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Gall midges (Cecidomyiidae, Diptera) of Los Monegros require protection of their biotops

Dr. Vclav Skuhravl, Csc. & Dr. Marcela Skuhrav, Csc.

Institute of Entomology Czech Zoological Society
Academy of Sciences Vini 7
Branigovsk 31 CZ-128 44 Praha 2
CZ-370 05, esk BudXjovice Czech Republic
Czech Republic

Introduction

Gall midges are usually small and delicate flies with body size usually of 0,5-3 mm. They occur, often in large quantities, in the nature where they inhabit various biotopes and form, despite of their small size, an important component of ecosystems. The majority of larvae are phytophagous causing galls on host plants, smaller part of larvae is mycophagous or zoophagous. Cecidomyiidae belong to large families of Diptera including in the Palaearctic Region more than 2200 described species (Skuhrav 1986) from which more than 1500 species occur in Europe. The fauna of gall midges in Spain includes 199 species (Skuhrav, Skuhravl, Blasco-Zumeta and Pujade, 1996) from which 28 gall midge species have been found in Los Monegros and adjacent areas (Skuhrav, Blasco-Zumeta, Skuhravl, 1993; Skuhrav, Skuhravl, Blasco-Zumeta, 1996).

The gall midges are very important group for evaluation of the value of an area or landscape for their specific relations to host plants. Galls of these gall midges remain on host plants in the course of the whole vegetation season and are, therefore, a good evidence of the presence of such gall midge species in the biotop even in the time when the adult gall midge, the originator of the gall on the host plant, left its gall and perished. Gall midges as adults have usually a very short life span which lasts mostly only several hours but their larvae developing inside galls live sometimes several months.

Results and comments

Los Monegros is from the point of view of gall midges the unique area where a very high number of gall midge species associated with semi-desert host plant species occur. Such large number of semi-desert species occurring in a relatively small area has not been found in whatever area of Spain, Europe and North Africa. 28 gall midge species are associated with sixteen host plant species belonging to several plant families (see Table 1). Six gall midge species are endemic, 18 are Mediterranean species mostly with the interesting disjoint western-eastern distribution, two are European and Euro-Siberian species with large distribution areas and other two species, viz. *Mayetiola destructor* (Say, 1817) and *Dasineura medicaginis* (Bremi, 1847), which are not indigenous to the area having been brought in this territory with agricultural technique, are just now, or have been in the past, serious pests of agricultural crops. However, such species are not applicable (or: suitable?) to biogeographical considerations.

The following six species have a particularly high value for Los Monegros because they are **endemic** to this area: *Contarinia camphorosmae* (Tavares, 1920), causing galls on *Camphorosma monspeliaca* L., *Dictyomyia salsolae* Tavares, 1924, *Misospatha salsolae* Tavares, 1924, and *Stefaniola parva* (Tavares, 1919), all on *Salsola vermiculata* L., *Rhopalomyia hispanica* Tavares, 1904, and *Rhopalomyia tavaresi* Gagn, 1975, both on *Artemisia herba-alba* Asso. The occurrence of these gall midges is, as far as we know, restricted only to this area. Galls of these gall midge species have been found only in Los Monegros or in nearly adjacent areas and the species were described based on adults reared from galls found here. The type-localities of these gall midges are situated inside the Monegros or in nearly adjacent areas.

The following five gall midge species have been discovered in the Monegros and in adjacent areas, their type-locality are situated here and their galls were found either in some of other part of Spain, or in Portugal, or in other countries of the Mediterranean: *Dictyomyia navasiana* on *Santolina chamaecyparissias*, *Etsuhoa thuriferae* on *Juniperus thurifera*, *Stefaniola bilobata* and *Stefaniola salsolae* on *Salsola vermiculata* and *Rhopalomyia navasi* on *Artemisia herba-alba*. All mentioned gall midge species, with the exception of the last one, occupy small restricted areas in the Mediterranean.

