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Research note

# Barrenador de pinos en fragmentos de bosque de Plan de Guadalupe, Atlamajalcingo del Monte, Guerrero, México

# Pine borer in forest fragments of *Plan de Guadalupe*, *Atlamajalcingo del Monte, Guerrero, México*

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**Abstract**

In recent years, in the temperate forests of *Montaña de Guerrero*, pines with wilting, yellowing foliage, dry stems and some dead individuals have been observed, symptoms attributable to the attack of several organisms. The objective of this work was to identify the insects that cause damage to *Pinus pseudostrobus* in pine forest fragments in the *Plan de Guadalupe* community, in addition to evaluate the level of infestation. Three 400 $m^2$ sites were established to record the number of pitch masses on the stem, the normal diameter and other symptoms to determine the damage degree of each tree. Larvae and pupae were collected for their taxonomic determination. The pine pitch moth or pine borer *Synanthedon cardinalis* was the insect present in the stem of living pine trees in the study community. This is the first record of the species in the community of *Plan de Guadalupe* and for the state of *Guerrero*. It was observed that the larvae produce pink pitch masses, in addition, as they grow, they form tunnels in the phloem and the cambium area. The infestation level of the three sites was 9.09 %. The average height of the location of the pitch masses was 70.9 cm and the average number of pitch masses was 2.81.

**Key words:** Pine forest, infestation, *Montaña de Guerrero*, forest pests, symptoms, *Synanthedon cardinalis* (Dampf, 1930).

**Resumen**

En los últimos años, se ha observado en los bosques templados de la Montaña de Guerrero a pinos con marchitez, amarillamiento del follaje, tallos secos y algunos individuos muertos; síntomas atribuibles al ataque de diversos organismos. El objetivo de este trabajo fue identificar a los insectos causantes del daño en *Pinus pseudostrobus* en fragmentos de bosque de pino en la comunidad Plan de Guadalupe, además de evaluar el nivel de infestación. Se establecieron tres sitios de 400 $m^2$ para determinar el nivel de daño de cada individuo, registrar el número de grumos en el fuste y el diámetro normal. Se recolectaron larvas y pupas para su determinación taxonómica. La palomilla resinera o barrenador de pino *Synanthedon cardinalis* fue el insecto presente en el fuste de los árboles vivos de pino en el área de estudio. Este es el primer registro de la especie en la comunidad Plan de Guadalupe y para el estado de Guerrero. Se observó que las larvas producen grumos de resina color rosado, además al crecer forman túneles en el floema y la zona del cambium. La infestación en los tres sitios fue de 9.09 %. La altura promedio de ubicación de los grumos fue de 70.9 cm y la media del número de grumos de 2.81.

