

## Life cycle of *Aiolopus strepens* (Latreille, 1804) (Orthoptera, Acrididae) in different habitats Mitija (Algeria).

<sup>1</sup>Kamel Hamadi, <sup>2</sup>Nora Chahbar, <sup>3</sup>Juan Jose Presa Asensio & <sup>4</sup>Bahia Doumandji-Mitiche

<sup>1</sup>USTHB, Faculty of Biological Sciences, Biodiversity and Dynamics Laboratory. B.P. 32, El Alia, Algiers, Algeria.

<sup>2</sup>University M'hamed Bougara of Boumerdes, Faculty of Sciences, Department of Agronomy, Algeria.

<sup>3</sup>Catedrático de Universidad Facultad de Biología Departamento de Zoología y Antropología Física, España.

<sup>4</sup>Department of Agricultural and Forest Zoology, National Agronomic Higher School, Algiers, Algeria.

### Address For Correspondence:

Kamel Hamadi, USTHB, Faculty of Biological Sciences, Biodiversity and Dynamics Laboratory. B.P. 32, El Alia, Algiers, Algeria.  
E-mail: hamadikamel@yahoo.fr

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### ABSTRACT

*Aiolopus strepens* (Latreille, 1804) is a common species throughout the Mediterranean region. Its reproductive cycle, like any other locust species, often depends on climatic conditions and food availability, remains poorly known in its range. A study on the phenology of this species was carried out in three types of environments Mitija (northern Algeria): A lawn in El Harrach, a cultivated area in Ain - Taya and fallow land in Baba Ali. The survey period spanned from November 1996 to October 1997. The number of individuals sampled is 582 including 227 adults and 355 larvae. During our surveys on land and after identification of the sampled orthopterological wildlife, we noted two distinct periods of occurrence of larvae of 1st, 2nd and 3rd stage, in autumn and spring. The results were compared with those described by some authors working on orthopteric bioecology stands in Algeria and other countries. These results revealed that the species *Aiolopus strepens* presented a succession of two generations, completing its life cycle twice a year, which confirms that it is bivoltine.

**KEYWORDS:** *Aiolopus strepens* (Latreille, 1804), phenology, Mitija, larva, bivoltine.

### INTRODUCTION

*Aiolopus strepens*, is a species of the subfamily Oedipodinae. It is widespread throughout the Mediterranean region until Asia Minor [9], often reported throughout southern Europe, North Africa and Near East [11]. Climatic factors play an important role in the spatial distribution of species [14]. Currently *Aiolopus strepens* is extending northward, probably thanks to the contemporary global warming [4]. It was discovered for the first time in Vendée (France), on 21 II 2012 in an old quartzite quarry in the town of Cheffois [4]. It is very common in Corsica, back dunes of the coastal zone to zone mountain where it reaches 1240 meters altitude [8]. This species is not mentioned in the list of Orthoptera identified in the Rhône department (France) by Girod et al. [17]. In the same department, Bouniol et al. [7] confirm that this species is poorly known, except for few mentions scattered throughout the southern half of the department. Ladron de Guevara et al. (1992) report that *Aiolopus strepens* is a very common species in the Iberian Peninsula, being in all types of habitats: meadows, uncultivated fields, moors, humid areas...

In Algeria, *Aiolopus strepens* has a wide distribution. It is mentioned in various biotopes along rivers, gardens, irrigated crops near Sebkhass or Chott [16], at the Oasis [35,12], in the regions of Biskra, Adrar and Tamanrasset [13] and even the Ahaggar National Park, the largest mountain range in the extreme south of Algeria [25]. This species can confine several habitats, but has a high affinity for cultivated area which are often open and mesohygrophiles. In the region of El Aouana (Jijel) Tekkouk [34] ranked *Aiolopus strepens* the first in

