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Plant communities and noctuids of central Spain : some notes on their relationships (Lepidoptera)

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Summary

Noctuid moths were sampled at three sites in central Spain. The ten most characteristic species for each of the three sites were determined. The reasons for the site preferences of these species are sought in their larval foodplants and other ecological factors.

Aim

These notes could be considered as a part of a planned global survey on the ecological preferences, the geographic distribution and the systematics, phylogeny and evolution of the noctuid moths of the Iberian Peninsula.

The main aims of this work are : 1 - testing, under the Mediterranean conditions of the area (i.e. "La Alcarria", a district of the Guadalajara province, central Spain ; see Fig. 1), the hypothesis that the composition of noctuid moths collected by means of light traps cannot be related to particular microhabitats of a plant community, but to the sum of their microhabitats ; 2 - to recognise characteristic noctuid species for each of the sampled plant communities. All sites were sampled in exactly the same way, therefore the only variable factor was the site itself. Any differences found in the samples would therefore reflect differences in the collecting sites.

Method

A 250 watt mercury vapour lamp was used. Samples were taken every two weeks between April 1983 and March 1985. Three sampling sites, placed approximately at the same altitude and covered by a relatively well-preserved natural vegetation, were selected. The physiognomy of each of the sampling sites is different and consequently also their floral composition.

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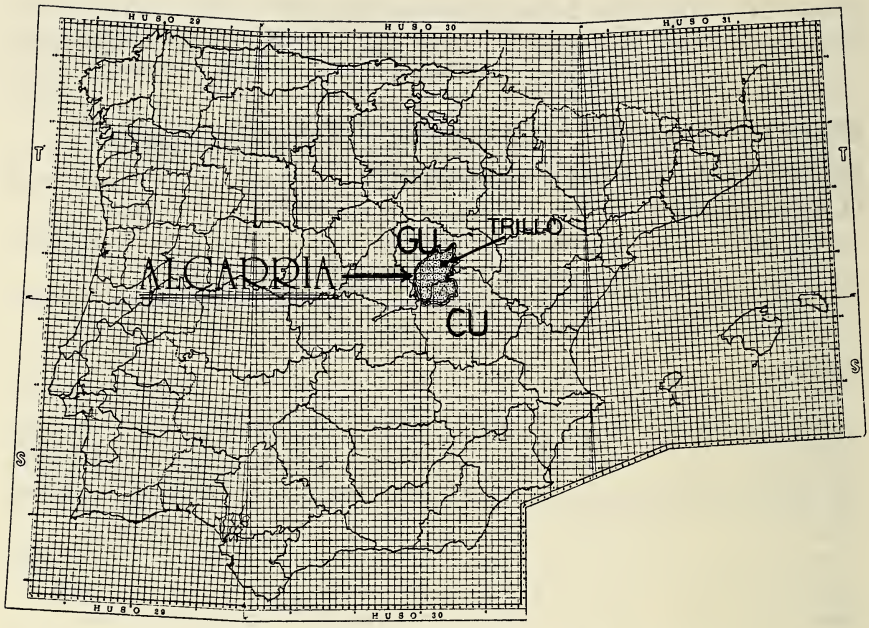

Fig. 1. The Iberian Peninsula : The situation of the sampled area.

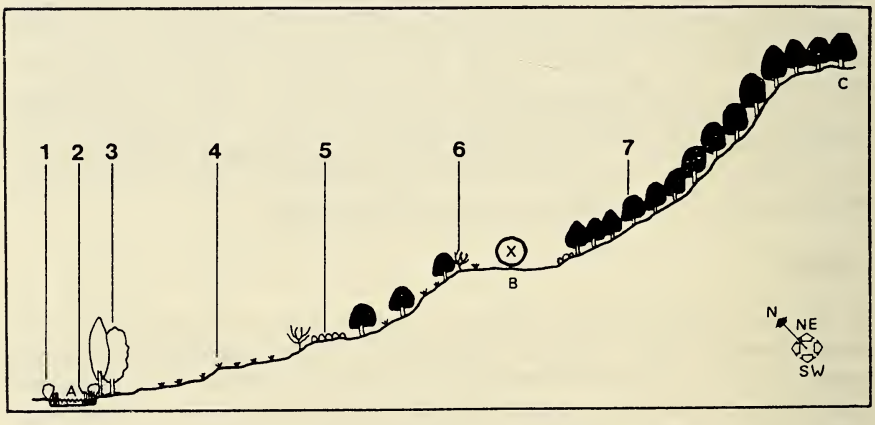

Fig. 2. Diagram of the vegetation of sampling site 1. A - Tagus River ; B - Sampling site ; C - Hill called "Peña de la Yeseria". 1 - Willows ; 2 - Phragmition ; 3 - Poplars ; 4 - Aphyllantion + Artemisio-Santolinion + Ruderal-xerophilous herbaceous plants ; 5 - Rosmarino-Ericion ; 6 - Some xerophilous shrubs ; 7 - Evergreen oak forest.