From the biogeographical point of view, the gall midges found in the Monegros have usually very interesting distribution areas which are shown in the maps (see Fig.1-9). Gall midges *Bayeriola thymicola*, *Rhopalomyia baccarum* and *Rhopalomyia tubifex* have large distribution areas spread in Europe or in Euro-Siberia. Other gall midge species have distribution areas spread in the Mediterranean which are usually divided into several small disjuncted parts. Very important seem to be limits of their distribution, both in the west and in the east. For that reason the following five gall midge species seem to be very interesting: *Baldratia suaedae*

on *Suaeda vera* which occurs in Canary Islands in the west and in Israel in the east; *Asphondylia conglomerata* on *Atriplex halimus* has been found in Israel in the east; *Rhopalomyia navasi* on *Artemisia herba-alba* occurs in steppe biotops in central Romania; *Rhopalomyia tubifex* on *Artemisia campestris* occurs in steppe biotops in Georgia (Caucasus).

As a remarkable case should serve the gall midge species *Asphondylia dorycnii* larvae of which cause the galls on *Dorycnium pentaphyllum*. The distribution area of this gall midge species is extended from the south, the most southern part of Europe, the Crete, up to central Europe. The most northern limits of its distribution area runs together with the limits of its host plant species in steppe biotops spread along the most southern part of the Czech Republic where the Protected Landscape Area "Plava", simultaneously proclaimed as the Biosphere Reserve of the UNESCO, are situated. The steppe biotops, spread in cultural landscape with very intensively agricultural systems, similar to them occurring in the Monegros, including rich steppe and forest-steppe plant and animal associations, are in the Czech Republic protected already since 1976 and are included in the area of the size of 70 square km. In this protected area extensive investigations of terrestrial invertebrates inhabiting this territory are carried out by many researchers. This project, which is aimed to protect the remainder of the original steppe biotops, is supported by the government and by several enlighten organizations which appreciate the necessity to protect the steppe biotops endangered by the activity of man. Many-sided researches continue in the course of several years persistantly and results of these studies have been published in many scientific papers (Rozkognl & Vaehara, 1995).

Table 1
Gall midges (Cecidomyiidae) of Los Monegros

Gall midge species	Host plant species	Distribution
Arceuthomyia valerii	*Juniperus oxycedrus*	Mediterranean
Asphondylia conglomerata	*Atriplex halimus*	Mediterranean
Asphondylia dorycnii	*Dorycnium pentaphyllum*	Mediterranean
Asphondylia rosmarini	*Rosmarinus officinalis*	Mediterranean
Baldratia suaedae	*Suaeda vera*	Mediterranean
Bayeriola thymicola	*Thymus vulgaris*	European
**Contarinia camphorosma*	*Camphorosma monspeliaca*	endemic
Contarinia cocciferae	*Quercus coccifera*	Mediterranean
Dasineura medicaginis	*Medicago sativa*	Euro-Siberian; pest
Dasineura scorpii	*Genista scorpius*	Mediterranean
**Dictyomyia navasiana*	*Santolina chamaecyparissus*	Mediterranean
**Dictyomyia salsolae*	*Salsola vermiculata*	endemic
Dictyomyia setubalensis	*Santolina rosmarinifolia*	Mediterranean
**Etsuhoa thuriferae*	*Juniperus thurifera*	Mediterranean
Mayetiola destructor	cereals (Graminae)	Holarctic; pest
**Misospatha salsolae*	*Salsola vermiculata*	endemic
Rhopalomyia baccarum	*Artemisia campestre*	Euro-Siberian
**Rhopalomyia hispanica*	*Artemisia herba-alba*	endemic
**Rhopalomyia navasi*	*Artemisia herba-alba*	Mediterranean
Rhopalomyia producticeps	*Artemisia herba-alba*	Mediterranean
Rhopalomyia santolinae	*Santolina* spp.	Mediterranean
**Rhopalomyia tavaresi*	*Artemisia herba-alba*	endemic
Rhopalomyia tubifex	*Artemisia campestre*	Sub-Mediterranean
Stefaniella trinacriae	*Atriplex halimus*	Mediterranean
**Stefaniola bilobata*	*Salsola vermiculata*	Mediterranean
**Stefaniola parva*	*Salsola vermiculata*	endemic
**Stefaniola salsolae*	*Salsola vermiculata*	Mediterranean
Cecidomyiidae sp.	*Ephedra distachya*	Mediterranean

* Species indicated by an asterisk were discovered in the Monegros or adjacent areas and their type-locality is situated inside this area.