the cultivated area compared to other orthopterologic species, and in Ain-Taya, the previous case has presented a constancy of 100% in cultivated lot [20]. The vast majority of Orthoptera species overwinter in the egg stage. At hatching, the larvae begin their growth which will be a little bit longer to reach the imaginal stage [30]. In the case of *Aiolopus strepens* the work of Hamdi [22] in the northern mid region of Algeria, Benrima [2] in the region of Kolea and Douadi in the region of Ghardaia indicated that the adults of this species are present throughout most of the year, however; the larvae begin to appear in April. Bounechada et al. [6] put *Aiolopus strepens* with embryonic diapause species presenting one generation per year. Similarly, in the region of Koléa and Soumaa Guendouz-Benrima et al. [18] observed a single generation per year with a shifted phenology of larvae, they report that the population of Kolea is ahead compared to Soumaa. Murcia (Spain), Hernández y and Presa [24], relate that *Aiolopus strepens* appears during two long periods of the year, from April to March and from July to December. Similarly, for two species of the genus *Aiolopus*, Mestre [28] reports that *Aiolopus simulatrix simulatrix* has two generations per year with imaginal arrest of development in the dry season. The same author reports that *Aiolopus thalassinus thalassinus* has a continuous reproduction with three generations per year, at least in the northern part of the air distribution. Thus, Duranton et al. [15] state that for the same species the number of generations can be variable depending on the region where the population grows or on annual weather patterns. In this respect, our work focuses on the study of the life cycle of *Aiolopus strepens* in three different areas of Mitija over a period of 12 months, taking into account the juvenile to provide more details on the number of generations per year that has this species.

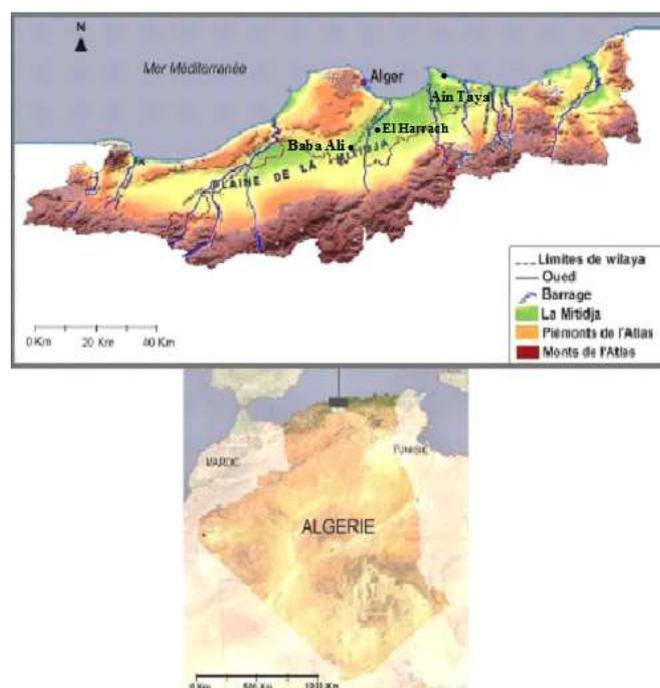
## MATERIALS AND METHODS

### 1. Study Sites:

Mitidja is the largest subtidal plain in Algeria. It is separated from the sea by the ride of the Sahel. South and on the eastern and western margins, Mitija is bordered by a range of mountains. Northwest and west the plain is bounded by the Djebel Chenoua (905m) Bou-Maad chain and Jebel Zekkar. Finally, what are the heights and hills of Lower Kabylia which close the plain to the east [29] (Fig.1).

The study surveyed stations are represented by three different habitats of Mitija. They are geographically distant, it is a fallow plot located Baba Ali (36° 42 ' 59" North, 3° 9' 00" East), a lawn at the National Agronomic Higher School, El Harrach (36° 43 ' 16" north, 3° 18' 15" east) and plots cultivated mainly potatoes, peas and zucchini located in the region of Ain-Taya (36° 47 ' 00" north, 3° 14' 00" east) (Fig.1).

