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First Record of *Pristomerus pallidus* (Hymenoptera: Ichneumonidae: Cremastinae) (Kriechbaumer) Parasitizing *Hellula undalis* (F.) (Lepidoptera: Pyralidae) in Crucifer Crop in Senegal

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Abstract

Cabbage is today an economically important crop grown in more than 90 countries around the world. Production is constantly threatened by pests including the cabbage webworm, *Hellula undalis* (F.) (Lepidoptera: Pyralidae) which just one or two larvae can cause severe damage by infesting the growing points or shoots of young plants. *Hellula undalis* is difficult to control by the use of chemical insecticides. The establishment of effective biological control is needed. The parasitoid species *Pristomerus pallidus* (Hymenoptera: Ichneumonidae: Cremastinae) was recorded for the first time in Senegal on larvae of *Hellula undalis* from cabbage fields infested with *H. undalis.* Laboratory observed parasitism was 7.4%. This is the first record of *Pristomerus pallidus* parasitizing *Hellula undalis* from Senegal. Furthermore, studies on the potential regulation of *Hellula undalis* under controlled and field conditions need to be evaluated for utilizing this parasitoid as a biocontrol agent against the cabbage webworm.

Keywords

Biological Control, Parasitoid, Pest, Market Gardening, Ziguinchor, Casamance

1. Introduction

Cabbage is today an economically important crop grown in more than 90 countries around the world [1]. In Senegal, the cabbage culture has an important part in market gardening. Cabbage is cultivated all year long and constitutes one of the main market gardening crops in the Niayes area [2]. In Casamance, market gardening has become an income-generating activity [3]. Cabbage is one of the most commonly grown vegetables. However, insect pests are a major constraint to cabbage production. This crop is frequently attacked by numerous insect pests, including *Plutella xylostella* (L.) the defoliating Lepidoptera [2] and *Hellula undalis* (F.) the drilling Lepidoptera [4], which are very dangerous. The cabbage webworm, *Hellula undalis* is one of the world's most serious defoliators of cruciferous vegetables, especially head cabbage [5]. Chemical control of *H. undalis* is not very effective because the larvae are shielded in a loose web in the growing point (shoot) and have probably acquired resistance to insecticides [6]. In response to these pressures, several methods have been adopted to combat *Hellula undalis*, including the use of neem leaf extracts [7] [8] and the use of intercropping to reduce the population of *Hellula undalis* [9]. Parasitoids have also been used to control *Hellula undalis* larvae [10]. Producers often use chemicals that are sometimes ineffective. Farmers often neglect the role of parasitoids in natural pest control [11]. In a situation of climate change associated with lower harvests, producers are increasingly using pesticides to protect crops. There are many consequences on the environment and on the health of vegetable producers and consumers. The species *P. xylostella* is difficult to control because it can often develop insecticide resistance [12] [13]. In the same way, *Hellula undalis* is also a pest that is difficult to control through the use of chemical insecticides [14]. The aim of this study was to find indigenous parasitoids that could potentially be used for biological control of the cabbage webworm.

2. Materials and Methods

2.1. Sampling Site

This study was conducted in three localities in the southern region of Senegal from May to September 2017. The locality surveyed was Bignona. The climate in this area is Sub-Guinean and is characterized by one rainy season (June-October) and one dry season (November-May) The larvae of *H. undalis* were collected from the market garden perimeter of the agricultural farm located in the village of Kafesse (12˚52'43.46"N 16˚09'33.91"W elevation: 24 MSL).

2.2. Sampling and Monitoring *Hellula undalis* Larvae

Larvae of *H. undalis* were collected from a cabbage field. When the pests were observed, field sampling was carried out. We conducted random and sporadic surveys in vegetable brassica fields to identify the occurrence of parasitoids on cabbage web worms.

The sampled larvae were brought back to the laboratory where they were fol-

lowed until the emergence of moths or parasitoids for parasitized larvae. Monitoring was conducted under laboratory conditions (25˚C ± 2˚C, 70% ± 5% RH and 12L: 12D). The parasitism rate was calculated by dividing the number of parasitized larvae (determined by parasitoid emergence, excluding dead larvae without parasitoid emergence) by the number of larvae collected, expressed as a percentage. For monitoring, the sampled larvae were individually placed in plastic pots and fed with fresh cabbage leaves until pupation. Pupae were also placed individually in plastic pots and followed until the emergence of the adult Lepidoptera.

2.3. Conservation and Identification of the Parasitoids

Emergent parasitoids were collected and introduced into a vial containing absorbent paper and ethyl acetate to kill them and facilitate their conservation and identification. After 48 hours, they were placed on cotton diapers. The "Dino-Capture" camera version 2.0 was used to better visualize and photograph parasitoids in the laboratory. Emerging parasitoids were individually conserved (in 1.5 ml microtubes with ethanol 70%) for further identification based on morphological characters (with the help of G. Delvare, CIRAD-UMR CBGP, Montpellier, France). For identification, the insects were observed with the "Dinolite" magnifying glass version 2.0. All adult insects obtained during this study were morphologically identified by using identification keys of Delvare and Aberlenc (1989) [15], while other specimens were preserved in the Laboratory of Integrated Production and Protection in Agroecosystem (L2PIA) of Cheikh Anta Diop University in Dakar.

3. Results

In May 2017, parasitoids *Pristomerus pallidus* (Hym.: Ichneumonidae: Cremastinae) were recorded for the first time in Senegal on larvae of the pest *Hellula undalis* (Lep.: Pyralidae). The species *P. pallidus* emerged from the larvae of the pest *H. undalis* (F.) followed in the laboratory for the determination of the parasitism rate. A total of 170 *Hellula undalis* larvae were collected from focal fields. The parasitism rate was 7.4%, with only 12 recovered parasitoids. Female has a long ovipositor (**Figure 1**).