Review of gall midge species

• *Arceuthomyia valerii* (Tavares, 1904) causes large galls on *Juniperus oxycedrus* L. (Cupressaceae). Mediterranean species described based on adults reared from galls collected near Setubal (Portugal). It has a disjuncted distribution area. Galls were found in xerotherm biotops of southern England, southern France, in the former Yugoslavia, Greece and in northern Africa (Algeria, Lybia).

• *Asphondylia conglomerata* Stefani,1900 causes large galls on *Atriplex halimus* L. (Chenopodiaceae). Mediterranean species decribed from Sicily. It occurs very rare, but then its galls are very abundant covering the host plant. Galls were found in Monegros area (Tavares, 1931), in southern Greece (Peloponesos and Crete) (Skuhrav, Skuhravl, 1997), in Israel (leg. Dr. Halperin, unpublished) and in Lybia (leg. Prof. Massa, unpublished) (Fig.1).

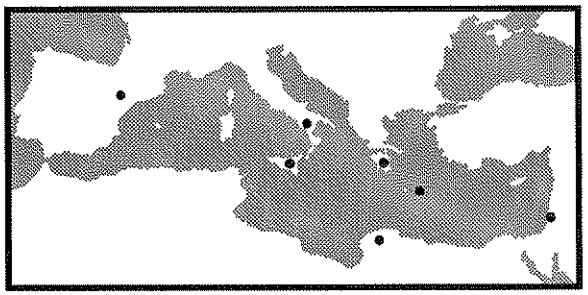

Fig.1: *Asphondylia conglomerata* on *Atriplex halimus*

• *Asphondylia dorycnii* (Miller, 1870) causes galls on *Dorycnium pentaphyllum* (D. herbaceum Vill.) (Fabaceae). Mediterranean species described from southern France, occurring rarely in southern Europe and found also on islands Mallorca and Crete. It reaches its northern boundary of distribution in the steppe biotops of the Plava Biosphere Reserve in the most southern part of the Czech Republic.

• *Asphondylia rosmarini* Kieffer, 1896 causes small pouch-shaped galls on leaves of Rosmarinus officinalis L. (Lamiaceae). Mediterranean species described according to material found at Marseille in southern France, known from Dalmatia, southern Italy and Sicily, Corsica and northern Africa (Tunisia).

• *Baldratia suaedae* Mhn, 1969 produces galls on stems of *Suaeda vera* J. F. Gmelin (Chenopodiaceae). Mediterranean species described on larvae which were obtained from galls found at Jaffa (Israel). Galls were in 1991 found in the Monegros. B. suaedae has a large disjunct distribution area. This specie is known to occur in Canary Islands and in Spain in the west, in Algeria in northern Africa and in Israel in the east-Mediterranean area (Fig.2).

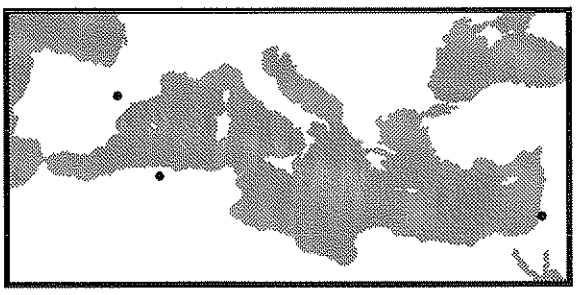

Fig. 2: *Baldratia suaedae* on *Suaeda vera.*

• *Bayeriola thymicola* (Kieffer, 1888) causes galls on *Thymus vulgaris* L. (Lamiaceae). It is an European species with large distribution area occupying southern part of Sweden up to northern part of Africa. In central and northern parts of Europe it is associated with *Thymus serpyllum* L. and *T. chamaedrys* Fries, in southern part of Europe with *T. vulgaris* L. Galls were in 1991 found in the Monegros on *Thymus vulgaris* L .

• *Contarinia camphorosmae* (Tavares, 1920) causes axillar and terminal bud galls on *Camphorosma monspeliaca* L. (Chenopodiaceae). It is an endemic species discovered at Zaragoza.

• *Contarinia (Blastodiplosis) cocciferae* (Tavares, 1902) causes cone-shaped galls on *Quercus coccifera* L. (Fagaceae). Galls were found in sclerophyllous formations in Portugal and Spain (in 1995 found also in Monegros), along the coast of the Mediterranean Sea: in southern France, most southern part of England, southern Italy, the former Yugoslavia, in southern Greece, in islands (Crete, Sicily, Mallorca) and in northern Africa (Algeria, Morocco). It is the typical Mediterranean species.