The calculation of the average monthly temperatures and precipitation of study stations shows a minimum monthly average of 11° C and 11.85° C respectively for the years 1996 and 1997 and a maximum monthly average of 25.5°C recorded in the month of August of two consecutive years. Similarly, a cumulative rainfall of 808mm recorded in 1996, which decreased to 527mm for the following year. It should be noted that our study areas belong to the bioclimatic sub-humid warm winter floor [33].



**Fig. 1:** Location of the study area

## 2. Methodology:

### 2.1. Sampling:

The sampling method we used in this study is that of sweep netting [27]. Twelve outputs for each area of study have been completed since November 1996 to October 1997. On the field, we first began by choosing a definite location of 500 m<sup>2</sup> where conditions appeared almost homogeneous. Using lightweight panels, we outlined five small areas of 9 m<sup>2</sup> called quadrats, in which we captured all these grasshoppers by hand or sweep net. The *Aiolopus strepens* adults were easily recognized, determined and released immediately, however; juveniles were placed in plastic bags and transported to the laboratory to be identified under a dissecting microscope by checking the morphological characteristics of each individual in order to confirm its belonging to the species and to clarify its larval stage. Individuals which flew out of quadrats were pursued and captured to be a reliable workforce of each survey site.

### 2.2. Species identification:

*Aiolopus strepens* is a species of medium size, 18 to 20 mm in males and 21-28 mm in females, with a pronotum with a subangular posterior edge. Individuals of this species are easily recognized on ground with their hind tibia only slightly shorter than the hind femora, red with a yellow ring at the base and normally equipped with 10 spines at the outer edge (sometimes 11) and 11 spines on inner edge. The wings are bluish color to the base (rarely greenish-blue), and usually with a clear dark apical spot, but sometimes slightly marked [9,10]. Furthermore, the identification of larvae sometimes requires observation under a dissecting microscope to clarify the larval stage. Indeed, on the chest of the juveniles a significant change is noted, it consists in the appearance of the organs of flight. The new born larva shows no trace of elytra or wing. These organs begin to appear after one or two molts, as expansions of lateral-posterior edge of meso and metanotum. These wing buds, after being extended, they are turned with their underside and consequently wings partially covering the elytra [9]. During early larval stages, wing buds of tegmens and hind wings are juxtaposed while tegmens at least partially cover the hind wings of adults. During the last larval stages, the hind wings overlap the tegmens. They are then provided as longitudinal grooves without cross venation [30]. For the last molt, flying body undergo a new reversal that puts them in their final position, the elytra covering the wings [9].

## RESULTS

During the months of orthopterologic prospection, 36 surveys were conducted on a total number of individuals *Aiolopus strpens*, 162 larvae and 90 adults for lawn areas (Fig.2), 103 larvae and 61adultes for cultivated land (Fig.4) and 90 larvae and 76 adults for the fallow land (Fig.3).

In the three aforementioned types of environments, adults of this species are present throughout most of the year except for the month of April when we did not notice any adult individual. However, for the same month the number of different larval stages captured were 38 individuals, 10 individuals and 24 individuals respectively lawn, fallow land and cultivated areas. Adults of *Aiolopus strepens* are less frequent in winter and spring periods in cultivated fields, and this is due to cultural practices and chemical treatment of plants often disturbing the habitat of this species.

The larvae of the 1st, 2nd and 3rd stage were also identified and confirmed for November and December of the year of sampling, even those of the 4th and 5th stages are also contacted for the same period in the cultivated areas, indicating that spawning occurred before, probably in September or early October.

In general, the species has been contracted under both adult and larval forms throughout the sampling period, except in the fallow land where *Aiolopus strepens* shows overwintering as adults, including January, February and March.