Description of the sampling sites

1. (Altitude : 790 m ; orientation : N.E. ; UTM. coord. : 30TWL3605) — Evergreen oak forest of the Castilian Aragonese Mesomediterranean basophilous series (Bupleuro rigidi-Querceto rotundifoliae sigmetum) (Fig. 2).

2. (Altitude : 700 m ; orientation : N.W. ; UTM coord. : 30TWL3305) — Gall oak (or Lusitanian oak) forest of the Castilian Meso-supramediterranean basophilous series (Cephalanthero longifoliae-Querceto fagineae sigmetum) (Fig. 3).

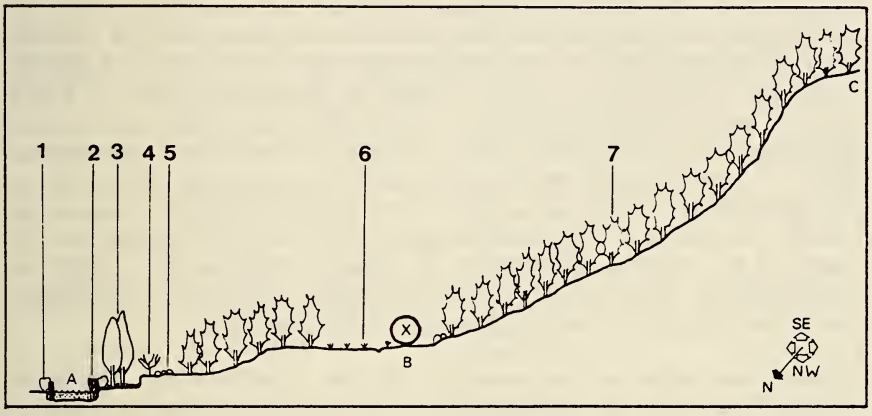

Fig. 3. Diagram of the vegetation in the surroundings of sampling site 2. A - Tagus River ; B - Sampling site ; C - Hill called "Cerro de los tres Caminos". 1 - Willows ; 2 - Phragmition 3 - Poplars ; 4 - Shrubs (Prunetalia) ; 5 - Aphyllantion ; 6 - Ruderal-xerophilous herbaceous plants ; 7 - Gall oak forest.

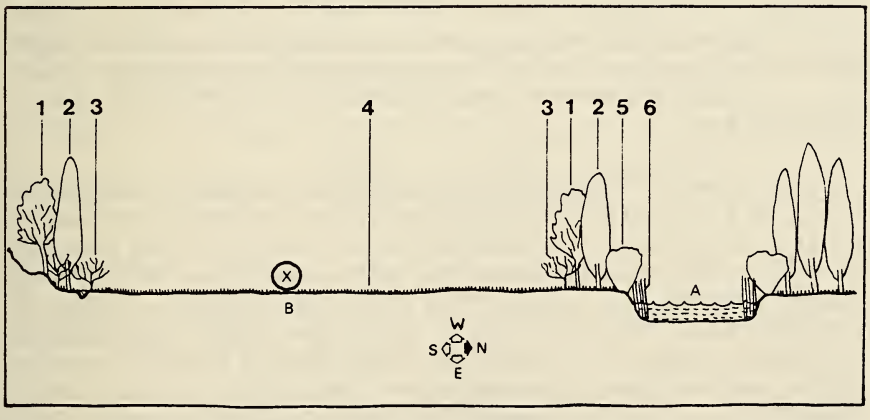

Fig. 4. Diagram of the vegetation in the surroundings of sampling site 3. A - Cifuentes River ; B - Sampling site. 1 - Elms ; 2 - Poplars ; 3 - Shrubs (Prunetalia) ; 4 - Mesophilous meadow ; 5 - Willows ; 6 - Phragmition. Note : Some small orchards are situated on two sides of the sampling site.

