POLSKA AKADEMIA NAUK
INSTYTUT ZOOLOGII

ANNALES ZOOLOGICI

Tom 33 Warszawa, 25 XI 1975 Nr 8

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Bionomics of *Formica* (*Coptoformica*) *pressilabris* NYL. (*Hymenoptera*, *Formicidae*)

[With 13 Figures and 3 Tables]

Introduction

Formica pressilabris NYL. belongs to the subgenus *Coptoformica* MÜLL. by 15 relatively rare species so far as known. To *Coptoformica* belong exclusively palaearctic forms. The nearctic species of ants of the *F. exsectoides* FOR. group formerly classified with these had been transferred recently to the subgenus *Formica* s. str. on the basis of certain morphological features (DLUSSKY 1967).

In Poland, in addition to *F. pressilabris*, exist 3 other species of *Coptoformica*: *F. exsecta* NYL., *F. forsslundi* LOHN., and *F. foreli* EM. Of all species of this subgenus widespread throughout the world as well as in Poland are *F. exsecta* and *F. pressilabris*. These two species are very similar in their ecology and ethology. Consequently, their populations are often found close to each other. The relation between these two will be a subject of a separate study.

In Europe *F. pressilabris* occurs in France, Belgium, Netherlands, Switzerland, Denmark, Poland, Sweden as well as in the southern parts of Finland and Norway. In the U.S.S.R. the northern frontier of its area runs through the 58th parallell while the southern along the 48th parallell. Its most easterly extension is in the Ilmen Natural Reserve in the Chelyabinsk district. (DLUSSKY, PISARSKI 1971) (Fig. 1). In Poland this species occurs in the eastern and northern regions (DLUSSKY, PISARSKI 1971) (Fig. 2).

The ants *F. pressilabris* are typical ecotonic forms. Their colonies like the colonies of the closely related *F. exsecta* occur on the margins of various forest types, woodland meadows, recently cut forest areas and among well lighted second growth. These ants prefer places which are dry and exposed to the sun.

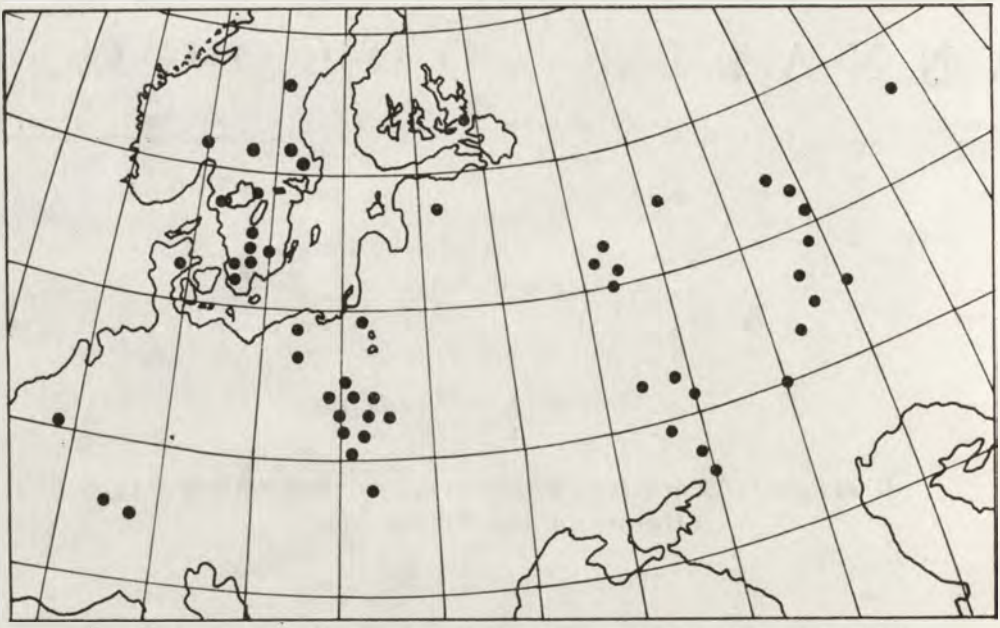

Fig. 1. Geographic distribution of *F. pressilabris* NYL, (DLUSSKY 1967).

However, they are encountered also on the peat bogs and wet meadows (STITZ 1939). The upper limit of both species in the mountains corresponds to the lower mountain forest (DLUSSKY, PISARSKI 1971). In Poland populations of *F. pressilabris* occur both in the form of single nests as well as in the form of the extensive polycalic colonies. In the U.S.S.R. they are found only as individual nests made up of monogynic swarms (DLUSSKY 1967).