• *Dasineura medicaginis* (Bremi, 1847) causes bud galls on *Medicago sativa* L. (Fabaceae). It is an Euro-Siberian species with large distribution area; if galls occur in larger quantities in fields where alfalfa is growing as fodder crop, it may change into a pest. With regard to this fact, this species is not suitable for biogeographical considerations.

• *Dasineura scorpii* (Kieffer, 1909) produces axillar or terminal galls on *Genista scorpius* (L.) DC (Fabaceae). Mediterranean species known only from galls collected in southern France. Galls were found in 1995 and 1996 in Monegros by J. Blasco-Zumeta.

• *Dictyomyia navasiana* Tavares, 1919 causes bud galls on *Santolina chamaecyparissus* L. (Asteraceae). Mediterranean species found and described on material from Zaragoza (the type-locality), found once again in 1991. It occurs only in the western Mediterranean area (Spain, Morocco and Algeria) (Fig.3).

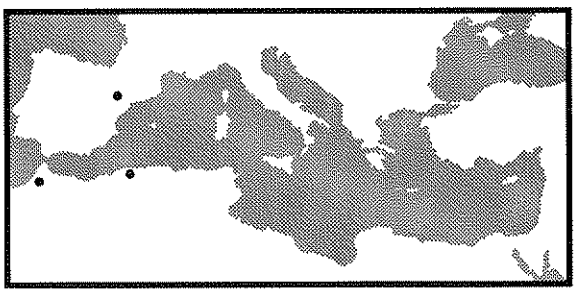

Fig. 3: *Dictyomyia navasiana* on *Santolina chamaecyparrissias.*

• *Dictyomyia salsolae.* Tavares, 1924. Larvae lives as inquilines in galls of *Stefaniola salsolae* Kieffer on Salsola vermiculata L. (Chenopodiaceae). It is an endemic species found and described based on female caught at Zaragoza (the type-locality).

• *Dictyomyia setubalensis* Tavares, 1902 causes galls on leaves of *Santolina rosmarinifolia* L. (Asteraceae). Western-Mediterranean species found in Portugal (Setubal is the type-locality), Spain (Monegros) and in Algeria (Fig. 4).

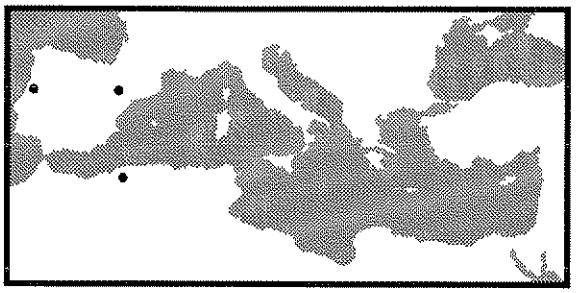

Fig. 4: *Dictyomyia setubalensis* on *Santolina rosmarinifolia.*

• *Etsuhoa thuriferae* Skuhrav, 1995 causes galls on *Juniperus thurifera* L. (Cupressaceae). Mediterranean species occurring in the Monegros where galls of this species were found and adults emerged. Retuerta de Pina, Monegros is the type-locality. Galls were found also in central Spain and Morocco. *E. thuriferae* is the only one representant of the genus *Etsuhoa* in western Palaearctis. Other species of this genus associated with other species of *Juniperus* occur in Asia (Ribera & Blasco-Zumeta, 1998) (Fig. 5).

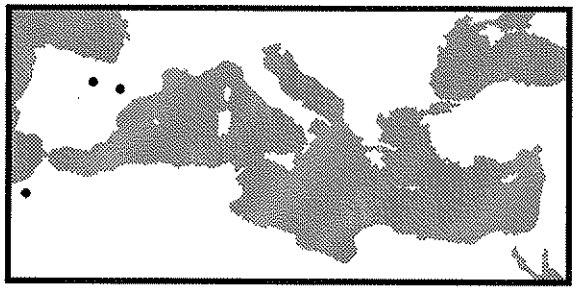

Fig. 5: *Etsuhoa thuriferae* on *Juniperus thurifera.*

• *Mayetiola destructor* (Say, 1817) causes stem swellings on various cereals (Graminae). It is a serious pest, mainly of wheat, with secondarilly Holarctic distribution. With regard to this fact, this species is not suitable for biogeographical considerations.

