OBSERVATIONS ON OVERNIGHT PERCH CONSTANCY BY A FEMALE DIGGER WASP, *AMMOPHILA AZTECA* CAMERON (HYMENOPTERA: SPHECIDAE), IN CAPTIVITY

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A female Ammophila azteca, *kept in cage, exhibited a remarkable overnight perch constancy, day after day, over a period of about 20 days and probably more. Among several stems of a vegetation clump it used almost exclusively one of them. Overnight perching was once observed to be preceded by elaborate flights around the vegetation clump that appeared to represent site recognition, probably based on topographical memory, well developed in these wasps.*

*Une femelle d'*Ammophila azteca, *élevée en cage, se montra remarquablement fidèle à un emplacement précis de sommeil, un brin, dans un bouquet végétal, pour une période d'une vingtaine de jours et probablement davantage. Avant de se poser sur l'endroit habituel, la guêpe a été observée une fois effectuant une série de vols autour du bouquet végétal, apparemment en relation avec la reconnaissance des lieux, bien développée dans cette espèce.*

BACKGROUND INFORMATION

Sleeping habits of various solitary or subsocial Hymenoptera have been described, analyzed and reviewed by a number of authors (some recent reviews in Evans and Linsley 1960; Evans and Gillaspy 1964; Evans 1966; Carayon 1967, etc.). Briefly summarized, the major characteristics and variables studied were, 1) the density and number of participants, that can vary from ball-like clusters of several hundred individuals (e.g. *Steniolia obliqua* wasps: Evans and Gillaspy 1964) to loose aggregations, with lower numbers (e.g. *Ammophila* spp.); 2) species composition, that varies widely. Monospecificity is apparently more likely in dense clusters (e.g. *Bembecinus godmani* wasps: Evans 1955) and heterospecificity (with or without species stratification) more likely in loose aggregations (e.g. Evans and Linsley 1960 found 21 species of wasps and 15 species of bees on a *Melilotus* clump occupied mostly by *Ammophila* wasps); 3) sex composition also varies with the different wasps and bees studied; 4) sleeping postures are almost always striking and characteristic for different kinds of wasps and bees (for *Ammophila* wasps see Fig. 1; for photos of other wasps and bees see for instance Evans and Linsley 1960; Evans and Gillaspy 1964; Carayon 1967); 5) daily and seasonal chronology has also been investigated in a few cases (e.g. same authors as above); 6) the influence of environmental factors has also received some attention, particularly the positive influence of bad weather (wind, storms, low temperature) on cluster formation (e.g. *Steniolia obliqua* wasps: Evans and Gillaspy 1964); 7) resting site characteristics and selectivity have been abundantly documented. Many Hymenoptera sleep on vegetation, besides *Ammophila* wasps. The apparent arbitrary choice of one particular vegetation clump among similar ones nearby has often been emphasized. A great diversity of other sleeping places has been reported in the literature (such as burrows, cracks, crevices, old buildings, under bark, stones, etc.).

Site and support constancy of individual wasps (8), the major object of the present paper, has been somewhat neglected, when compared with the other variables mentioned above. Indeed marking of wasps for individual recognition has been used in few studies, for instance by Evans and Gillaspy 1964, who found considerable variation in cluster composition of *Steniolia obliqua*, over days; one individual was even found in a cluster one km from the original cluster. Constancy at the species/population level is known far better and in this respect

Evans and Linsley 1960 made the distinction between *casuals* (seen less than 5 of 23 observation days, e.g. one species of *Ammophila*), *irregulars* (between 5 and 10 days) and *regulars* (more days). Most *Ammophila* wasps observed were in the latter category (seen even all of the 23 days). Species site constancy over years has been documented in few studies, but Evans and Gillaspy (1964) report that some perches were used by several successive generations of *Steniolia*, year after year.

OBSERVATIONS

On June 15, 1977, a female *Ammophila* was caught in central Oregon, U.S.A., about 12 Mi. S. of Prineville (Crook Co.), along the banks of the Crooked River, while feeding. The specimen (collection No. 1040) was later identified by the author as *A. azteca* Cameron, using Menke's key (1965). This wasp was maintained in a controlled laboratory unit among solitary wasps of other genera, from June 15 to August 4, 1977.