In view of the considerable divergence of terms used by different authors, I shall indicate the meaning of terminology used in this paper:

swarm — ant association (workers, sexual forms, brood) inhabiting a particular nest,

society — an association of ants inhabiting a single nest or a colony of nests,

nest — a structure inhabited by ants,

colony — nest together with the swarm in it,

monocalic colony — an isolated nest,

polycalic colony — an ant colony of common genetic origin and in mutual contact. Usually made up of several ant hills,

branch — filial nest established by ants originating from a maternal ant hill,

station — group of foraging ants from a common nest, inhabiting a temporary, simple nest near the sources of food,

territory — an area in the vicinity of the nest defended by a given ant society,

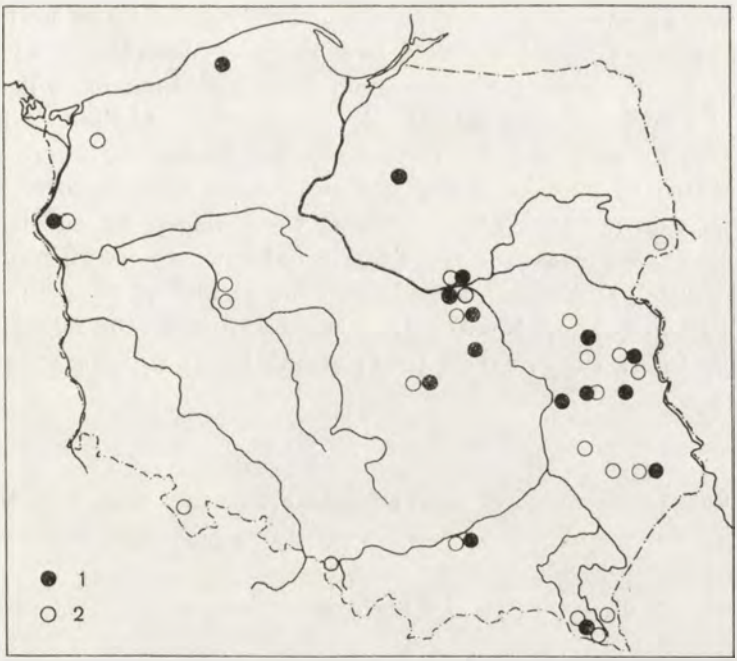

Fig. 2. Distribution of *F. pressilabris* NYL. and *F. exsecta* NYL. in Poland. 1 – *F. pressilabris*, 2. – *F. exsecta* (DLUSSKY, PISARSKI 1971).

foraging area – an area explored by the ants in search of food, and

colony fission – a term to indicate the process of the division of swarms and the origin of the filial nests.

Subject and Method of Research

The investigation described in this paper was carried out in 1971–1972 during the summer from June through September in the Bieszczady Mts. area in the vicinity of Ustrzyki Górne at an altitude of about 500 meters above the sea level. In this area in addition to the very numerous colonies of *F. exsecta* there are found with fair frequency colonies of *F. pressilabris*. Observations were carried out on several polycalic colonies as well as on some isolated nests of the latter species. Some partial data gathered on this species in this area by Dr. B. PISARSKI in 1968–1970 are also included in this paper.

In order to estimate the relative population numbers in an ant colony and to analyse the contacts between different colonies it was essential to mark individual ants. This was done by marking the tergites of the abdomen with tiny brush to form a small dot. "Wilbra" dye used to colour lether was employed here. Different individuals originating from different nests from a preselected part of the colony were marked in different colours and after recapture in another

nest were marked over again, with a dye indicating the latter nest. Estimation of the ant numbers in a particular swarm was accomplished by the control captures i.e. so-called numbers captures. This was done by collecting within the period of 5 minutes of all individuals on the surface of the nest found within an area set off by wire ring 15 cm in diameter. These rings were placed upon the nest's suface 15 minutes before the observations begun so as to allow the ants to quiet down. Captured individuals were placed for the time being in a high plastic container (whose rim was wetted with the paraffin oil to prevent escape of the ants), and then released upon the surface of the nest. The relative number of ants in the nest N was estimated according to the following equation (Chew 1959, 1960; Czen, Dżan 1961; Ayre 1962; Pętal, Pisarski 1966):

$$N = \frac{Tn+1}{t+1},$$

in which: T — total number of marked individuals in a nest, n — total number of all individuals caught during control captures, t — total number of marked individuals caught during control captures.

The numbers of queens in the nest was established during excavations of the nests.

Contacts between the nests were estimated by the control captures: namely, during the 5 minute period all individuals marked with colours other than the colour of the particular nest found upon its surface were captured. Next, the intensity of these contacts was assessed by the average number of the marked individuals in proportion to the total number of captured individuals from a "foreign" nest during the single control captures. The data thus gathered for different colonies were compared. The control captures were carried out for about two weeks from the time of marking between 9 and 11 a.m. when ant activity is at its highest.