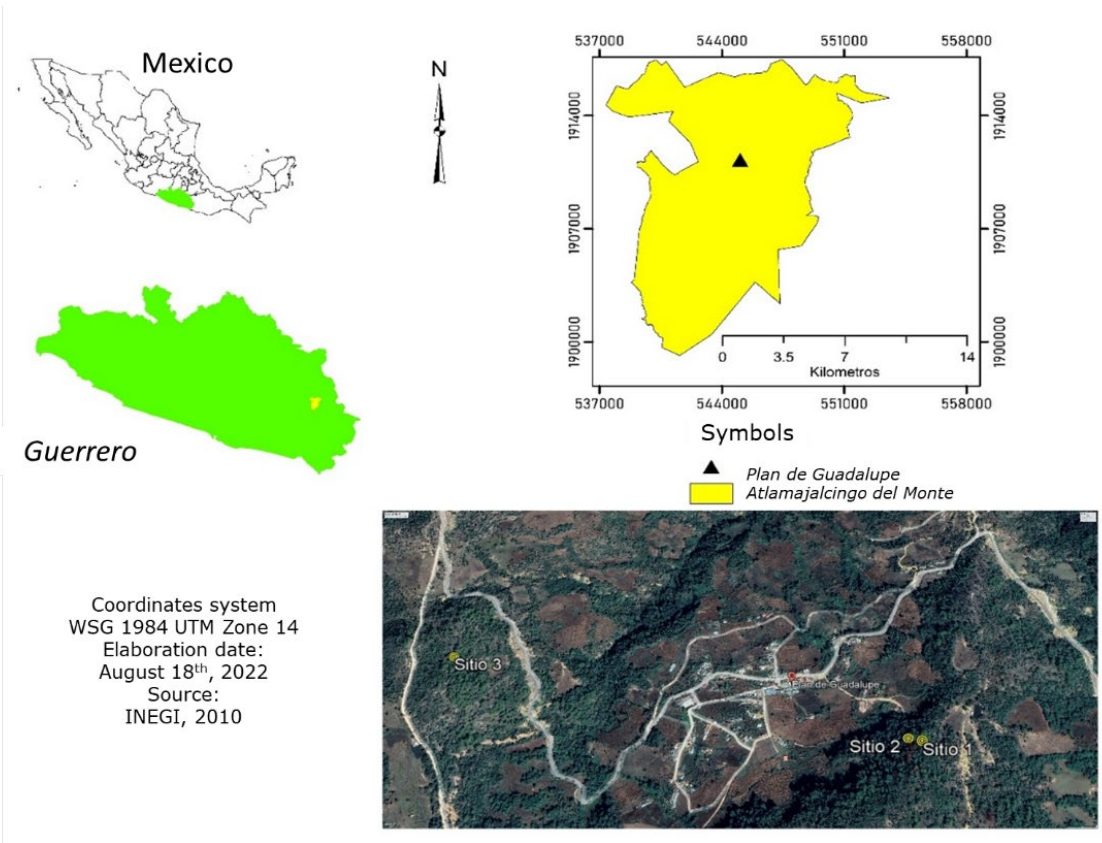
**Palabras clave:** Bosque de pino, infestación, Montaña de Guerrero, plagas forestales, síntomas, *Synanthedon cardinalis* (Dampf, 1930).

In the state of *Guerrero*, 4.3 million hectares of forest ecosystems have been documented (67 % of the state territory), 1.9 million (30 %) are temperate forests prone to attack by borer insects, defoliators, bark beetles, parasitic plants and some diseases (Consejo Civil Mexicano para la Silvicultura Sostenible A. C., 2008). In the case of borers, the affected area until 2020 was only 45.69 hectares (Conafor, 2021). These organisms include many Lepidoptera and Coleoptera species that are economically important to many forest species, particularly pines. In regard to harmful Lepidoptera, Tortricids included in the *Apolychrosis* (Amsel, 1962), *Choristoneura* (Lederer, 1859), *Eucosma* (Hübner, 1823), *Retinia* (Guenée, 1845) and *Rhyacionia* (Hübner, 1825) genera (Lepidoptera: Tortricidae) are mentioned; likewise, species such as *Synanthedon cardinalis* (Dampf, 1930) (Lepidoptera: Sessidae) have been recorded only for some Mexican states, although Cibrián *et al.* (1995) do not give them economic significance.

In the aforementioned entity, the borer species have not been fully identified. Likewise, the estimate of their damages has not been documented either, despite the relevance of the pines in the communities of *La Montaña* region, where its inhabitants use their wood for house building and fuel, in addition to the fact that its commercialization they obtain an economic income that contributes to family finances.

In *Plan de Guadalupe* community, at *Atlamajalcingo del Monte* municipality, *Guerrero*, Mexico larvae of an insect have been observed that damage pine trees, which present withering and some of them become standing-dead; this situation has disturbed the residents of the town, because they are losing vegetation cover. Therefore, the objective of this work was to identify the insect that causes damage to pine trees, as well as to assess the infestation degree in forest fragments of the community under study.

*Plan de Guadalupe* belongs to the *La Montaña* region; It is located at 2 050 masl, between 17°10' and 17°21' N, 98°30' and 98°39' W; it is bordered to the north by *Malinaltepec*, *Copanatoyac* and *Xalpatláhuac* municipalities, to the east by *Xalpatláhuac* and *Metlatónoc*, to the south by *Metlatónoc* and *Malinaltepec*, and to the west by *Malinaltepec* and *Copanatoyac* (Inegi, 2022) (Figure 1).




