BROWN MARMORATED STINK BUG (BMCB) IN THE CONDITIONS OF ROMANIA VS ALGERIA

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Abstract. *Through this work we want to do a comparative study between the distribution of Halyomorpha halys species in Romania and Algeria. We are also considering the exposure of the host plants through updating. The aim is to see if there are differences or similarities in frequency and feeding behavior in the two mentioned countries, considering that they are part of 2 different climatic zones. The species originating from China, arrived in Romania in 2015 and in Algeria much later, in 2021. Our searches showed that it is widespread all over Europe and only in 2 countries in North Africa. Which entitles us to note the ability to move or spread through the plant trade, most likely through Spain, which is very close to Algeria. It is clear that in Romania, the Brown marmorated stink bug (BMSB) species is much more advanced in terms of population size, but especially the range of host plants. So, 33 preferred plant species were identified in Romania but for Algeria the situation is still uncertain, which is explainable due to the recent entry. However, it is expected that the evolution in Algeria will be much faster as it is known that there are species that prefer heat and sunny days. Comparing the different climatic zones of the 2 countries, it can be concluded that BMCB is very adaptable to new conditions, from temperate continental ones to warm Mediterranean ones. And these will be new subjects of study for the scientific world, if it stops expanding considering the very high temperatures in the central and southern part of Algeria.*

Keywords*: BMCB, pest, spreading, host plant, climatic conditions.*

INTRODUCTION

Brown marmorated stink bug (BMCB) known by the scientific name of *Halyomorpha halys* is an insect of the order Hemiptera, family Pentatomidae. This, originally from Asia (China) (JOSIFOV AND KERZHNER, 1978), has experienced a spectacular expansion over time, managing to be present on most continents (Asia, North America, South America, Europe and Africa) (HOEBEKE AND CARTER, 2003; CALLOT AND BRUA, 2013; DE MICHELE AND GROZEA, 2018; GAO ET AL., 2019; GYAWALI ET AL., 2019; LOONEY ET AL., 2019; KONJEVIC, 2020; EPPO, 2021).

In Europe, from 2004 until now, it has expanded almost everywhere except the northern part. Recently, it has been sown in the Canary Islands and Madeira (VAN DER HEYDEN AND PETROVAN, 2023; GASPAR ET AL., 2023).

In Romania it was reported for the first time in 2015 in the middle of the country and from there it spread to other regions so that the picture is quite vast at the present time (MACOVEI ET AL., 2015; CICEOI ET AL., 2017; GROZEA ET AL., 2022). The pest has been reported on numerous host plants in Romania until now, from vegetables, to fruit trees, ornamental plants and woody plants from various areas (NEACSU AND GROZEA, 2019; MITREA AND STAN, 2019; GROZEA AND COSTEA, 2020; VIRTEIU ET AL., 2022; GROZEA ET AL, 2022).

In Africa, it has been reported in Egypt (GADALLA, 2004) and in last years, in 2 regions in the north, the first time in Morocco (NOUERE ET AL., 2019) and then in Algeria (EPPO, 2021).

In Algeria, the insect was observed 6 years later, by reporting a single adult in the northern area (Skikda city) (VAN DER HEYDEN, 2021; EPPO, 2022).

For Africa, although the species is present, no host plants have been officially identified, at least to our knowledge, as there is no information in the specialized literature.

Bearing in mind the already mentioned, we focused our attention on this species with invasive and harmful phytophagous status and especially on the ability to adapt to new geographical areas and implicitly to new species of plants to ensure their feeding.

The current worldwide distribution can be found in figure 1, as well as the study sites in the 2 countries belonging to 2 neighbouring continents.