However, the number of the marked individuals in the subsequent control captures did not correspond to the numbers marked on the initial control captures. As a result of our activities while marking ants, the nest was much disturbed. The ants living permanently under the ground swarmed all over the surface of the nest, returning to their environment when the danger was over. Furthermore, the number of the marked ants diminished with time due to the falling off of the paint on their abdomens. It is also possible that the marked individuals for reasons not known suffered from increasing mortality. The decrease in the numbers of the marked individuals took place in all the nests and did not interfere in the investigations of the contacts between the particular swarms. On the other hand, this would result in considerable errors in efforts to estimate total number of ants in the colony. To avoid this, series of special captures were introduced in order to investigate the rate of decrease among the marked ants after they had been released. Here, series of 400 or 500 individuals were marked each in one of five different colours in a preselected nest

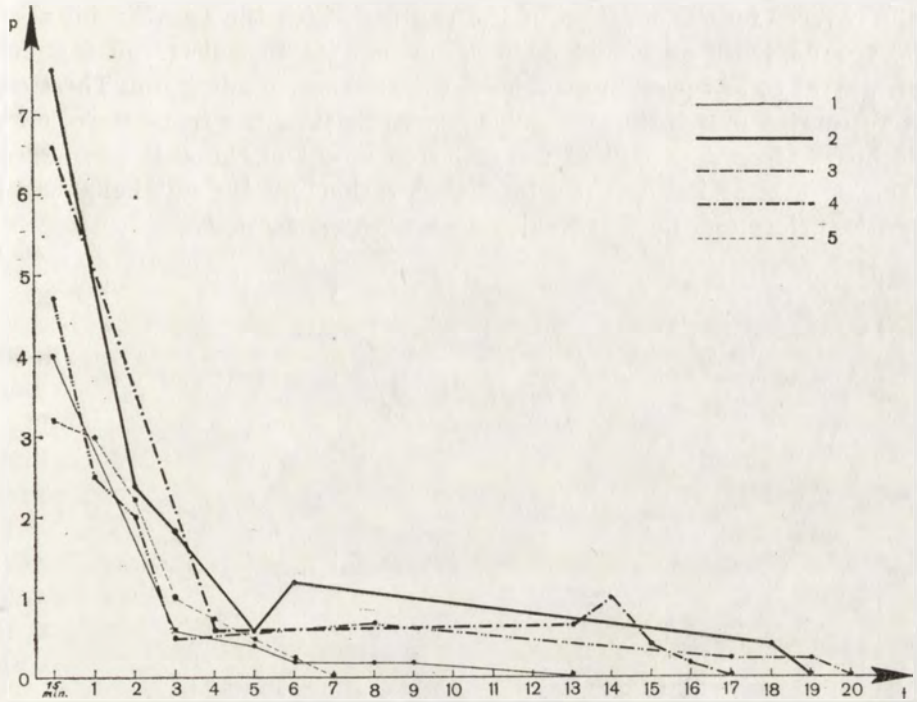

Fig. 3. Decrease in numbers with time of the individuals of *F. pressilabris* NYL. marked with the dye: p – number of individuals caught during captures in relation to the size of series (%), t – time after markings (days); 1, 2, 3, 4, 5 – curves refer to given series.

during several days. Following this, control captures were carried through in this nest until complete or nearly complete disappearance of the marked ants. First control captures in each of the different series were carried out 15 minutes after the completion of the markings. The average number of these captures indicated the percentage of the individuals captured during the 5 minutes on the surface of the nest in relation to all as yet undiminished number of all individuals in this series. On this basis, results of the succesive captures allowed to estimate the decreasing number of ants as yet remaining within the nest. (Fig. 3 and 4, Table 1).

Table 1. Decrease of the number of individuals in the colony

Succesive days in marking	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
% of the size of series	100	68	42	26	18	13	11	10.5	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4

In order to investigate relative population density of *F. pressilabris* within the foraging area a set of dry Barber's traps was established in a selected part of the colony's area. Glass jars, 4 cm in diameter and 10 cm deep, with

the rim covered for the duration of the captures with the paraffin oil were set in the ground (with an aid of an instrument used to collect soil samples) in such a way as to have rim at even level with the surrounding soil. These captures were carried out during several days. Each time the traps were left over for 24 hours after the count of the captured ants and the ants were released.

During this period also constant observations on the ant behaviour over the nest's surface and in the foraging area were carried out.

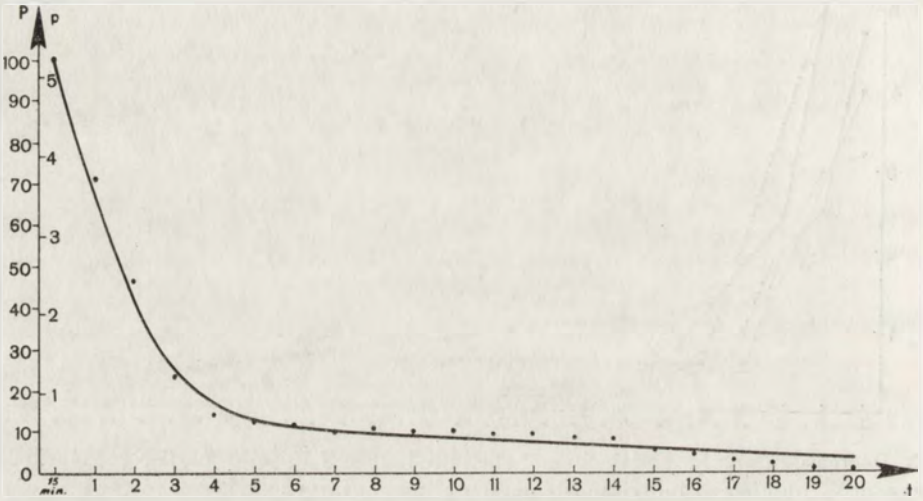

Fig. 4. Durability of the markings of *F. pressilabris* Nyl. with the dye (median values for the data for each series): P — total number of individuals marked in ant hill in % of the size of series, p — number of marked individuals captured during a single catch in relation to the size of the series (in %).