Some intermittent observations on sleeping behavior, with special emphasis on perch constancy (or lack thereof), were made during this period. A small clump of dried stems was provided to the caged wasps, (Fig. 2) for overnight use. It was placed near the right rear corner of the floor and left there untouched for the whole study. The wire mesh of the sides and top of the cage was also used by wasps with perching habits (including *Ammophila* wasps in a previous study) in addition to or instead of vegetation. The individual *A. azteca*, however, showed a marked, almost exclusive, preference for the vegetation clump. It also became apparent that this wasp selected almost invariably the same stem (No. 2 circled, Fig. 2) within the vegetation clump, day after day. This perch constancy was studied almost daily, starting on June 30 and throughout July. The wasp slept or rested on this perch for the night 18 days out of 21 (range of observation time: 1600-2245), almost always close or very close to the tip (range of distances to the tip: 0.7-5.0 cm; see Fig. 2, double arrow). Details of the observations are summarized in Table 1. It should be mentioned that location on perch No. 2 was not imposed on the wasp, for instance by crowding or unsuitability of all the other perches, including the wire mesh. If anything, occasional crowding on the vegetation clump interfered with, rather than promoted, this habit. (see Table 1, first footnote). Also these wasps did not function as attractants since the *Ammophila* individual was the first to occupy the vegetation clump. Furthermore other disturbances (presence of grasshopper exuviae on perch 2, on July 26) were probably also responsible for the wasp perching on top of the cage one day, rather than on perch No. 2 (Table 1, second footnote).

No special attention was given in this study to the preparatory stages of sleeping and presumably perch recognition implied by perch constancy over days. On one occasion, however (July 14), a detailed study of this behavior was undertaken, by continuous observation from 1955 to 2026 h, when the wasp settled for the night. Before the latter occurred, the wasp performed a series of elaborate hovering flights around the vegetation clump, only a few cm from it, and with progressive concentration around perch No. 2, interspersed with several landings both on nearby perches and later on perch 2 only. This strongly suggests orientation flights with site recognition (locality study), as observed so often in these and other solitary wasps when leaving and/or returning to their nests. Much grooming preceded sleeping, as usual, in the posture shown in Fig. 1, but a curious grooming bout in an upside down (venter up) sleeping posture was also observed that day, with all legs free of any contact with the perch. At least some days the wasp did not land right on target (perch 2) but reached the latter on foot from nearby vegetation stems.

The excellent homing abilities and locality recognition of *Ammophila* wasps while returning to the nest have been well documented. Some of these wasps easily solve detour

Table 1. Summary of observations on overnight perch constancy over days.

Date: July 1977	Observation time	Overnight. on perch 2	Overnight. elsewhere	Distance (cm) from tip
June 30		+		2.5
1	1930	+		5
2	1730	+		5
3	1600	+		2.5
"	1710	+		5
4	1741	+		2.5
9	1930	+		2.5
10		No	1	2.5(1)
11		No	Not 2	
12	1945	+		2.5
14	2026	+		0.8
15		+		"tip"
16		+		
17	1910	+		1.2
18		+		2.5
19	2045	+		0.8-0.9
21	2245	+		"tip"
26	even.	No	Top cage(2)	
27	2020	+		1.8
28	1915	+		0.8-1.0
29	1936	+		2
30	2030	+		0.7-0.8
Totals: 21 days		18 days	3 days	
Ranges:	1600-2245			0.7-5.0

(1) see Fig. 2, single arrow; some crowding on vegetation clump noticed that day.
(2) grasshopper exuviae visible on perch 2, fixed to usual sleeping site (disappeared later).

problems created by artificial obstacles (Thorpe 1950) and/or can even remember the state and location of several nests provisioned simultaneously over several days (including *Ammophila azteca*: Evans 1965).

GENERAL DISCUSSION

Such behavior raises many unsolved questions. First what characteristic(s) make a perch suitable, preferable or unique? Alternatively is the choice completely or in part arbitrary? Perch No. 2 did not appear to differ strikingly from some other perches, in diameter and general characteristics. It is perhaps important that it was more vertical than some other (but not all) perches and rather in the middle of the vegetation clump (as mentioned by Evans and Linsley 1960) and devoid of leaves. At least these observations show that perch selectivity and constancy do not depend on presence of other wasps (conspecifics or not) as an attractant, at least not as a proximate factor. Of course this wasp could have formed a habit of

site selectivity and constancy, on the basis of attraction to other wasps or not, before it was captured. In natural conditions, Linsley (1962) plausibly suggests that perches are located on plants exposed to early morning and late evening sun, and protected from the elements, from wind for instance (see also Evans and Gillaspy 1960; Carayon 1967, etc.). Studies in captivity could open interesting new experimental possibilities. Homing precision and locality recognition have clear adaptive value for nesting, hunting and also territorial behavior (for the latter see Steiner 1975), but it is not always as clear for sleeping behavior. If it promotes and maintains aggregation of many wasps on the same perch, however, then the possible benefits of aggregations might have to be considered, such as protection in numbers (see Evans and Linsley 1960), mating (e.g. some *Steniolia* wasps: Evans and Gillaspy 1964), etc.