Sitio = Site

**Figure 1.** Location of the sampling sites of a pine borer, in *Plan de Guadalupe* community.

The type of climate in the community is C($w_2$)(w) corresponding to temperate sub-humid with summer rains (INEGI, 2008). The dominant vegetation is pine-oak and oak-pine forest (Inegi, 2022).

Three sampling areas were selected, in agreement with the community authorities, based on the presence of pine trees with yellowish and/or dry foliage, resin on the stems and small holes. The above symptoms occur in patches of the forest, so the sampling areas had different sizes and shapes, two of them only 50 m apart and the third 2 km away from the previous two (Figure 1). In each area, a 400 $m^2$ quadrant was established, where three samplings were carried out on different dates (March, April and September 2021), based on the methodological proposal of Pacheco-Flores *et al.* (2006).

For the description and determination of the infestation level, the following procedure was carried out: a) Registration and marking of the damaged pines based on the presence of lumps on the stem, b) Counting the number of lumps and the height at which they were located, and c) Categorization of the level of infestation adapting the classification proposed by Billings and Espino (2005) for barking insects:

Level 1: The tree has a green crown and lumps of fresh resin.

Level 2: The tree is infested by larvae inside the bark, it presents a yellowish crown with dry and hard lumps along the stem.

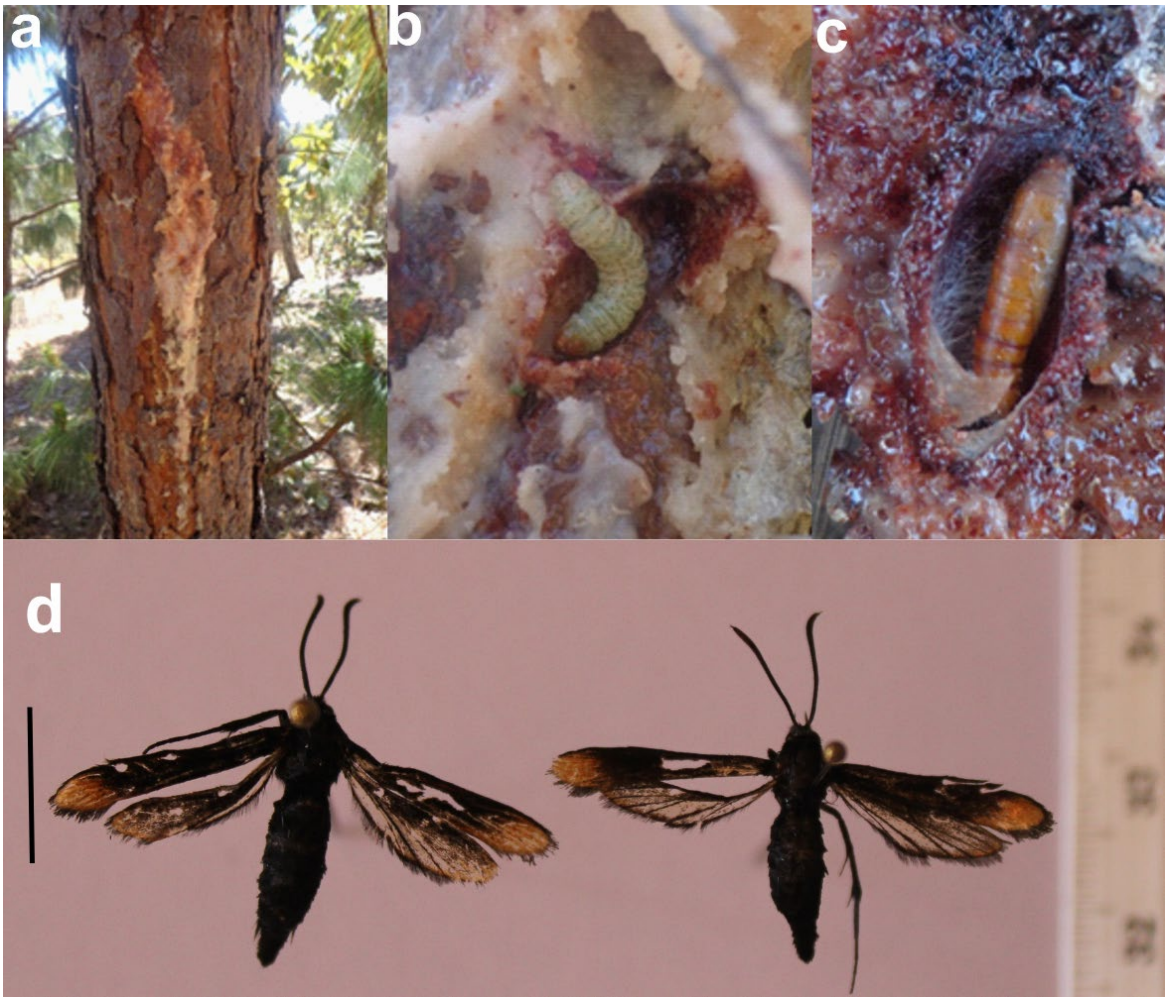
Level 3: It is characterized because the tree has a reddish or brown crown, as well as dead trees without leaves.

