

INTRODUCTION

Global species translocation has become a common phenomenon because of the trade of goods, plants, garden soils etc. According to the Regulation (EU) 1143/2014 alien species are defined as “live specimen of a species ... introduced outside its natural range ... that might survive and reproduce”, and invasive alien species are defined as “species whose introduction or spread threatens or impacts upon biodiversity and related ecosystem services”.

Land snails and slugs are passively transported by humans with soil and plants, or carried by vehicles and containers (Dörge et al., 1999; Horsák et al., 2020). A recent work on invasive alien species of Greece stresses the lack of knowledge on alien land snail and slugs in our country (Korakaki et al., 2020). So far, five species are known to occur in Greece: *Boettgerilla pallens* Simroth, 1912, *Deroceras invadens* Reise, Hutchinson, Schunack & Schlitt, 2011, *Ambigolimax valentianus* (Férussac, 1821), *Hawaiiia minuscula* (Binney, 1841) and *Zonitoides nitidus* (Müller, 1774) (Vardinoyannis et al., 2020).

Here, we compile a comprehensive list of occurrences of alien land snails and slugs found in Greece since 2000, draw distribution maps and discuss future research steps.

METHODS

We searched published literature on Greek land snails and slugs since 2000 and we recorded all occurrences of alien species. We also gathered data on collection dates, habitats and other information relevant to the species ecology, and we created distribution maps of the alien species.