F. pressilabris in the Bieszczady Region

In the Bieszczady area *F. pressilabris* occurs mainly in the dry and strongly sunlit areas. Open meadows among alder growth, strongly illuminated spruce and larch second growth, forest margins and dry *Carex* meadows are its favorite habitats. Individual colonies are also encountered in the high grass or wet meadows.

The upper part of the nest over ground is built of the material available in the area and resembles a pile of hay. Remnants of dried grass, moss, seeds, bits of earth all serve as the construction meterials. The nests can be constructed also of "foreign" material such as saw-dust, tiny gravel, etc. artificially spread around the ant hill. On the average the nests are 15 to 20 cm in diameter, however larger are also found. The largest nest found in the Bieszczady region was a monocalic colony on the Wołosaty stream near Bereżki village. This mound measured nearly 1 meter in diameter at the base, but it was an exception. The shape of the ant hill is variable, and depends upon the nature of the habi-

tat. In the open the nests are usually low and flat. But in the high grass and shawdowed places they tend to be high, mound shaped, with steep sides. Very often the nests are located in the earthen mounds deserted or partly inhabited by the ant *Lasius* (*Chtonolasius*) *flavus* FABR. During the period when new ant nest is established, a group of workers selects such place as most suitable for the new settlement. The attraction frequently being slight elevation and soft surface. As the new swarm of *F. pressilabris* grows in size, it gradually displaces the former inhabitants, eventually taking over the entire earth mound.

Relative population of the studied nests varied from several hundred to a thousand. Assuming that only 60 % of the swarm is available to marking and control captures while the remaining do not leave the interior of the nest, the actual population of the ant nest should vary from 1000 to 2000 individuals.

The societies of *F. pressilabris* in the Bieszczady region occur in the form of monocalic nests, associations of several nests and very extensive polycalic colonies occupying the surface of several thousand square meters and numbering sometimes over 100 nests. It is probable that the occurrence of this ant in the U.S.S.R. only in the form of individual, isolated ant nests might be explained in the fact that this area represents the outliers of its distribution, that it is essentially western Palaearctic and that therefore in Poland it finds more suitable environment. On the other hand, much more widely distributed

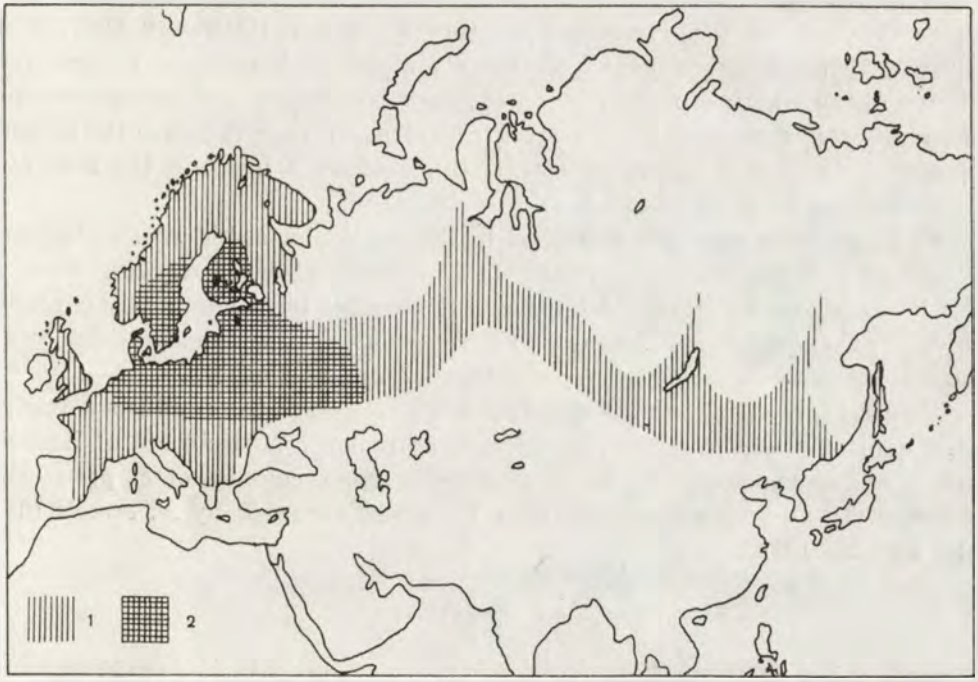

Fig. 5. Geographical range of *F. exsecta* NYL. and *F. pressilabris* NYL. 1 – *F. exsecta*, 2 – *F. pressilabris*.

F. exsecta forms extensive polycalic colonies both in Poland and in Asia. Polycalism should be regarded a type of higher organisation of the ant societies (PISARSKI 1973).

