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INSECTS TRAPS: A PROSPECTIVE STUDY

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Abstract-The collection, assembling and preservation of insects is an excellent form of learning in addition to the records found in books or scientific articles. With the surprising number in terms of the biodiversity of this group and the consequent variety of habitats, different types of collection methods are necessary. This work aimed a technological prospection of patents related to technologies to measure innovations of the use of traps for insect capture, through verifications in databases EPO, WIPO and INPI. Brazilian market is satisfactorily specialized in this area, presenting from simple to complex equipment. However, at the international level and on the status of legal patents, present in the databases analyzed, it has been demonstrated that is underexplored.

***Key-words*:** Catching insects, Insect traps, Light trap

1 INTRODUCTION AND THEORIES

Almost one million species of insects are described and currently constitute the dominant group of animals on the planet and can be considered the most successful inhabitants in the terrestrial environment, and therefore their variable habitat (CRUZ, OLIVEIRA, FREITAS, 2009; TRIPLEHORN, 2015). A surprising number in terms of biodiversity, as they can be found everywhere: gardens, forests, freshwater or saltwater sites, urban environments and many others (TESTON, CORSEUIL, 2004).

Human have long had an arduous relationship with insects, and many species affect the economic system causing damage to crops, grains and other stored products. They attack humans and animals of economic interest through injuries and bites that inject substances that cause allergies or act as disease vectors (FUJIHARA et al., 2011).

Collecting, assembling and preserving this group is a great way to study and learn about them. Handling, as well as collection, reveal information through direct observation, which is often not recorded in books or scientific articles (TRIPLEHORN, 2015). The fact that insects have varied habitats combined with a variety of morphologies makes it necessary to use different collection methods, which generally tend to be more or less selective (RAFAEL, 2002).

Catch can be done during the day or at night, directly or indirectly. According to Azevedo-Filho and Prates-Junior (2005, p.36): "In direct collection there is intense collector action using some equipment to capture specimens, and in indirect collection there is no intense collector action, because insects are caught by a trap ".The use of capture systems allows a significant increase in sampling effort time, which increases the chances of capture and consequently the identification of a larger number of species in a given period of time (SILVA et al., 2016).

Through capture it is possible to identify more precisely the individuals (FREITAS, SILVA, 2007). A trap can be defined as a mechanical, physical or chemical process that captures an organism, capable of keeping it inside or over itself (AZEVEDO-FILHO, PRATES-JUNIOR, 2005; SILVA et al., 2016). For the purposes of systematic studies of a particular animal, the trap may have attractive to the specimens, which may be physical, chemical or biological, called baits (NAKANO, MILK, 2010).

There are many types of traps, some of which are frequently used, but over the years and as technology and science have grown, they have been modified to better suit the procedure being used to meet the needs of technicians and researchers (SILVA et al., 2012), with different colors, shapes and materials.

Light trap types began to be described from the 1950s (LUMSDEN, 1958) and underwent adjustments in the following years (MINTER, 1961; CHANIOTIS, ANDERSON, 1968, HAWK, 1981) to the present day with improvements to meet specific groups in which one wants to work (DUBBERSTEIN et al., 2013; PUGEDO et al., 2005). These traps use lights to attract insects that are trapped inside a container or can be performed with some variations, such as the use of fabrics as supports or walls where the collector directly collects groups attracted by lighting (GARBELOTTO, CAMPOS, 2014). Lamps located outside urban centers and in isolation produce an more efficient results (CRUZ, OLIVEIRA, FREITAS, 2009).

These types of traps do not pollute the environment as well as do not promote biological imbalances, however the operation based on electricity becomes one of the limiting factors in rural areas far from cities, making it necessary to use batteries (DANTAS, 2015).

There are companies specialized in this type of service, where the traps are composed of UV lamps and adhesive refills that make the capture of insects (BALIEIRO, 2015). In addition to capture, this also allows tracking and analysis of the type of insect found and the amount, facilitating preventive action and avoiding larger infestations. These compact models are suitable for homes, commercial establishments or experiments and have innovative designs (DANTAS, 2015).

The aim of the present work was to perform a technological prospection of patents related to technologies and innovations on the use of insect trapping, through different databases.

2 METHODOLOGY

Data collection was performed in January 2019 and different words were used to specify the search in the databases, in order to find the actual number of patents present in the national and international market. The term *light trap* was used in consultation with the INPI (http://www.inpi.gov.br) website for title and/or summary, in a more advanced analysis was used the terms *insect traps* and *insect capture*, thus referring to the title proposed in this paper.

In the other search platforms, EPO (https://www.epo.org/index.html) and WIPO (https://www.wipo.int/portal/en/index.html) also used the same terms, *insect traps* and *catching insects*.