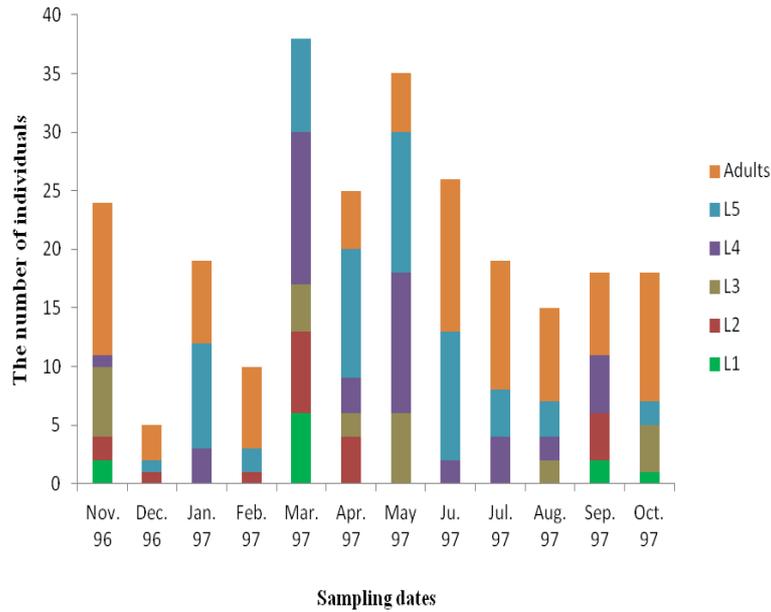


Fig. 2: According to *Aiolopus strepens* adults and larvae periods recorded in a lawn area (El Harrach) (Original)

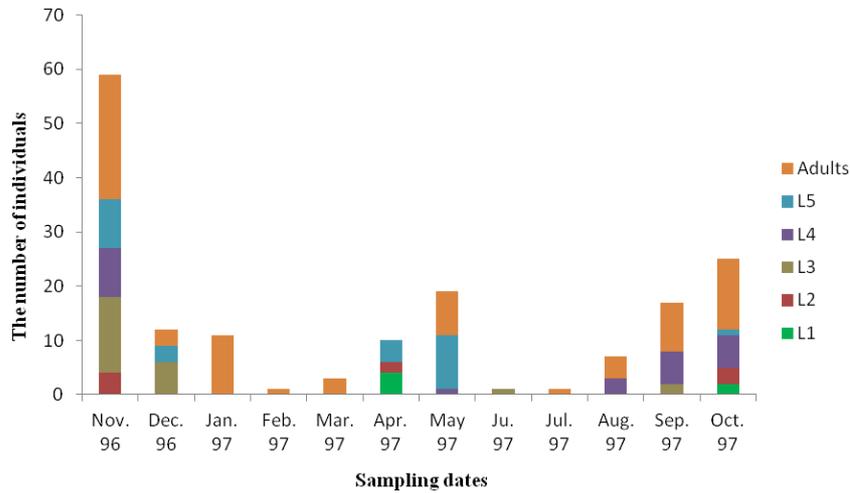


Fig. 3: According to *Aiolopus strepens* adults and larvae periods recorded in a fallow land (Baba Ali) (Original)