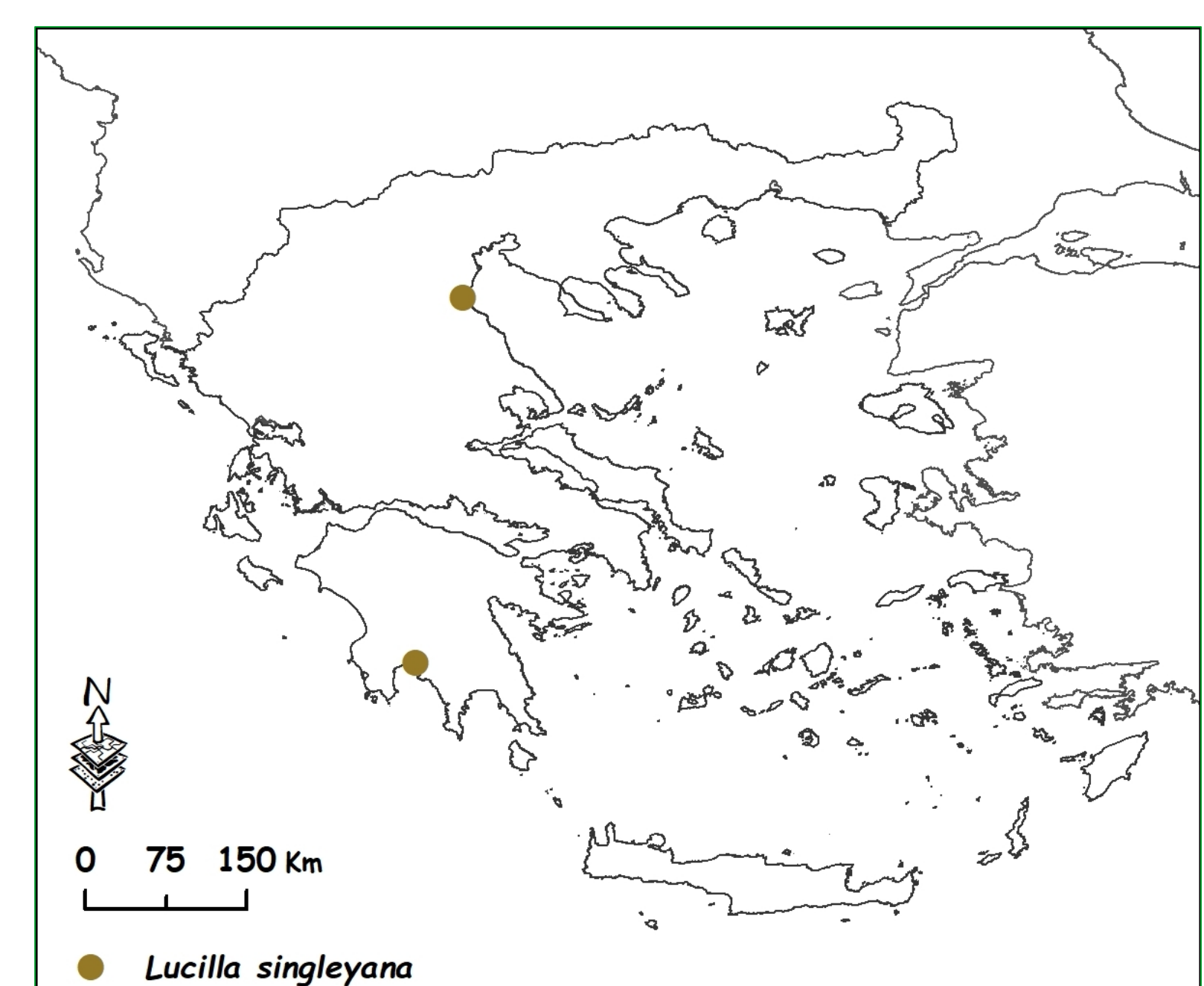
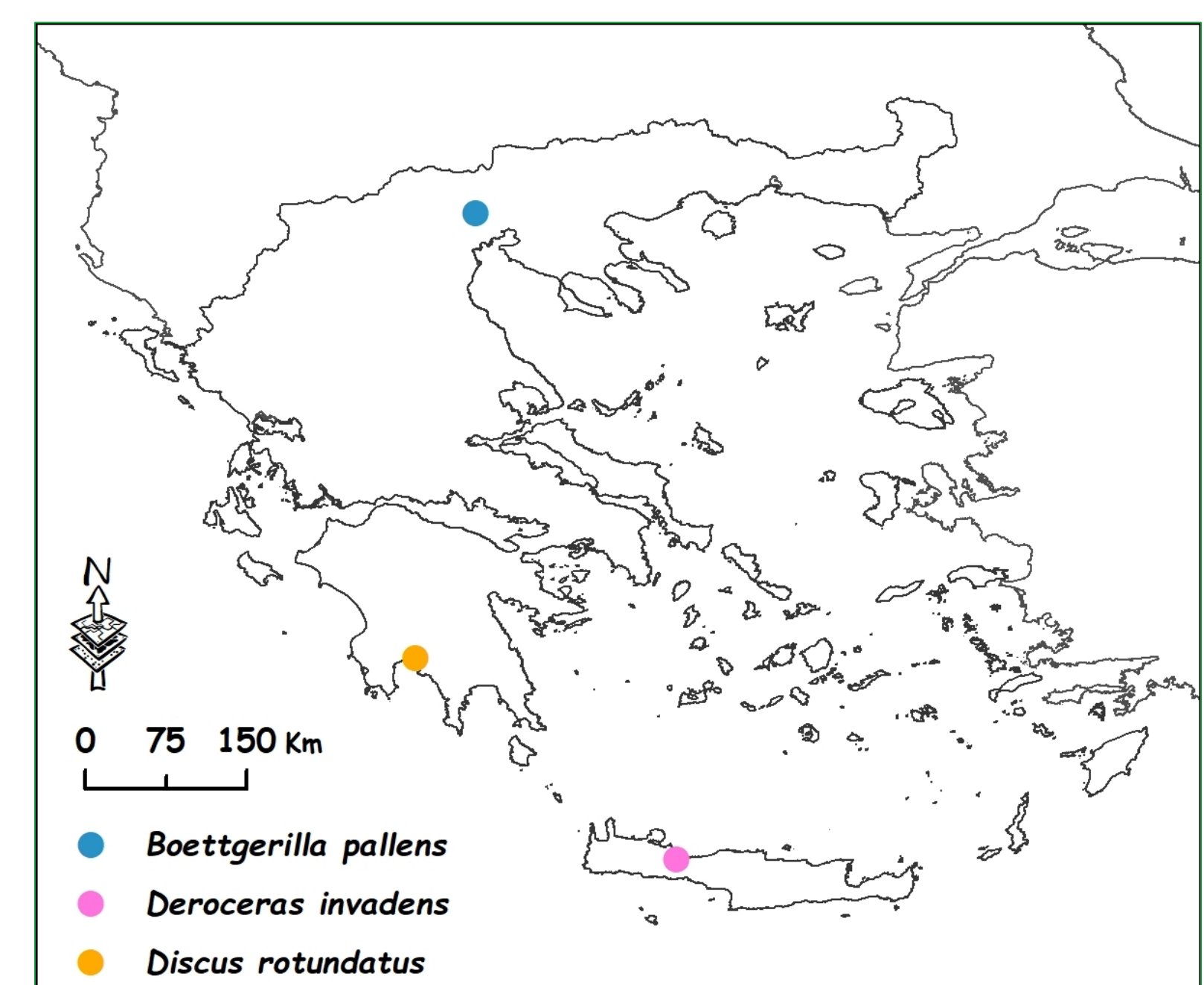