Ant nest density in the colony area of *F. pressilabris* is very high and frequently exceeds 0.7 nest to a sqare meter taking into an account only inhabited nests. Distance between the nests may be less than 20 to 50 cm. Under the circumstances, isolation of the foraging area of different swarms of our species is impossible because individual ants freely penetrate each others nests. This is precisely opposite to the situation occurring in *F. rufa* where these are isolated (Zakharov 1972).

Food

As most species of ants, *F. pressilabris* is predatory, however, its basic food is honeydew from the aphids which parasitize stems of green plants and the young shoots of many trees and bushes. Near every colony of aphids which is the source of food for the ant nest are found not only foraging ants but also those that act as "guards" for them. These had been observed chasing away lady beetles (*Coccinella septempunctata* L.) which tried to approach the aphids. Where larger colonies of aphids parasitize twigs of the green plants which provide especially rich source of ant food, the workers of *F. pressilabris* construct protective sheath of the same material as is used for the construction of the nest.

In contrast to the primarily predatory *F. exsecta* (DLUSSKY 1967, WESSELINOFF 1968), *F. pressilabris* feeds mainly upon the honeydew. Protein food this ant obtains mainly from the insects easy to capture and overpower such as lepidopteran larvae and small earth worms. Hourly observation of the medium size nest showed that during this time the workers bring into the nest only few specimens of invertebrates.

F. pressilabris does not specialise in the particular aphid species but uses all such as conveniently are available and occur within its foraging area. In the Bieszczady region during August and September most commonly exploited aphids are: *Aphis chloris* KOCH., *Aphis frangulae* KALT., *Brachycaudus cardui* (L.), *Cinara boerneri* H.R.L., *Microsiphum* sp. and the others.

No doubt, the type of food of these ants is related to the conditions existing in the habitat occupied by the particular ant society. With an aid of Barber's traps it was determined that the territories in which colonies of *F. pressilabris* are found are faunistically poorer than the areas occupied by *F. exsecta* (data from Dr. B. PISARSKI).

Social Structure

Within the subgenus *Coptoformica* the typical form is *F. exsecta* in which occur both types of social structure known among ants. The swarms might be either polygynic, that is containing several queens of monogynic, that is

having only one queen. The ethology of the swarm reflects its social structure. The external diagnostic traits of a nest are shown in the reaction of the swarm toward the individuals artificially introduced from another nest. Ants from the polygynic societies are never hostile toward the individuals even from very distant ant nests or colonies. Oh the other hand, monogynic swarms immediately kill all "foreign" individuals of their own species both on the surface of their nests or within their own territory (Pisarski 1973). Monogynic colonies always occur in monocalic forms, but polygynic can expand into extensive polycalic colonies.

All ant colonies of *F. pressilabris* in the Bieszczady area are always polygynic in character even if occurring singly. This has been shown in experiments which tested mutual relationship of the workers on the surface of the nest as well as the rather rapid blending together of artificially introduced samples of different filial nests from the same polycalic colony.

Excavations of several ant hills of *F. pressilabris* had shown presence of up to 20 queens in each of them. This data, however, come from only very small ant hills. Probably very large ant hills inhabited by very strong swarm may contain up to several hundred queens, just as do the analysed societies of *F. exsecta*. When few cells were exposed under the stone, bordering on the large nest of *F. pressilabris* it was found that they contained over a dozen queens. Undoubtedly, the entire nest contained many times that number.

Of course, this cannot exclude the possibility of the existence in Poland of the monogynic colonies of this species of ant. Such colonies probably do exist as they do in *F. exsecta* but are difficult to find due to the rarity of the species.

Establishment and Development of New Colonies

In *F. pressilabris*, as in many species of ants, new colonies develop as a result of reproduction of the newly emerged sexual forms or by colony fission. Sexual reproduction in succession involves: periodic emergence of sexual forms, mating flight and setting up of a new nest by a young, fertile female (queen). On the other hand, colony fission consists by turns of: division of swarms, development of the filial nests and in the end formation of an extensive polycalic colony. Females of *F. exsecta* establish their own new societies in the nests of the ants of the subgenus *Serviformica*, most commonly *F. fusca* L., lacking its own queen. With the aid of the workers of such nests they breed their own progeny. Such mixed societies are only temporary. They last only until the last of the orphaned workers of the swarm of *Serviformica* disappear (Kutter 1956, 1957, Pisarski 1973). Although this phenomenon occurs only sporadically, it is important because it enables the species to spread and conquer new territories.

The biological and ethological analogies between the species *F. exsecta* and *F. pressilabris* suggest that sexual reproduction process in both is similar.

The mating flight of the young sexual generation of *F. pressilabris* in the Bieszczady takes place in July.

The monogynic colonies of *F. exsecta* and probably also of *F. pressilabris* established by temporary social parasitism in some instances may accept an additional, fertile queens and, to become polygynic, capable of colony fission (Pisarski 1973).

Main reason for the separation of the filial swarms from the maternal nest seems to be overpopulation of the workers in the nest. Separation of such swarms begins when the increasing demand for food (in the main swarm) results in the overextension of the foraging territory and as a result, transport of the food back to the nest becomes troublesome, in other words uneconomic.