• *Misospatha salsolae* Tavares, 1924: one female was reared from *Salsola vermiculata* L. (Chenopodiaceae) with the gall of *Stefaniola salsolae* Kieffer found at the type-locality "Caesaraugustus" (Zaragoza). It is an endemic species.

• *Rhopalomyia baccarum* (Wachtl, 1883) causes globular galls on *Artemisia campestre* L. (Asteraceae). Euro-Siberian species, described on material from Wien (Austria), with large distribution area spread from Portugal and Spain in the west, across northern Italy to the former Yugoslavia, Albania to central and eastern Greece in the Mediterranean, up to steppe biotop at the foot of northern part of the Caucasus Mts.

• *Rhopalomyia hispanica* Tavares, 1904 produces small bud galls on shoots of *Artemisia herba-alba* Asso (Asteraceae). This species has been described according to adults reared from galls which were found at Serra de Guara (Huesca), the type-locality. Galls were found in Monegros once again in 1991. It is an endemic species.

• *Rhopalomyia navasi* Tavares, 1904 causes large conspicuous galls, densely white pubescent, on *Artemisia herba-alba* Asso (Asteraceae). Mediterranean species described according to adults reared from galls collected at Serra de Guara (Huesca). Galls were found in 1991 and 1992 and are abundant in the Monegros. This species occurs in Algeria, Tunis and Lybia in the Mediterranean area, and in Pannonian steppe in central Rumania (Fig. 6).

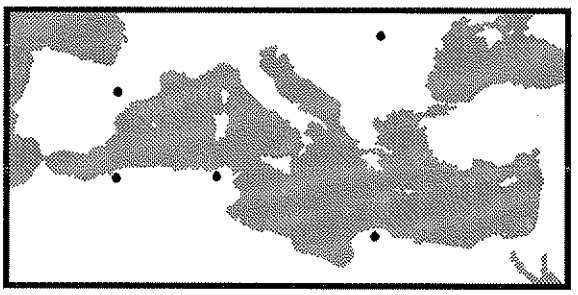

Fig. 6: *Rhopalomyia navasi* on *Artemisia herba-alba.*

• *Rhopalomyia producticeps* Kieffer, 1912 causes large tubular galls on *Artemisia herba-alba* Asso (Asteraceae). Species has been described from Algeria, North Africa, and later found also in Lybia. It is a Mediterranean species discovered in 1991 in the Monegros (first record in Europe) (Fig. 7).

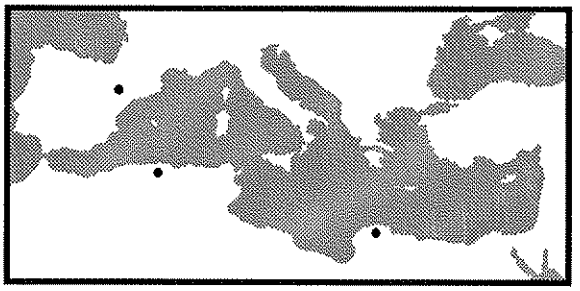

Fig. 7: *Rhopalomyia producticeps* on *Artemisia herba-alba.*

• *Rhopalomyia santolinae* Tavares, 1902, probably an inquilin in galls of *Dictyomyia navasiana* Tavares, 1919 on Santolina spp. (Asteraceae). Mediterranean species, described on material from Portugal, with restricted distribution area in Spain and Portugal.

• *Rhopalomyia tavaresi* Gagn, 1975 (*Eudictyomyia artemisiae* Tavares, 1920), is probably an inquiline; adults were obtained from galls of *Rhopalomyia navasi* Tavares, 1904, formed on *Artemisia herba-alba* Asso (Asteraceae) at the locality Quinta del Salvador e María (Zaragoza). It is an endemic species.

• *Rhopalomyia tubifex* (Bouch, 1847) causes tubular galls on *Artemisia campestre* L. (Asteraceae). Sub-Mediterranean species with large distribution area spread from northern Europe (southern Finland and Sweden) up to northern Africa (Algeria, Tunisia, Lybia) and from Spain up to eastern Greece and up to steppe biotops in Caucasus Mts. in Georgia.