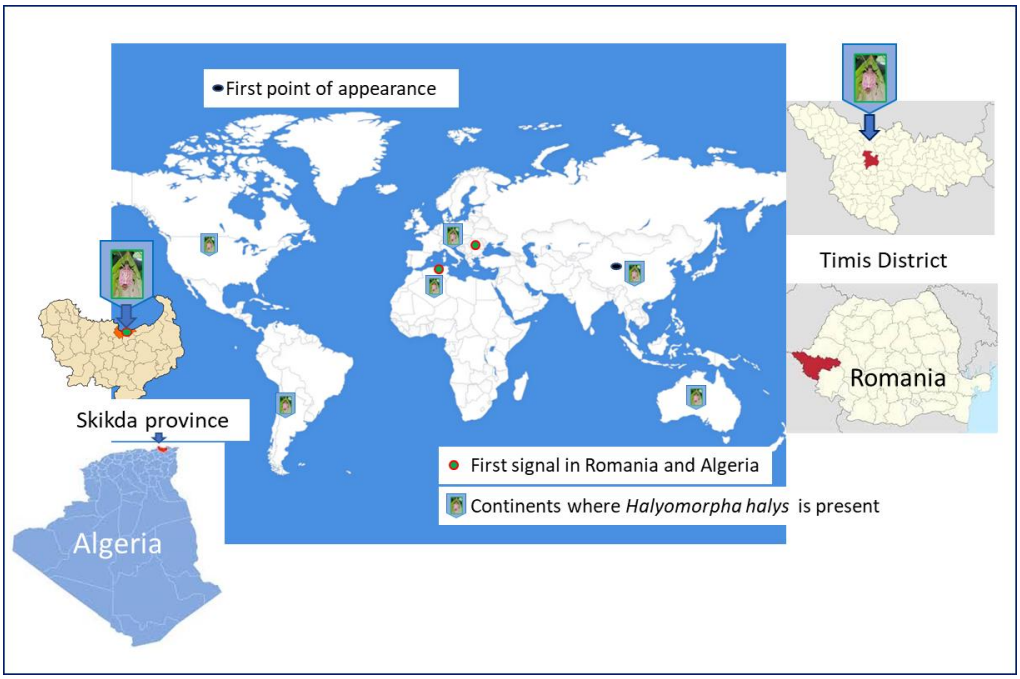

Figure 1. Distribution of the species *Halyomorpha halys* in the world; study areas in Romania and Algeria; the maps worked on by authors were taken from the public domain

This work is actually a search for information combined with own observations for 2 regions where the invasive insect *Halyomorpha halys* is present and can become dangerous in the absence of adequate management.

MATERIAL AND METHODS

The places of observation

About 2 areas were taken into account, one for the on-site study (Timisoara, Romania) and one for the analysis of the existing informative material (Skikda, Algeria) (figure 1).

I order to establish host plants were analyzed combined (information collected from specialized literature and direct observations) and compared through existing studies but also done on site in an area where the pest is present in abundance.

Observations on the spot

In the University Park (USVT) in Timisoara (about 2 ha) and in the Botanical Park (surface of 9.8 ha), we made biweekly direct observations between April 1 - May 7 (5 weeks) from the year 2023. Special containers for large insects were used for collection. They were transported alive to the laboratory to be classified.

Plants subject to observation

From the range of plant species existing in the parks, 23 species (grasses, shrubs and trees) were subjected to macroscopic observations. Only by simply viewing a passage in the time interval 14-17 (both sunny days and cloudy days).

Figure 2. Detailed analysis of samples in the Phytosanitary Diagnosis and Expertise Laboratory (ULS Timisoara) in order to identify the pest

Identification studies

In order to identify the specimens found, I used a binocular magnifying glass as well as other additional tools from the Phytosanitary Diagnosis and Expertise Laboratory (within the ULS Timisoara) (figure 2).

Environmental factors

In Timisoara, the average annual temperature in recent years was somewhere around 16°C and rainfalls about 5 l/m^2, July being the warmest (with a monthly average of 22°C) and January being the coldest with an average temperature of around 2°C. For Algeria, the average temperature values are around 20°C and the rainfalls is 7.6 l/m^2. The coldest month being February (12°C) and the warmest is August with about 26°C.

RESULTS AND DISCUSSION

The first reports in the 2 countries under analysis showed that the species *Halyomorpha halys* does not take into account the climatic conditions, considering that in Romania it appeared in a central area (Transylvania) (MACAVEI ET AL., 2015) with an annual average temperature of 8-9°C and in Algeria in a northern area (Skikda) (VAN DER HEYDEN, 2021; EPPO, 2022) with an average of 19°C (table 1).

