species of orchids bloom, creating a truly unique spectacle at the orchidarium.
- The school children took pictures of the different varieties of orchids and filmed some aspects of Samat's exhibition.
- Samat answered all the questions asked by the school children, teachers, and guests and encouraged them to set up a small orchid garden at the ESBU.

**Conclusions:** This activity demonstrated how a person who loves nature and in particular orchids, with his or her own effort, cultivates and protects a Cuban cultural heritage. It also encouraged schoolchildren to love and care for nature.

**Guidance for the next activity:** the students were told that in the next activity, the results of the system of activities will be socialised and that they will produce advertisements, a mural of orchids, an art festival with poetry, drawings, a video exhibition, and where the students should seek support from teachers, villagers, and school directors so that the final activity will be of the required quality.

#### Activity V

**Title: To socialise the results**

**Objective:** To disseminate the aspects related to the presence of orchids in the flora of Cuba, their history, endemism, protection, utilizing videos, triptychs, and artistic manifestations.

Keywords: mural, results, socialise, triptych.

Actions:

1. Work was organized in teams and tasks were assigned to each of the schoolchildren as:
2. Preparation of triptychs.
3. Exhibition of videos and photos.
4. Creation of an ESBU mural of photos and leaflets,
5. Preparation of a morning event to present the results of the activities, with the participation of the specialists who worked on the research.

#### An art festival, with poetry, drawings, posters, and other activities

All these actions were carried out by the students and teachers, creating a space in the school to socialise the results obtained, creating a mural which the students called ORQUIMURAL, in reference to orchids, the drawings were placed on a table created for this purpose, and two videos were shown called How to take care of orchids? 4 minutes and 48 seconds long and What to do when orchid flowers fall off, 9:25 minutes long.

**Conclusions:** the schoolchildren were asked to express the importance of what they learned in the activities that were implemented.

By way of discussion, it can be said that, in the research, the theoretical and methodological foundations that support the work about the knowledge of the orchids present in the flora of Cuba were implemented, taking into consideration the thorough bibliographical analysis consulted. In addition, the application of the different methods of information collection and processing of the information collected made it possible to determine the current state of knowledge of the schoolchildren of the 7th grade III of the ESBU "Rubén Martínez Villena" about the Orchidaceae family.

The contents, requirements, structure, and organization of the system of activities to be elaborated were determined, which would contribute to the knowledge of the schoolchildren of the 7th grade III of the ESBU "Rubén Martínez Villena" about orchids. In this sense, we agree with [18,19,25].

The system of activities was carried out in two fortnightly shifts, extracurricular, where there was instruction by doing, experiential learning, coordination of activities with the management of the center, specialists with vast experience, teachers of the ESBU "Rubén Martínez Villena" and guests. This

does not disagree with what is pointed [19,23,26].

The authors conceived the activities in the form of a system in line with what has been done by other authors in this respect. [16,19,22]. In this sense, the system was made up of different interrelated components that, in a certain integrated formation, only acquired specific properties in relation to the others. In this sense, the components that made up the system exhibited interdependence, logical and hierarchical ordering, and it is classified as an open and non-static system [21,22].

In the design of the system of activities, an extensive bibliography of more than 30 scientific articles was used, which is of vital importance for carrying out research [24].

The authors consider that, with the system, each schoolchild became more involved in the knowledge of orchids, participating in each of the planned activities, without missing a single one of them, which made a great impression on the group of researchers, and that this contributed to the scientific conception of the world, to the learning of new concepts that make possible the relationship between nature and economic activity, to the development of scientific-research work, to the interest in the protection of nature, to aesthetic taste and the spirit of collective work, among others, thus enabling the integral education of schoolchildren, with a strong component in the global perspective of floriculture and horticulture, aspects that were confirmed *in situ* in this research [23,24,25].

As with other research of this nature, the evaluation of schoolchildren was aimed at assessing their knowledge, habits, skills and attitudes, and exclusive attention was paid to knowledge, in line with what was stated [24,27,28]. Taking into account all these elements, there is no doubt that through this system of activities inserted and promoted from an early age in our students, the love for the protection and conservation of the flora of a country, and especially the promotion of sustainable floriculture, which is inculcated and trained from an early age, with the involvement of schools and families being vital [29,30,31,33].

The experts consulted provided premises that allowed for the enrichment of the proposal, stressing that it is necessary, relevant, novel, original and generalizable, and taking these criteria as a basis, it was implemented in the teaching-learning process of Biology I in the 7th grade, in the 2024 academic year.

## Conclusion

With the implementation of this system of activities, related to the knowledge of the orchids present in the flora of Cuba, not only did the schoolchildren acquire knowledge about these particular plants, but it also favoured mutual stimulation, the interaction of the schoolchildren with their classmates; an exchange of experiences and sensations was achieved, and an interaction between the researchers and the schoolchildren was achieved.

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