Two factors influence the development of the polycalic colony. The process of polycalisation and the constant increase in the number of queens which after the mating flight land on the territory of their own colony and re-enter the nest, and the absence of the ethological barriers between the polygynic ant hills and colonies which allows constant enlargement of the genetic pool due to the adaptation of the queens flying in from other territories.

Structure and Function of Polycalic Colonies

Rapid expansion of the colony permits the polycalic forms of ants to overrun large territories which coupled with the huge populations of their societies results in the dominant role these ants play in the entomofauna of their habitat. Polycalic colonies are also long lived as a result of constant inflow of young queens and the considerable security which they enjoy to a degree which do not attain other types of insect societies.

The complex society represented by the polycalic colony of ants can function adaquately only through diversification and specialisation of its different elements. In a typical colony of *F. pressilabris* several types of nests can be distinguished. Most important of these are permanent nests, both maternal and filial and the temporary nests known as stations. The maternal nests are the main centers of colony fission and serve the colonies as centers for the production of the sexual forms and for breeding of progeny. Filial nests should be considered as potential parental colonies because after period of dynamic expansion they assume reproductive function. However, the stations are made up only of the foraging workers separated from the swarm for the time being and located near the permanent sources of food. These inhabit small nests, usually about 5 cm in diameter located most frequently in the clump of grass and lacking subterraneal structures. With the completion of the exploitation of the food resources in a locality, the station is abandoned.

In contrast to other species of ants, particularly from the subgenus *Formica* s. str. the workers of *F. pressilabris* which supply the swarms do not form distinct paths leading to the food resources. Penetration however, is not enti-

rely haphazard. It is possible to recognise certain permanent feeding paths with fluctuating borders and low population density. These paths or tracks lead mainly to the plants parasitized by the aphids. The path of a single ant is not straight but has detours of few centimeters. Maximum distance from the nest for the foraging ants changes according to the location of the sources of food. Very frequently foraging is limited to the narrow strip of vegetation immediately adjacent to the nest. Sometimes the foraging track however, follows several meters. In two instances the paths were observed connecting the maternal ant hill with the foraging station situated in the cluster of *Achillea millefolium*