3. (Altitude : 710 m ; orientation of the river valley : W.-E. ; UTM coord. : 30TWL3306) — Riparian forest (poplars, willows and elms) with orchards, in a small valley (Aro italici-Ulmeto minoris sigmetum ; Rubio tinctoriae-Populeto albae sigmetum ; Saliceto triandro-eleagni sigmetum ; small orchards) ; also some mesophilous meadows.

Results and discussion

10375 specimens, belonging to 255 species, were captured ; 3755 in sampling site 1 (202 species), 3046 in site 2 (198 species) and 3574 in site 3 (211 species). There was a high degree of species shared by the sampling sites ; 178 were collected both at site 1 and at site 2, 168 both at site 1 and at site 3 and 168 at both site 2 and at site 3. This is mainly due to the known high dispersal ability of noctuid moths and supports the above-mentioned hypothesis on the impossibility of relating noctuid moths, caught with light traps, to the specific microhabitats of a plant formation. It is worth mentioning that the results of the captures are basically the same in both sampling years ; no large migratory waves and no drastic population oscillations of r-strategist species were observed in the sampling sites during this period.

Samples were subjected to χ^2 analysis in order to evaluate the significance of the differences in the absolute frequencies of captures. Species whose χ^2 value point out significant differences among the samples of each plant formation, showing pronounced preference for a particular sampling site, are called "characteristic species" ; the remainder are called "less characteristic" and "not characteristic", depending on the degree of the significance of the differences of the capture frequencies. It is worth mentioning that "characteristic" species are not necessarily the most abundant ones. Table 1 shows the number of species of each of these categories (1 = sampling site 1 ; 2 = site 2 ; 3 = site 3). The most characteristic species of each site are given in Tables 2, 3 & 4.

The high number of "characteristic" species suggests that adults of most noctuid species, at least in Mediterranean ecosystems, are not evenly distributed in the field, but depend on certain environmental factors, the most important of which is the vegetation cover. This result suggests that Mediterranean noctuid moths act more selective than those of most regions of central or northern Europe. This may be due to the fact that Mediterranean habitats are generally composed of a much more heterogeneous succession of mesophilous and xerophilous plant communities. The number of "characteristic" species is low only when comparing both types of oak wood (evergreen oak wood, site 1, and gall oak wood, site 2), because of the higher degree of environmental and floral similarity of these plant communities compared to the riparian forest.

Table 1

Numbers of species of each category recorded at the three sites

	Sampling sites			
	1-2-3	1-2	1-3	2-3
'Less' and 'not' characteristic	52	13	64	65
Characteristic	13	32	61	60

Table 2

The ten most characteristic noctuid species of sampling site 1 (Evergreen Oak Forest). The third column shows the number of specimens captured in each of the sampling sites (1, 2 & 3 respectively). Larval feeding characteristics : polyph. = polyphagous ; oligoph. = oligophagous ; herb. = herbaceous plants ; tr. = trees and shrubs. No. of generations : 1 (2) = usually one, with a partial second. Chorological groups : MA = Asiatic-Mediterranean ; AM = Atlanto-Mediterranean

Species	χ^2 value	No. of captures	Larval feeding charact.	No. of generations	Chorology
C. aspersa	252.42	293, 137, 19	polyph. herb.	1	MA
A. witzenmanni	187.32	267, 153, 30	polyph. tr.	1	AM
C. yvanii	181.96	237, 143, 18	oligoph. herb.	1	AM
C. staudingeri	131.91	128, 28, 16	polyph. herb.	1	AM
D. labecula	75.77	61, 14, 2	oligoph. tr. (*Quercus*)	1	MA
T. crassicornis	67.10	57, 12, 4	polyph. herb.	1	AM
S. ruticilla	63.67	76, 50, 3	oligoph. tr. (*Quercus*)	1	MA
M. albarracina	52.77	42, 4, 6	polyph. herb.	1	AM
S. philopalis	46.56	73, 40, 11	polyph. herb.	1	AM
N. revayana	41.78	35, 11, 0	oligoph. tr. (*Quercus*)	1 (2)	MA

Table 3

The ten most characteristic noctuid species of sampling site 2 (Gall Oak Forest). 1 (+) = one generation, with isolated specimens at a later date when environmental conditions are favourable. EA = Eurasiatic. Legend otherwise as for Table 2