Based on the methodology proposed by Márquez (2005), the larvae were extracted from the affected stems with a *machete*, the damaged bark was removed to locate their location, they were taken with forceps to deposit them in transparent jars and later they were transferred to the Laboratory of Entomology of the *Universidad Intercultural del Estado de Guerrero* (UIEG) (Intercultural University of the State of *Guerrero*, UIEG) to process and fix them in 70 % alcohol. In addition, pupae were

collected and monitored every three days, until the emergence of the adult in the months of May and June.

For the determination of the species, bibliographic material from Cibrián *et al.* (1995; 2015); likewise, adults reared in the laboratory were compared with the description of Beutelspacher (1983) and Hernández (1983). The collected specimens were stored in the biological collection of the Laboratory of Entomology of the *Universidad Intercultural del Estado de Guerrero* (UIEG) (Intercultural University of the State of *Guerrero*).

The insect responsible for the damage to the pine trees in the study community corresponded to *S. cardinalis*, commonly known as the resin moth or pine borer. The species was collected from the stem of the trees with the presence of light pink lumps of resin. It was observed that the developing larva builds tunnels in the phloem and the cambium area (Figure 2). The pupae are reddish-brown in color, averaging 1.5 to 2.0 cm in length and 0.5 cm in width. The adults are moths that measure between 2.5 and 3.0 cm of expansion; the wings have reddish-orange scales and black venation. It is the first record of *S. cardinalis* as a pest species of forest importance for the state of *Guerrero*.




a) Resin on the stem b) larvae, c) pupa and d) adult. The scale bar for d) equals 1 cm.

**Figure 2.** Symptoms and signs of attack by *Synanthedon cardinalis* (Dampf, 1930).

A total of 694 pine trees were recorded in the sampled sites, 64 of which had a borer (9.22 %). Likewise, 59 (8.50 %) of these individuals registered level 1 damage, two (0.28 %) level 2 and two (0.28 %) level 3. In site 1, which had 348 pines, 13 damaged individuals were counted (3.73 %); seven in the first sampling, two in the second, and four in the third. In site 2, with a total of 111 pines, 33 showed infestation (29.72 %) and it was in sampling one when 32 individuals were recognized, while in the third sampling one more case was added. In site 3, a total

of 235 pines and 18 infested (7.6 %) were recorded, in sampling 1, 16 (6.80 %) infested individuals were recorded, and in the last two more pines were added.

The lumps were detected at different heights of the stem, in a range from 0 to 2.5 m above ground level, however, the averages show that in general these were located between 0.5 and 1.25 m in height, without infesting the middle or upper part of the stem (Table 1).