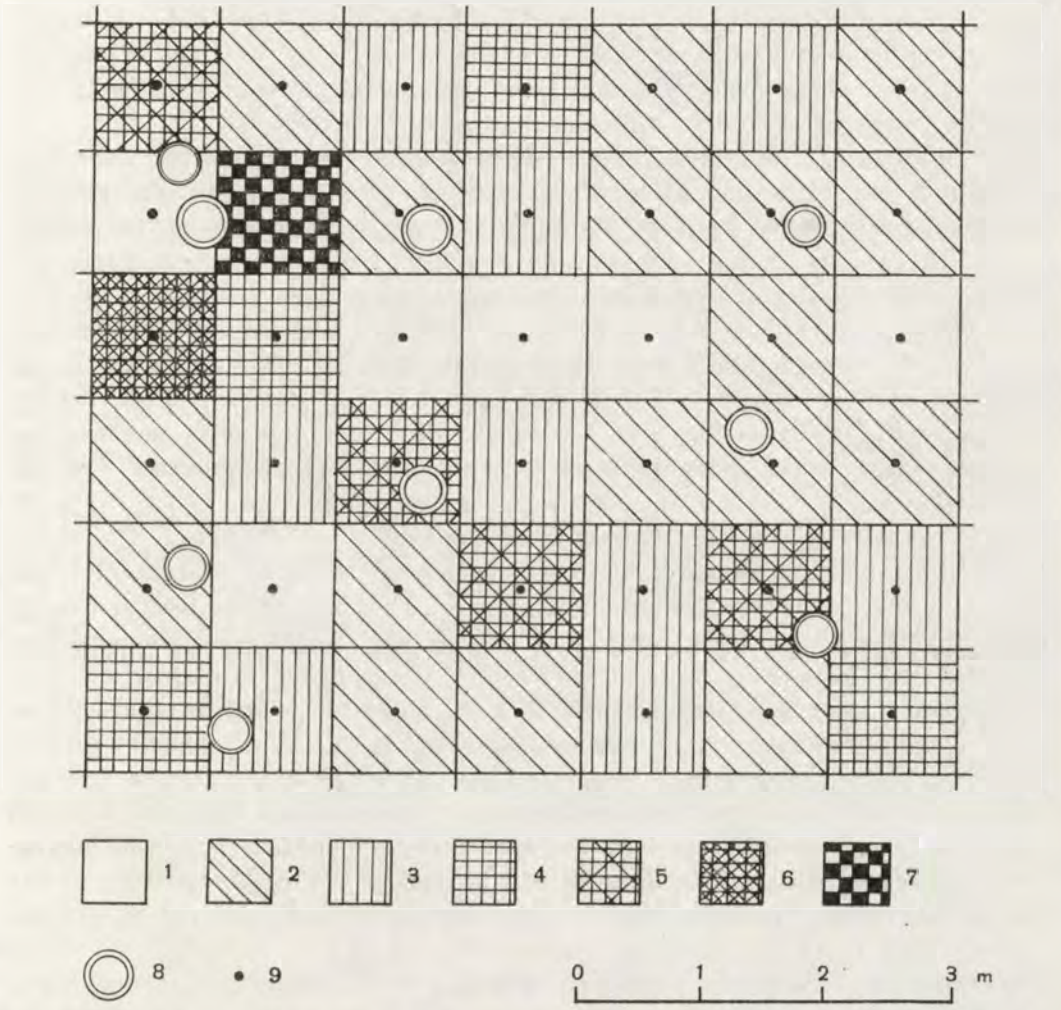

Fig. 6. Population density in the territory of a polycalic colony of *F. pressilabris* Nyl. based on daily catches with Barber's traps: 1 — absence of exploring individuals, 2 — one individual, 3 — two individuals, 4 — three individuals, 5 — four individuals, 6 — five individuals, 7 — above 5 individuals, 8 — nest, 9 — trap.

L., parasitized by the aphids. This was the only source of food in the immediate vicinity of the nest. There were no ants in the remaining territory adjacent to it.

As a rule, scattered penetration within the entire territory around the nest is virtually unobservable. This is probably due to the fact that the predation is of little importance in the feeding habits of *F. pressilabris*.

Population density in the trophic area is unequally distributed. It is determined by the local sources of food (Fig. 6).

It is characteristic of the polycalic colonies of *F. pressilabris* that their structure is related to the food resources of the environment occupied by the given society. The intensity of migrations between the nest of a colony is determined by the conditions in its immediate feeding area. This kind of influence of environment upon the appearance of the colony and the rules of contact between different swarms of it had been analysed in three different polycalic societies, each living under different conditions.

Colony no. 1 was situated on the edge of a large meadow and had unlimited possibilities for expansion. However, as a result of frequent pasturing of cattle, the grass got trampled upon and the aphid host plants got destroyed. The outcome of this was condition of famine for the ants. On the territory of this ant colony were found many deserted nests, mostly large from 20 to 30 cm in diameter. These probably developed when the conditions were more favourable. But permanently occupied nests were rather small 10 to 15 cm in diameter. Along were also found many small filial nests and foraging stations. Most striking characteristic of this colony was nest's instability, the filial nests and foraging stations originating frequently and as frequently swarms deserted the old nests, moving to new locations. The plan of this colony made in 1971 (Fig. 7) was in the next season valid only in a bare outline.

Colony no. 2. occupied habitat only somewhat richer in food supply. The aphids in this territory were numerous in species but few in numbers and could not supply the ants with a sufficient food necessary for full development. The possibility is for the expansion of the colony were limited to a small meadow located on the southern slope of the hill, surrounded by growth of Black Alder (*Alnus glutinosa* GAERTN.) and *Frangula alnus* MILL. The growing bushes formed an increasingly constraining ring around the colony, as shown by the deserted nests on the edge of the meadow. Certainly, the swarms from the deserted nests on the periphery moved over toward more central locations, thus aggravating already precarious conditions of the society. As in the territory of the colony no. 1, here too, were observed signs of deserted, old nests and many temporary filial nests and foraging stations (Fig. 8).

Colony no. 3 occupied part of the second growth of larch and spruce, exposed to strong sunshine. This territory gave the ants unlimited scope for development and also provided them with a rich source of food in the masses of aphids parasitizing spruce and larch trees. The colony consisted of two isolated associations of ant nests, divided by wide stretch of bushes largely made