After the two basic searches, an advanced search was performed, using additionally the text "AND" in to the words already used. This data were showed in tables and graphs for better assimilation.

3 DISCUSSION AND RESULTS

Keywords were evaluated for their patent applications by database (Table 1). The term *insect traps* is more prevalent in WIPO (69,971), followed by EPO (515) and INPI (80). When the term was changed to *catching insects* there was a reduction in results, where WIPO remained predominant (11,291), followed again by EPO (994) and INPI (30). The term *light trap* was evaluated only at the national base, INPI, containing 12 patent applications.

Table 1 - Distribution of patents in databases.

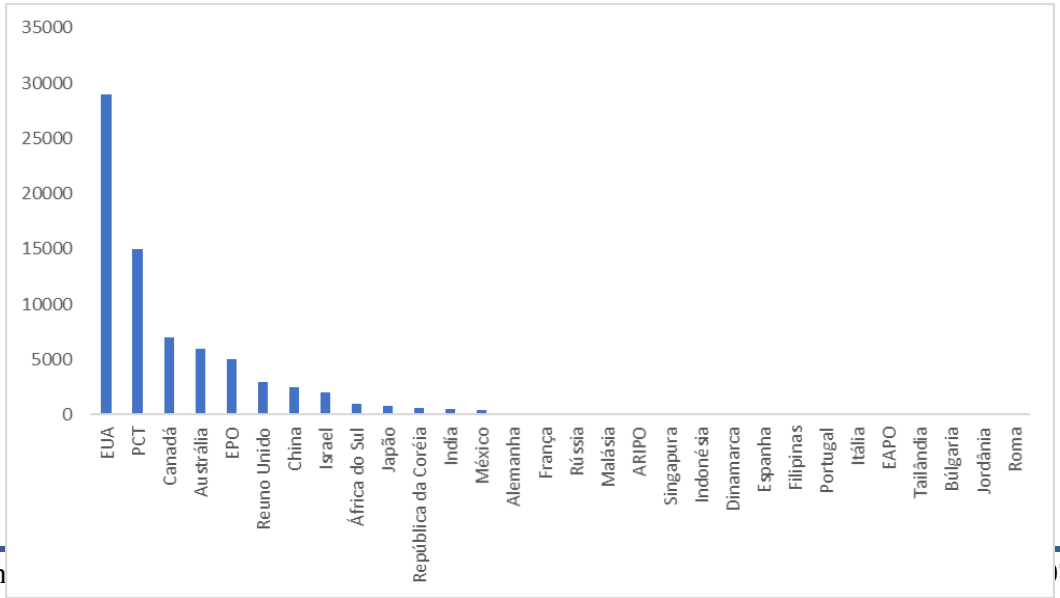
	INPI	*EPO*	*WIPO*
Insect traps	80	515	69.971
Catching insects	30	994	11.291

Source: Own Autorship (2019)

3.1 Distribution of patents by country

Using only WIPO data, the country with the highest number of patents related to insect traps was the United States (30,000), followed by 15,000 applications filed through the World Intellectual Property Organization (WO), through Patent Cooperation Treaty (PCT) (WIPO, 2014) as shown in Figure 1.

Figure 1 - Distribution of patents by country. The (PCT) corresponds to Patent Cooperation Treaty.

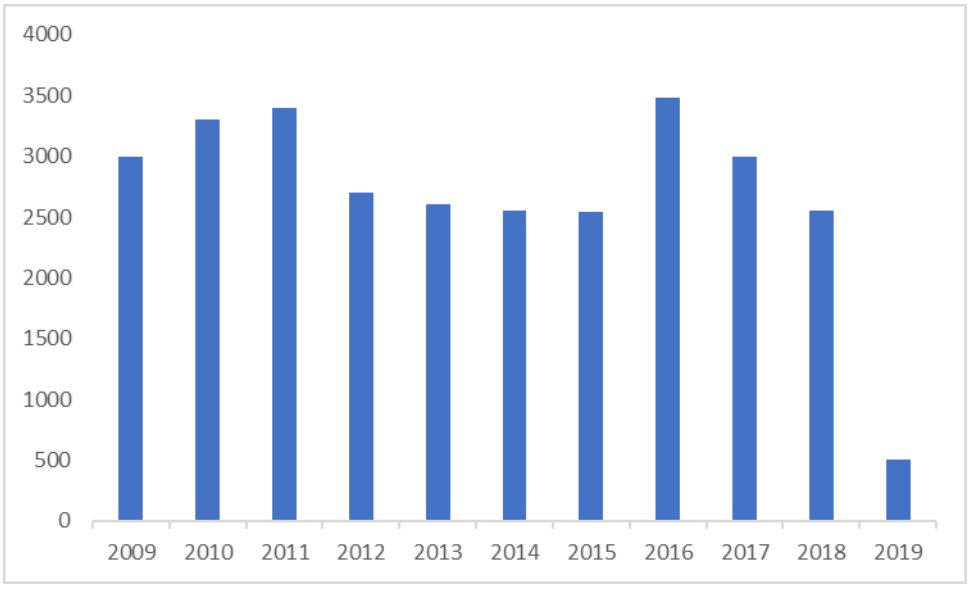


D.O.I.: 10.7198/S2318-3403201900010978

Source: WIPO (2019)