• *Stefaniella trinacriae* Stefani, 1900 causes large swellings on branches of *Atriplex halimus* L. (Chenopodiaceae). Each swelling includes several chambers, each with one larva. Mediterranean species described based on adults reared in Sicily. Galls were found in France, in the Monegros (Spain), in northern Africa (Algeria, Tunis) and in eastern Mediterranean - in Crete (Fig. 8).

• *Stefaniola bilobata* (Kieffer, 1913) causes elongated bud galls on *Salsola vermiculata* L. (Chenopodiaceae). Mediterranean species described on adults collected probably at Zaragoza. Galls were found also at Granada and in northen Africa (Algeria, Morocco) (Fig. 9).

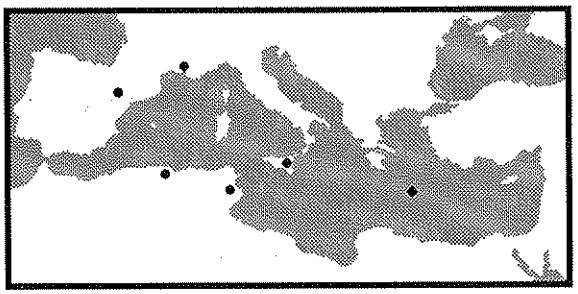

Fig. 8: *Stefaniella trinacriae* on *Atriplex halimus.*

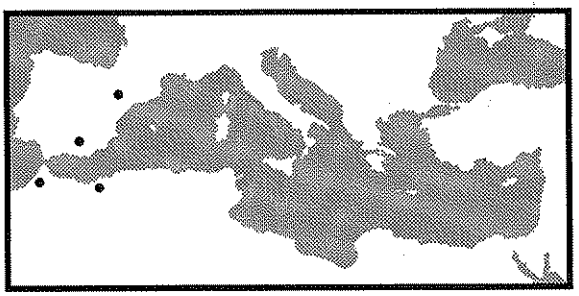

Fig. 9: *Stefamiola bilobata* on *Salsola vermiculata.*

• *Stefaniola parva* (Tavares, 1919). Larvae live as inquilines in galls of *Stefaniola salsolae* on *Salsola vermiculata* L. (Chenopodiaceae). This species has been described from the type locality at Zaragoza. It is an endemic species.

• *Stefaniola salsolae* (Tavares, 1904) produces rosette galls on stems of *Salsola vermiculata* L. (Chenopodiaceae). This species has been decribed according to materials found at Sierra de Guara. It is a Mediterranean species with a restricted area of distribution known only from Spain and Portugal.

Cecidomyiidae sp. Larvae of this undescribed species cause large galls on *Ephedra distachya* L. (Ephedraceae). Galls were firstly found in southern France. In 1995 were galls discovered in the Monegros by J. Blasco-Zumeta. He was successful and reared adults. Description of a new species is in preparation. It is a Mediterranean species known from Spain, southern France and southern Italy from localities lying in islands of disjunct area of distribution of its host plant, *Ephedra distachya.*

Conclusions

Los Monegros is unique area where a very high number of gall midge species associated with semi-desert host plant species occur. Such large number of semi-desert species occurring in a relatively small area has not been found in whatever area of Spain, Europe and North Africa.

From the point of view of gall midges, the area of Monegros has an unique value: from 28 gall midge species found in the Monegros in the course of 20th century, 11 gall midge species were discovered here, in Los Monegros and nearly adjacent areas. Their type-localities are situated in the Monegros or nearly adjacent areas. Six of them are endemic to this area having been not find elsewhere and the remaining five, with exception of one species, *Rhopalomyia navasi*, have small distribution areas restricted to the Iberian Peninsula. To secure the survival of these unique gall midge species for the future, it is necessary to protect their host plant species, plant communities where these host plant species are growing, the biotops and the whole unique steppe ecosystem against the man-made destruction of this landscape.

From the biogeographical point of view, the gall midges occurring in the Monegros have interesting distribution areas with disjuncted islets of occurrence which documented their very old origin.

Unique plant-animal communities which are represented in our case by the host plants with their gall midges, developing in galls, form a natural wealth and heritage of Los Monegros that need to be protected and preserved for the present and for the future generations.

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