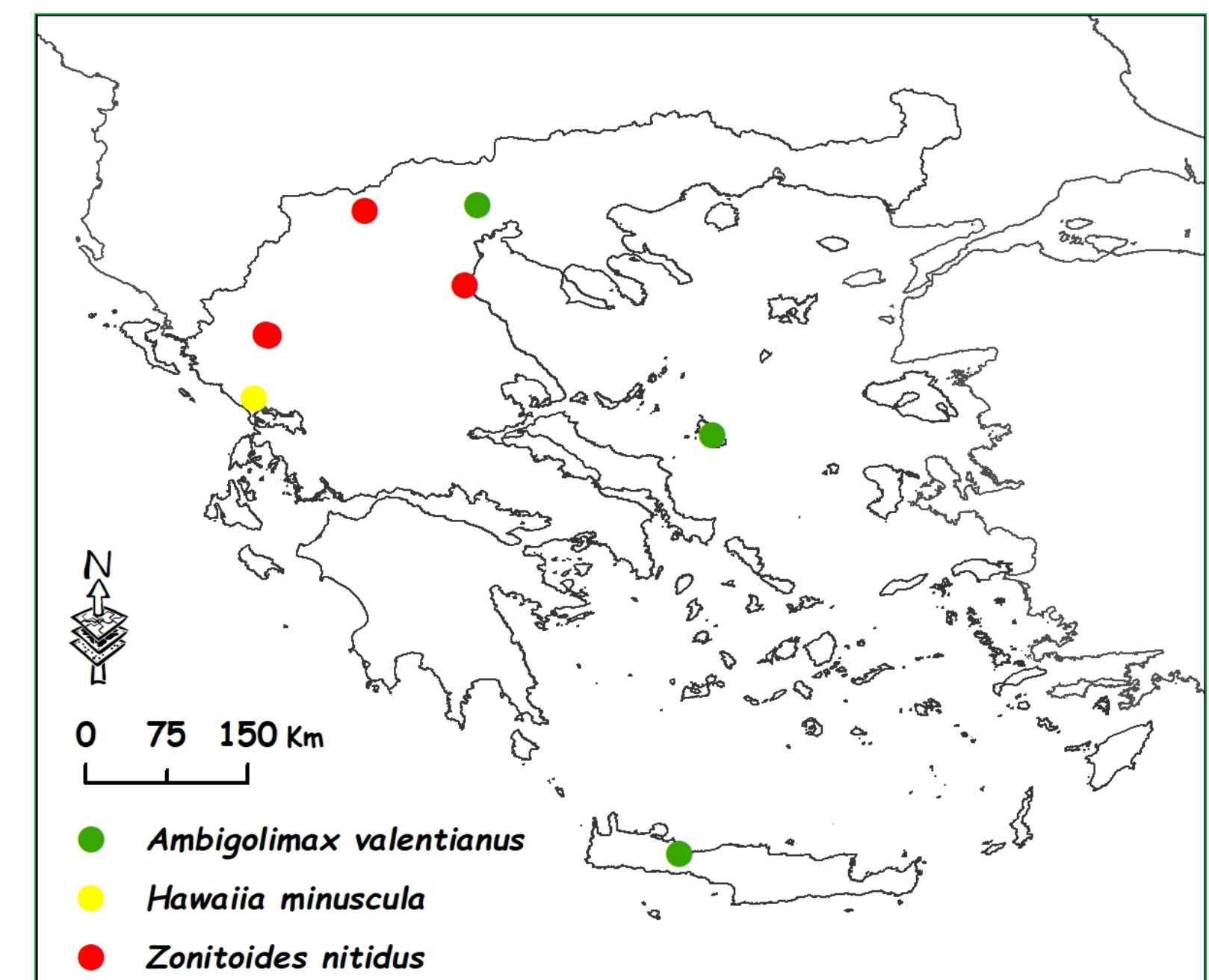
RESULTS