Regarding the year of patent publication, analyzing the 10-year interval, the database that obtained the highest number of patent applications was WIPO, the analysis of the annual evolution of these patents shows the applications from 2009 to 2019 (Figure 2), where 2011 and 2016 had the highest number, with approximately 3,500 patent applications. These results suggest that studies and technologies with insect trapping have been growing over the years.

Figure 2. Patent applications by date in WIPO database



Source: WIPO (2019)

3.2 Legal Status of Brazilian Patents

The legal status of the publication of the 12 patents requested in the INPI's general patent search, it was found that only three have been granted. The data demonstrate how the issue of patent legalization granting time interferes with this type of research and that there is an indispensable time demand for patents to be evaluated and granted.

Therefore, as regards the patent granted, entitled BIFACIAL LIGHT TRAP WITH FLYING INSECT PLATE, as described in patent letter MU 7901863-7, this work aimed to develop a utility model, with a transparent V-shaped shield surrounding the attraction fluorescent lamps to protect users from possible explosion of the lamps while trimming insects towards an adhesive plate. This mechanism was created by Hélcius Batista Pereira, this trap becomes efficient for allowing insects to enter both the front and rear face; safer because it has a transparent protector surrounding the lamps; and more hygienic by not allowing captured insects to be visible.

Another patent granted is entitled FLYING TRAP FOR FLYING INSECTS, as described in patent letter MU 7801852-8 Y1, where the constructive arrangement of the trap allows trapped insects 10 to be hidden on the inner side of the plate, as well as better trap efficiency because the plate is between the lamps and therefore does not obstruct the light path. Created by Marcelo Batista Pereira.

Finally, the patent granted entitled LIGHT TRAP FOR INTEGRATED CONTROL OF WASHING PEST IN GENERAL. According to what was described in charter No. MU 6200934-6 Y1 in order to improve control against harmful insects and crops. Created by ARRIGO MARCUS ANTONIO and whose holder is the company Intral S / A. - Electrical Materials Industry (BR / RS).

3.3 Legal Status of International Patents

Some of the international patents found were reviewed for their legal status as a publication. One of the requests obtained from the EPO search, publication number WO 2016/130182, called INSECT TRAPS AND MONITORING SYSTEMS was received at the International Bureau on September 27, 2018. This disclosure relates to pest control and, more particularly the detection of bed bug infestations. Insects are often considered "pests" because they can be harmful and a source of health risks. Detecting them is the first step in knowing if there is a problem. Classifying them is essential to prescribing and implementing proper treatment. Doing both quickly can prevent infestations. Traps rarely eradicate pests, but can reduce pest-human encounters.

Embodiments of the present invention provide discrete and secure insect monitoring systems that can attract, capture, detect and identify insects, quickly communicating their results. Due to their low cost and non-intrusive, the insect monitoring systems described here are particularly useful for the hospital sector, and widely useful for transportation, homes and other market segments.

The invention includes a housing, an interior camera within the housing and a light source disposed within the housing as well to illuminate at least a portion of the bottom surface of the interior camera. A multi-pixel optical sensor is disposed within the housing so that a sensor field of view comprises a substantial part of the floor surface. A processing circuit disposed within the housing receives optical data from the multi-pixel optical sensor, analyzes optical data to detect intrusion of an insect or other object into the inner chamber, comparing most recently received optical data to previously received optical data, and generates an indication in response to detection of the intrusion of an insect or other object. Detection classification results can be sent wirelessly to another device.

4 CONCLUSION

Each light trap model has specific characteristics and meets all safety requirements, and is a system that does not generate any intervention to the environment. The Brazilian market has a range of companies specialized in this type of trap, from simple to the most specialized equipment. However, according to internationally obtained data and on the status of legal patents (INPI, WIPO and EPO) is not yet a much explored topic, as demonstrated by the small number of patents indicated in the INPI. This highlights the need for further investment as infestations and insect-borne diseases are considered public health issues that should not be overlooked, both in research as well as in government incentives.

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