Species	χ^2 value	No. of captures	Larval feeding charact.	No. of generations	Chorology
C. pallida	110.31	35, 123, 17	oligoph. lichens	1	AM
C. daubei	58.43	19, 57, 3	oligoph. tr. (*Buxus*)	1	AM
N. cicatricalis	57.80	2, 36, 2	oligoph. lichens	1 (2)	MA
M. strigula	52.94	8, 40, 1	polyph. tr.	1 (2)	MA
R. canteneri	43.81	48, 91, 23	polyph. herb.	1 (+)	AM
M. acetosellae	42.10	19, 41, 0	polyph. tr.	1	EA
M. lunaris	31.53	27, 47, 6	oligoph. tr. (*Quercus*)	1 (+)	MA
D. oo	26.17	4, 19, 0	oligoph. tr. (*Quercus*)	1	MA
D. roboris	25.24	17, 31, 2	oligoph. tr. (*Quercus*)	1	AM
C. ligula	15.44	4, 21, 7	polyph. tr.	1	EA

Table 4

The ten most characteristic noctuid species of sampling site 3 (Riparian Forest, with orchards). * = continuous generations, homodynamic species. H = Holarctic ; C = Cosmopolitan. Legend otherwise as for Tables 2 & 3

Species	χ^2 value	No. of captures	Larval feeding charact.	No. of generations	Chorology
X. c-nigrum	382.02	15, 28, 263	polyph. herb.	2	H
O. plecta	335.96	26, 15, 236	polyph. herb.	2	H
X. xanthographa	83.02	35, 29, 119	polyph. herb.	1	MA
Th. decimalis	74.42	1, 1, 41	polyph. herb.	1	EA
C. morpheus	67.6	4, 6, 50	polyph. herb.	1	EA
H. blanda	56.71	4, 11, 50	polyph. herb.	1	MA
P. sericata	56.34	3, 25, 60	polyph. herb. & tr.	1	MA
P. flavicincta	53.6	12, 6, 52	polyph. herb.	1	AM
A. gamma	52.55	56, 20, 98	polyph.	*	C
A. sordens	50.00	0, 0, 25	polyph. herb.	1	H

Analysis of the "characteristic" species

Larval feeding character : the larvae of three of the "characteristic" species of both site 1 and site 2 feed on *Quercus* spp. ; in site 3 there are no quercophagous "characteristic" species, most of them being polyphagous on herbaceous plants.

Number of generations : all of the "characteristic" species of site 1 and site 2 are univoltine, although two of those of the latter sampling site could be considered as partially bivoltine and from another two accidental and isolated specimens could be observed in periods other than the usual ones. One "characteristic" species of site 1 seems to be also partially bivoltine (*N. revayana*). On the other hand, two of the "characteristic" species of site 3 are bivoltine, and a third one is potentially multivoltine (although it is usually bivoltine in central Spain). It can be concluded that in Mediterranean areas, habitats with a relatively high summer air humidity, such as river valleys or lake shores, are more favourable for supporting noctuid species with double- or multi-brooded life cycles and some of these species are characteristic of the habitats. This is due to the higher availability of substrate for oviposition and larval feeding during late spring and summer ; in the xerophilous areas of the evergreen oak and gall oak forests, most plants become hard or shrivelled and are not suitable or available for feeding.

Chorology : all of the "characteristic" species of site 1, and almost all of site 2, have Mediterranean distribution patterns (Asiatic-Mediterranean & Atlanto-Mediterranean). Among species characteristic of site 3 there is a wider range of distribution types : only four are Mediterranean, two are Eurasiatic, three Holartic and the other one Cosmopolitan. Thus the sampled riparian forest (and by extrapolation the riparian forests of central Spain) could be considered not only as an "ecological refuge" for more mesophilous species, but also

as a "biogeographical refuge". Several Eurasiatic species reach the southern limits of their geographical distribution in the river valleys of central Spain.

Final comment

Most of the results of this work, particularly those concerning the "characteristic" species of the sampling sites, could not be generalised to the whole ensemble of evergreen oak forests, gall oak forests and riparian forests of central Spain. The patterns of ecological distribution of some species, especially those whose larvae are oligophagous, depend more or less on the distributional patterns of their host plants. Other aspects, such as the dispersal ability of the different noctuid species, the year-to-year fluctuations in abundance of the more "generalistic" species (r-strategists) and certain environmental and biogeographical factors (considered in this work, but not discussed here), should be taken into account. A more detailed study of these factors, with more samples from other localities, would contribute to our knowledge of the ecological distribution and the environmental preferences of noctuid moths of the Iberian Peninsula.