4. Discussion

Pristomerus pallidus is moderately small to moderately sized (6 - 8 mm long); yellow to reddish overall with variable dark markings on first tergites and often around scutellum [16]. Clypeus is strongly transverse, densely but very shallowly punctate; malar line moderately long to long; remainder of head coriaceous to punctate-granulate; occipital carina joining hypostomal carina shortly above mandible base; antenna long with 28 - 35 flagellomeres. To date, no effective parasitoid has been identified. This is the first record of the species *Pristomerus pallidus* as a parasitoid of the pest *H. undalis* in Senegal. The female can actively

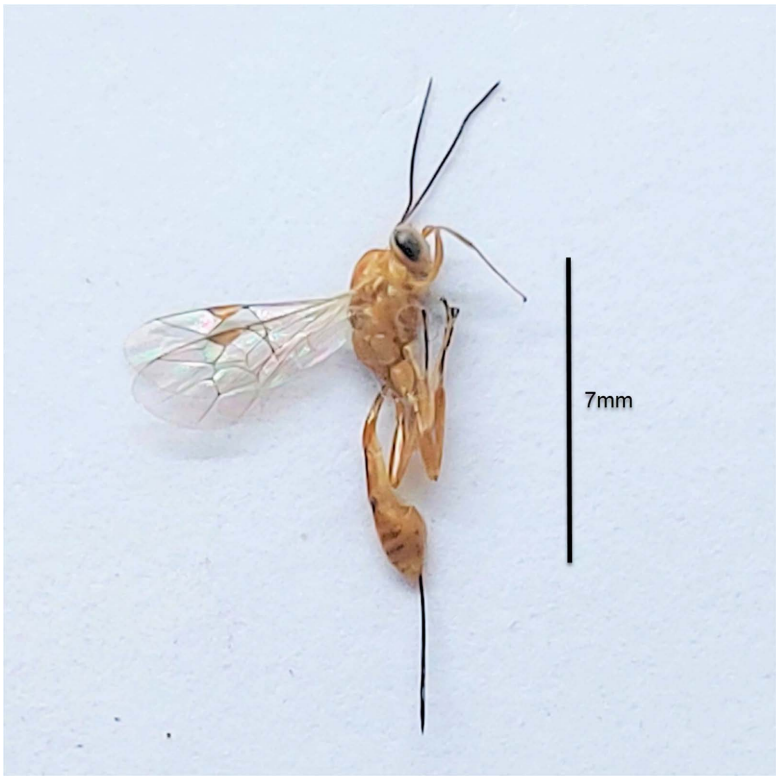

Figure 1. *Pristomerus pallidus* female lateral habitus.

bend the ovipositor tip and thus to forage more efficiently within the host's hideaway [17]. This ovipositor makes it possible to reach larvae of the pest especially since they are most often housed in the heart of the cabbage. This species' ability to parasitize *H. undalis* larvae despite their inaccessibility is partly due to the presence of this long ovipositor. Indeed, *H. undalis* larvae most often occupy the central bud of the cabbage plant. The larvae, most often housed inside the cabbage, are difficult to reach by parasitoids, predators and insecticides. In addition, *H. undalis* is a pest that is difficult to control through the use of chemical insecticides [14]. The parasitoid *P. pallidus* is reported to be a potentially useful host for biological control. The parasitoid *P. pallidus* is a common species in Africa with many known hosts [16]. New species of the genus *Pristomerus* are reported in Africa and especially in the Afro-tropical region [16] [18]. In West Africa, more specifically in Côte d'Ivoire, *P. pallidus* has been found on the pest of the rice "boron" plant [19]. The genus *Pristomerus* includes nearly 100 species described worldwide [20] and are parasitoids of many insect pests [21]. Among parasitoid wasps, Ichneumonidae is the most important family with nearly 25.000 species described [20]. These Ichneumonidae parasitoids are widespread throughout the world and play an important role in the natural regulation of arthropods in agricultural ecosystems [22]. Many of these Ichneumonidae are probably still not described [23] or not reported, especially in Africa where most African insect families are still very poorly known [24]. New descriptions of Ichneumonidae are being made in Africa [18] [25] [26] [27], in Europe [28] [29] [30], in Amer-

ica [31] [32] and in Asia [33] [34]. Rousse and Van Noort (2015) report that in Senegal, paralectotypes of *Prisomerus cunctator* were observed on the larvae of *Rhaguva* sp. and *Rhaguva albipunctella* [ex millet ears with *R. albipunctella* larvae]. In Senegal, *Pristomerus pallidus* is reported on the larvae of the millet head miner *Heliocheilus albipunctella* [35] and on the tomato leafminer *Tuta absoluta* [36], but never on the cabbage webworm larvae, *Hellula undalis*. To date, no effective parasitoid has been identified as a parasitoid of *Hellula undalis* in Senegal.

5. Conclusion

The present study is the first detection of *P. pallidus* as a parasitoid of the pest *H. undalis* on the cabbage field in Senegal. The preliminary study on the occurrence of *P. pallidus* suggests that this parasitoid is a potential biological control agent of the cabbage webworm. Conservation and augmentation of the parasitoid are required to reduce the cabbage worm infestation. Furthermore, studies on the potential regulation of *Hellula undalis* under controlled and field conditions need to be evaluated for utilizing this parasitoid as a biocontrol agent against the cabbage webworm.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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