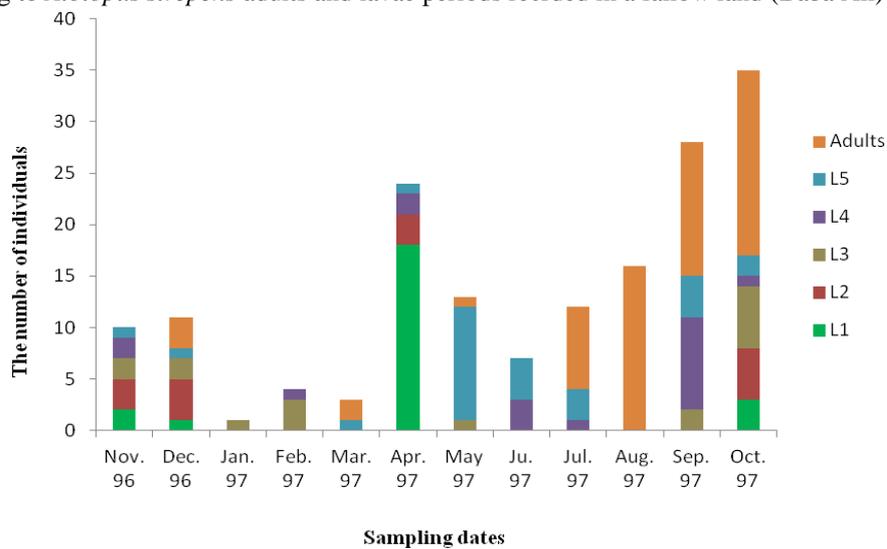


Fig. 4: According to *Aiolopus strepens* adults and larvae periods recorded in a cultivated area (Ain-Taya) (Original)

## DISCUSSION

The adult *Aiolopus strepens* are present at the study sites during most of the sampling period. The largest number of mature individuals was often recorded during summer- fall with a staff of 13 individuals in July and October respectively for lawn and fallow areas, and 18 individuals in October for the cultivated area. These results are consistent with those reported by Fellaouine [16] in the region of Sétif, Hamdi [23] in the Algerian coast and Zergoun [36] in the region of Ghardaia. These authors noted the presence of adults *Aiolopus strepens* for most of the year with only one generation per year (univoltine) in imaginal hibernation. Rouibah and Doumandji [31] reported that *Aiolopus strepens* part of orthopterological species that dominate the region Gerrouch (Jijel), stating that it was captured along the year, even during the winter diapause. In the region of Cape Djinet, Hamadi et al. [21] classify *Aiolopus strepens* ubiquitous in the prospected environment. The juveniles of this species appear only in the late summer and fall and come to spend the winter to breed the following spring (April-May) [4]. In southern Spain, *Aiolopus strepens* appears to have two generations per year, the first appearance of larvae in March which marks the first generation, while adults are noted in April. In the second generation, the cycle starts again from July to December with a dense stand and between these two periods the species is in hibernation; and the two generations overlap and adult individuals met throughout the year [24,26]. Females dissected of this species in September showed the presence of ovarioles filiform whitish, thus indicating that they may have just suffered fledging [1,31]. Moreover, Hacini [19] reported that in mid March to the end of this month, the females of this species have basic previtellogenesis oocytes and vitellogenesis.

The time tracking of individuals of this species reveals an almost permanent presence of juveniles at different stages, with the exception of the fallow area showed no larvae during the winter. The presence of larvae of 1st and 2nd stages remains an inescapable evidence of the reproduction of the species. At the three surveyed areas, the first instar larvae were captured from October 1997 or even November and December 1996, this confirms that spawning occurred well before probably September or late August. The larvae of the second and third stages were taken during most of the fall period and even early winter (January-February). Benrima et al. [3], who worked on the reproductive activity of female *Aiolopus strepens* diet based show that the onset of vitellogenesis is related to the amount of food ingested, which is in turn based on the amount of water absorbed at the first rains during September. There are differences in the life cycles of different species of Orthoptera from one station to another and from one year to another depending on environmental factors such as temperature, rainfall, the moisture content of the soil, vegetation and the degree of human activity [6]. A second period of occurrence of larvae of 1st and 2nd stages was observed in the spring and more specifically in late March, April and May in the three surveyed areas. The largest number of larvae of the first stage is noted for the cultivated fields located in Ain-Taya with 18 individuals and the cultivated land remains a favorite area for this species as they can provide vegetation and a suitable rate of humidity for the reproduction of this insect. It is clear from these results that *Aiolopus strepens* which was considered as a univoltine species has presented two generations for two different periods of the year, in autumn and spring, this is confirmed by the identification of juvenile 1st, 2nd and see the same 3rd stage present during these two periods in the three studied environments, despite the existing ecological station differences. So we can say that the surveyed area *Aiolopus strepens* is considered bivoltine since it reproduces twice a year.

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