In total we found 11 records of the so far known alien species living in Greece. In addition, we found two records of the species *Lucilla singleyana* (Pilsbry, 1889), which is of north American origin. The European species *Discus rotundatus* (Müller, 1774) was also found in one locality. The results are listed in Table 1 and species known locations are shown in Figures 1-3.

Table 1. List of alien species of land snails and slugs in Greece known from the literature.

a/a	Species	Collection date	Collection habitat	Natural range	Family
1	<i>Ambigolimax valentianus</i> (Férussac, 1821)	07/2010	river banks, under boards	Caucasus	Limacidae
2	<i>Ambigolimax valentianus</i> (Férussac, 1821)	2011	unknown	Caucasus	Limacidae
3	<i>Ambigolimax valentianus</i> (Férussac, 1821)	before 2008	unknown	Caucasus	Limacidae
4	<i>Boettgerilla pallens</i> Simroth, 1912	07/2010	river banks, under boards	Caucasus	Limacidae
5	<i>Deroceras invadens</i> Reise, Hutchinson, Schunack & Schlitt, 2011	2011	unknown	southern Italy and Sicily	Agriolimacidae
6	* <i>Discus rotundatus</i> (Müller, 1774)	04/2014	river deposits	European (C-W & N)	Discidae
7	<i>Hawaiiia minuscula</i> (Binney, 1841)	08/2003	Eucalyptus pot, plant nursery	North America	Pristilomatidae
8	* <i>Lucilla singleyana</i> (Pilsbry, 1889)	07/2006	river banks	North America (uncertain origin)	Helicodiscidae
9	* <i>Lucilla singleyana</i> (Pilsbry, 1889)	04/2014	river deposits	North America (uncertain origin)	Helicodiscidae
10	<i>Zonitoides nitidus</i> (Müller, 1774)	07/2006	river banks	Holarctic	Gastrodontiidae
11	<i>Zonitoides nitidus</i> (Müller, 1774)	09/2013	lake shores	Holarctic	Gastrodontiidae
12	<i>Zonitoides nitidus</i> (Müller, 1774)	09/2013	lake shores	Holarctic	Gastrodontiidae
13	<i>Zonitoides nitidus</i> (Müller, 1774)	08/2012	flood plains on lake shores, among garbage	Holarctic	Gastrodontiidae

*records need further investigation



Figures 1-3. Distribution maps of known locations of alien snails and slugs found in Greece.

DISCUSSION-CONCLUSIONS

- We found 10 records of the five alien species (i.e., *B. pallens*, *D. invadens*, *A. valentianus*, *H. minuscula*, *Z. nitidus*) known so far from Greece.
- We found two more species that may qualify as alien (*L. singleyana*, native range: N. America and *D. rotundatus*, native range: European). *D. rotundatus* is recorded for the first time from Greece (Reischütz et al., 2015), although it occurs in neighboring countries (see Welter-Schultes, 2012).
- The only species that can be associated with plant trade is *H. minuscula*. The species was found in a pot in a plant nursery (Reischütz & Reischütz 2009). It is unknown whether the species has established viable populations or has escaped in the wild.
- All species (except *H. minuscula*) were found in disturbed habitats, scattered all over Greece. The validation (via the study of morphology, anatomy and molecular identification) of the recorded alien land snails and slugs will provide further information on the potential pathways of their introduction to Greece.
- Targeted field investigations, e.g. in plant nurseries, green houses and habitats under extensive anthropogenic pressure, are needed in order to evaluate the current status of alien snails and slugs in Greece.

REFERENCES

- Dörge et al., 1999. Z. Ökologie u. Naturschutz. 8:1-10; Horsák et al., 2020. Malacologia, 63(1):123-130; Korakaki et al., 2021. First Edition. (Eds) Pullaiah & Ielmini. Wiley & Sons Ltd.; Reischütz & Reischütz, 2009. Nachr.bl. erste Vorarl. malak. Ges. 16:41; Reischütz et al., 2015. Nachr.bl. erste Vorarl. malak. Ges. 22:71-72; Vardinoyannis et al., 2020. (Ed) Pafilis. Broken Hill Publishers Ltd.; Welter-Schultes, 2012. Planet Poster Editions.