**Table 1.** Characteristics of the *Synanthedon cardinalis* (Dampf, 1930) attack on *Pinus pseudostrobus* Lindl. within three study sites located in *Plan de Guadalupe*.

| Site | Average height (±1*ES*) of lumps presence (m) | Number of lumps per tree (mean+1*ES*) | Normal diametr of host (cm) |
|---|---|---|---|
| 1 | 1.25 (0.102) | 1.75 (0.250) | 6.90 |
| 2 | 0.61 (0.096) | 3.76 (0.656) | 9.70 |
| 3 | 0. 53 (0.131) | 1.78 (0.374) | 11.28 |

*ES* = Standard error.

It was observed that the trees affected by *S. cardinalis* had an average number of lumps per tree between 1.75 and 3.76 (Table 1), which can be designated as a relatively low infestation. Exceptionally, a tree with up to 19 lumps was found at site 2, which undoubtedly influenced the average for that site. The range of the normal diameter of the sampled individuals was from 2 to 36 cm, with an average of 9.6 cm. The averages per site were 6.9, 9.7 and 11.28 respectively (Table 1).

Cibrián *et al.* (1995) reported that *S. cardinalis* in Mexico is not considered a pest of economic importance and they classify it as a kind of secondary borer, which does not cause tree death, which coincides with the results of this study. Peralta-Méndez and Alba-Landa (2004) have documented the death of pine trees in the state of

*Veracruz* (*Naolinco*) caused by this insect, but in the sites of this study the mortality attributed to it was only 0.43 %. However, Del Río (1990) mentioned that the damage caused by the larvae of the resin moth is the primary deterioration, and that it would be enough for a female moth to oviposit in an individual for three generations for it to die, so it is important monitor their and other insects in the temperate forests of the *La Montaña* region.

In the sampled areas of the *Plan de Guadalupe* community, the attacked trees presented dry and fresh pink and reddish resin. Del Río (1990) pointed out for the *Purépecha* forest region, state of *Michoacán*, *S. cardinalis* shows itself along the stem from the ground and congregates in certain places (around the branches), something similar to that identified in the pines of the *Plan de Guadalupe* community. On the other hand, the range (1 to 19) of the number of lumps per individual of *Pinus pseudostrobus* Lindl. is similar to that reported by Ruiz-Montiel *et al.* (2018), who mention 1 to 10 lumps in *P. patula* Schltdl. & Cham. in the center of *Veracruz* State. Furthermore, they recorded similar data on *P. rudis* Endl. and *P. teocote* Schltdl. & Cham.

The average diameter of the attacked trees was 9.6 cm, a value consistent with that described by Ruiz-Montiel *et al.* (2018), who mention that the trees affected by the resin moth had diameters of less than 10 cm.

The height of the clumps recorded in the different individuals was between 0 and 2.5 m; in this regard, Hernández (1983) stated that the damage of *S. cardinalis* in *P. moctezumae* Lamb. they occurred in trees of 10 to 59 cm of normal diameter, with heights of 7 to 12 m, while in *P. patula* it was 1 to 9 m in height. A possible explanation may be that *S. cardinalis* females prefer to oviposit in sites with higher larval activity. Gentry and Wells (1982) mentioned that the resin mixed with larvae feces (lump) stimulates the oviposition of the female of this insect, which indicates that the species of the *Pinus* genus are good hosts. The reviewed and quantified trees showed relicts of dry resin, in addition to alterations or deformities in the stem

and fresh resin, which indicates that the larvae were there before, that they have already emerged and others that are developing.

In *Plan de Guadalupe* community, the economic impact was not estimated and, according to its level of infestation, *S. cardinalis* behaves as a secondary pest. However, it is necessary to carry out monitoring in the studied areas and others in the Mountain Region to know the distribution of this insect and recognize its dynamics.

This record of *S. cardinalis* is the first for the state of *Guerrero*. Likewise, the infestation levels recorded by this insect in the sampled areas confirm that it is not a pest of economic importance in the study area, at present.

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## Conflict of interest

The authors declare no conflict of interest.

## Contribution by author

Ricarda Ortiz Pinzón: design, organization, data collection, information analysis and writing of the manuscript; Marisa Silva Aparicio: design, validation and review of the manuscript; Cutberto Pacheco Flores: design, validation and review of the manuscript.

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