Table 1

The status (history) of the species in the 2 countries

Country	Reporting year	Place of first report	The status of the species in the country/7 May 2023
Romania	2015	Transylvania area several individuals (adults)	Present, widespread (everywhere)
Algeria	2021	*Skikda province 1 single individual (adult)	*Present, limited distribution (no details)

*According to https://gd.eppo.int/taxon/HALYHA/distribution

As such we tend to believe that the appearance in an area is determined by trade and the expansion in that area is caused by environmental factors.

The lack of information and studies focused on this insect in Algeria and in Africa in general does not mean that it is not present in smaller or larger limits than it is in the referential flow. That's why we reserve our opinion until new studies are published for this part of the world.

The situation in Romania, however, is different, where the species is present everywhere, explainable, considering the 6 years ahead of Algeria. In order to update the situation of the population level, following biweekly observations during the period April - May, 2023 we found that in the city of Timisoara it is still present at a high level (185+84 adults, i.e 269 ad.), but of course it varies depending on the size of the planted surface, but we also suspect the set of host plants.

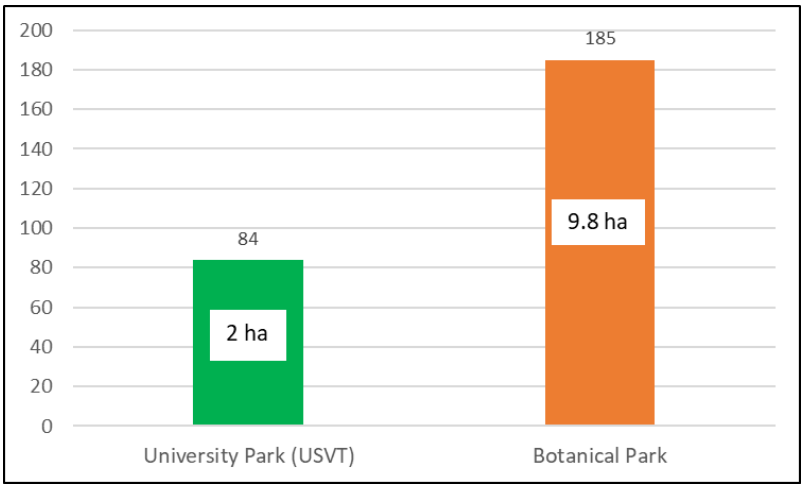

Figure 3. Comparative values between the number of adult specimens quantified in the 2 parks of Timisoara

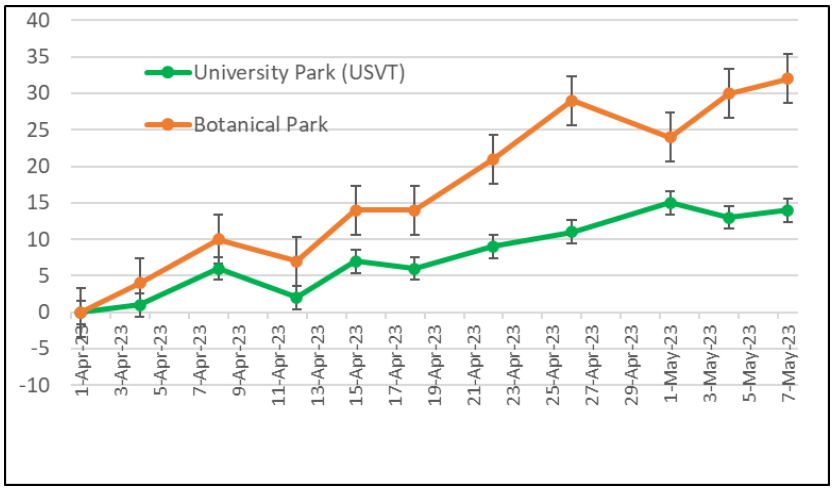

Figure 4. Biweekly evolution of *Halyomorpha halys* adults in 2 parks in Timisoara (Romania)

In detail, in the 2 parks subject to observation, 84 ind./ ULST park and respectively 185/ Botanical Park (PB) were found. Considering the surfaces from which the insect samples were collected, it can be said that the ratio between the 2 locations was 2:1 (ULST: PB) (figure 3).