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Fig. 1. Sleeping posture of a female *Ammophila breviceps* Smith kept in cage (Arizona, U.S.A., Southwestern Research Station, Portal, Cochise Co., of the American Museum of Natural History, New York: June 1973).

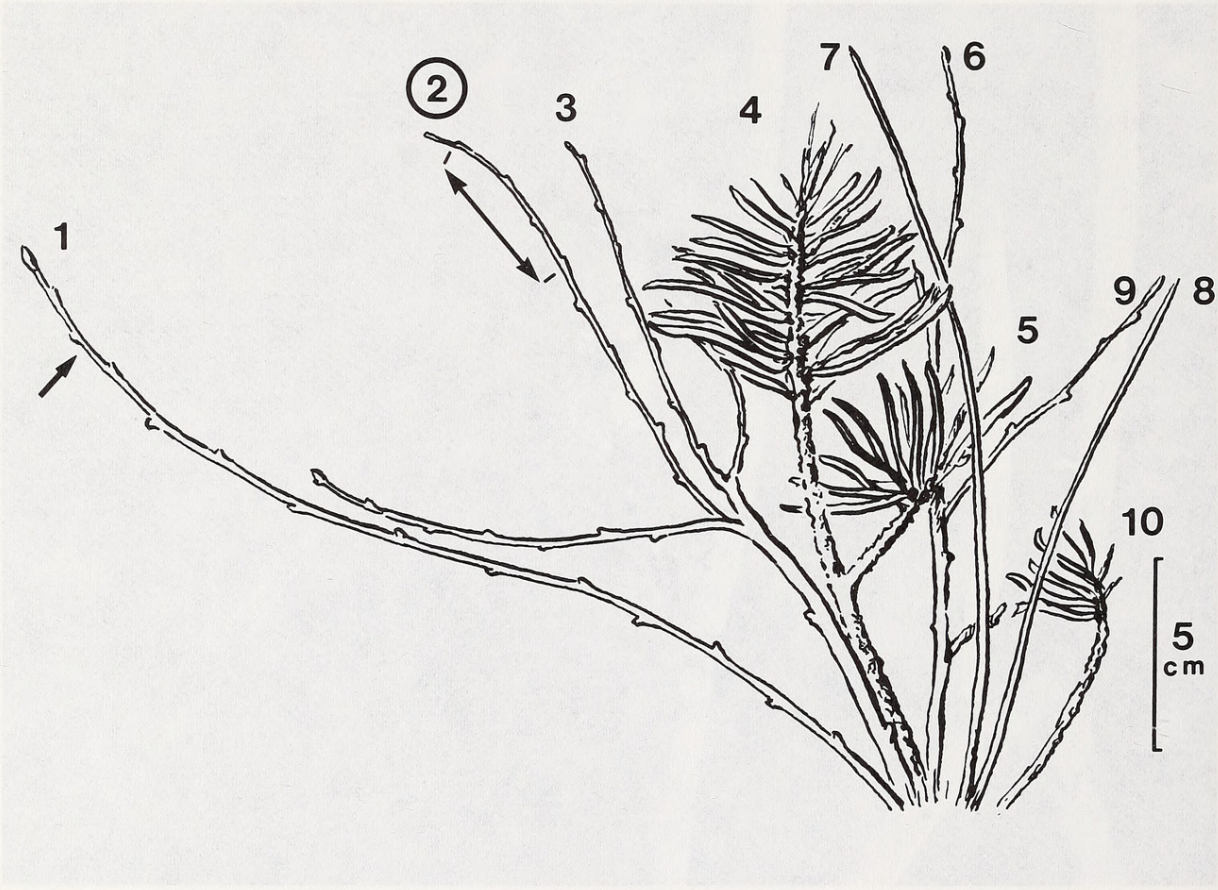

Fig. 2. Dry vegetation clump available to a captive female *Ammophila azteca* Cameron, showing preferred overnight perch (No. 2, circled) among ten different ones (1 to 10) of various angles and other characteristics; double arrow indicates maximum range of variation of point grasped with mandibles by sleeping wasp, for 18 days of observation; 1,2,3,6,9: thin terminal branches of small unidentified shrub; 4,5,10: thin terminal branches of *Pinus* sp. tree; 7,8: long needles of *Pinus ponderosa*. (Drawn as seen through window of frontal side of cage).