The bimonthly evolution of hibernating adult insects is shown in Figure 4. Anyway, the trend for the April-May period, from the appearance of the first hibernating insects, is one of slow progressive growth and which probably would have increased if the research had continued.

We noticed that even if there were a lot of rains during this period, still on sunny days they are present on the plants in abundance. Probably, the drought is not favourable for the development of the insect, but neither are cloudy days with rainfalls.

The plants on which Halyomorpha adults were observed under the conditions in Romania are shown in Table 2. They were identified as belonging to the category of vegetables, ornamental plants, vines, fruit trees and crop plants. The insect was observed in various places such as public parks, private gardens, orchards, vineyards, but also on agricultural land.

Table 2

The potential host plants for *Halyomorpha halys* in the Romanian conditions

The host plant for feeding		Category	Area type
Latin identity	Common identity		
Zea mays	Maize	Field culture	Agricultural land
Solanum lycopersicum	Tomato	Vegetable	Vegetable garden
Capsicum annuum	Pepper	Vegetable	Vegetable garden
Phaseolus vulgaris	Common bean	Vegetable	Vegetable garden
Prunus armeniaca	Apricot	Fruit tree	Orchard
Prunus domestica	Plum	Fruit tree	Orchard
Malus domestica	Apple	Fruit tree	Public Park
Juglans regia	Walnut	Fruit tree	Public Park
Prunus persica	Peach	Fruit tree	Private Garden
Prunus persica var. nucipersica	Nectarine	Fruit tree	Private Garden
Ficus carica	Fig	Fruit tree	Private Garden
Vitis vinifera	Vine	Vine	Vineyard
Lycium barbarum	Goji	Ornamental plant	Public Park*
Chaenomeles japonica	Japanese quince	Ornamental plant	Public Park
Forsythia intermedia	Border forsythia	Ornamental plant	Public Park
Rosa sp.	Rose	Ornamental plant	Public Park
Syringa vulgaris	Lilac	Ornamental plant	Public Park
Spiraea vanhouttei	Bridalwreath	Ornamental plant	Public Park
Magnolia grandiflora	Magnolia	Ornamental plant	Public Park
Acer palmatum	Japanese maple	Ornamental plant	Public Park
Cornus sp.	Dogwoods	Ornamental plant	Public Park**
Sambucus sp.	Elderflower	Ornamental plant	Public Park
Lonicera caprifolium	Perfoliate honeysuckle	Ornamental plant	Public Park

*on goji plant it was reported by CICEOI ET AL., 2017

**on Cornus plants it was reported by MACAVEI ET AL., 2015

Figure 3. *Halyomorpha halys* (adult stage) on host plants in parks from Timisoara (Romania): 1, 3, 4-ornamental plants (Japanese quince, border forsythia and rose); 2-fruit tree (apple); the pictures taken in the parks of Timisoara, in April 2023

Table 3 mentions 4 species of ornamental plants that are actually supposed to be host plants for Halyomorpha because it was seen near them.

Table 3

The potential host plants for *Halyomorpha halys* in the Algerian conditions

The host plant for feeding		Category	Area type
Latin identity	Common identity		
Ziziphus mauritiana	Jujube	Ornamental plant	Green space*
Washingtonia sp.	Palm	Ornamental plant	Public Park*
Malum granatum	Pomegranate	Ornamental plant	Green space*
Ailanthus altissima	Heaven-tree	Ornamental plant	Public Park*

* The plants were mentioned by VAN DER HEYDEN (2021) as potential hosts for H. halys; there is no clear specification of the feeding affiliation for one of them

CONCLUSIONS

As a conclusion, it is clear that the trade in plants between countries and the neighbourhoods are the causes of the spread. Like, they probably arrived in the north of Algeria through the trade with Spain and in Romania also through the intra-European trade of ornamental plants. However, the expansion within a country or region is caused by the host plant area and the climatic conditions, and these must be with normal to high temperatures, with sunshine.

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