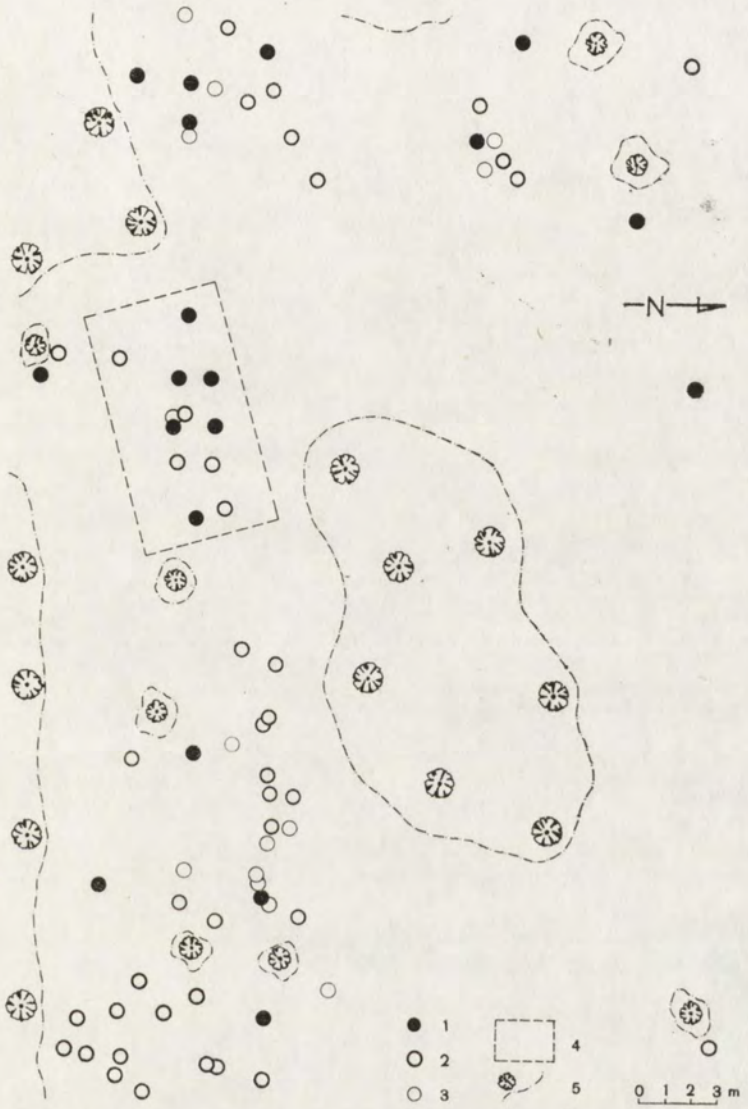

Fig. 7. Polycalic colony no. 1 of *F. pressilabris* Nyl.: 1 — nest above 20 cm in diameter, 2 — nest 10–20 cm in diameter, 3 — nest up to 10 cm in diameter, 4 — association of nests in which investigation on migration were carried out, 5 — limit of dense growth (six most outlying nests were not included in the study for technical reasons).

Fig. 8. Polycalic colony no. 2 of *F. pressilabris* Nyl.: 1 — nest over 20 cm in diameter, 2 — nests 10–20 cm in diameter, 3 — nest up to 10 cm in diameter, 4 — abandoned nests, 5 — association of nests subject to the study of migration, 6 — limit of dense growth, 7 — direction of the incline of the slope.

up of *Vaccinium vitis-idea*. L.. The nests were relatively far apart 2 to 4 m away from each other and inhabited by strong, numerous swarms whose relative population reached as many as 1500 individuals. In spite of the considerable possibilities for territorial expansion, there were few changes in the structure of the colonies during the two years. During that time there originated only a single filial nest separated from the largest nest. A single swarm moved about 1 m away from its former location under the overshadowing branches of young spruce tree. Favourable conditions were also reflected in the appearance of individual ants from this colony. The average weight of a worker was about 4 mg, while this figure was reached only by the individuals from only some most favourably located nests in the colony no. 2., Conversely, the average weight of the worker from the colony no. 1., was about 3.7 mg.

The above data from different colonies of *F. pressilabris* show ways in which the ants exploit their foraging area. In the rich habitat the ant societies take the form of few and widely dispersed ant hills inhabited by strong swarms. But in the poor environment they have tendency toward maximum exploitation of the available territory by covering it with a dense net of small ant hills while simultaneously the size of the swarms decreases.

This was subsequently verified by an experiment carried out on a group of nests of *F. pressilabris* occupying part of the pasture. These existed in an extremely impoverished environement and poor condition in a low, trampled, and dried out grass. Both in variety as well as in numbers the entomofauna of this region was extremely limited, the ant hills weak, small and underpopulated, with the largest measuring only about 10 cm in diameter (Fig. 9). In July 1971

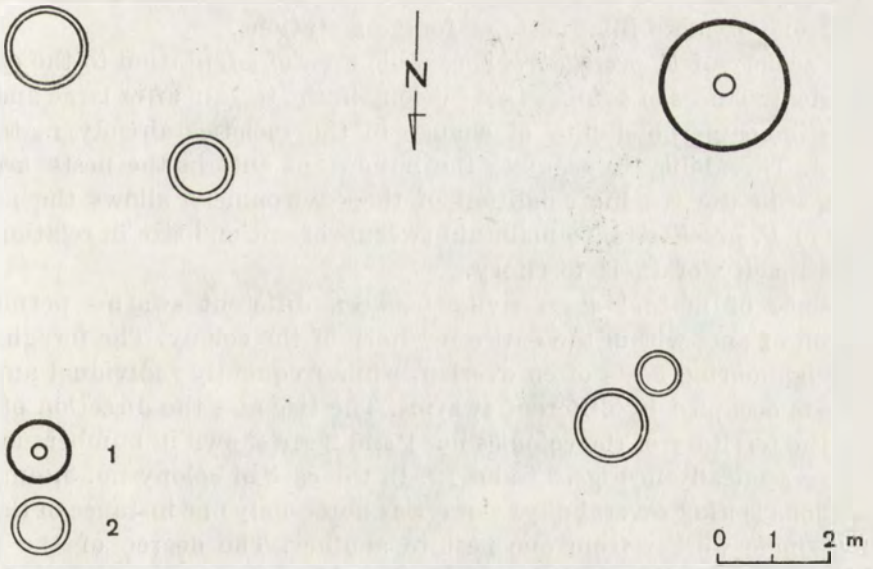

Fig. 9. Exploitation of the feeding area by the society of *F. pressilabris* Nyl. — initial appearance: 1 — maternal nest, 2 — filial nest.

the nests got excavated leaving out only the largest. In 1972 this particular nest gave few small filial nests (Fig. 10). In some of the excavated ant hills both the queens and their brood were found. These then were the reproductive swarms, despite the fact that the maternal nest was inhabited by rather few ants.

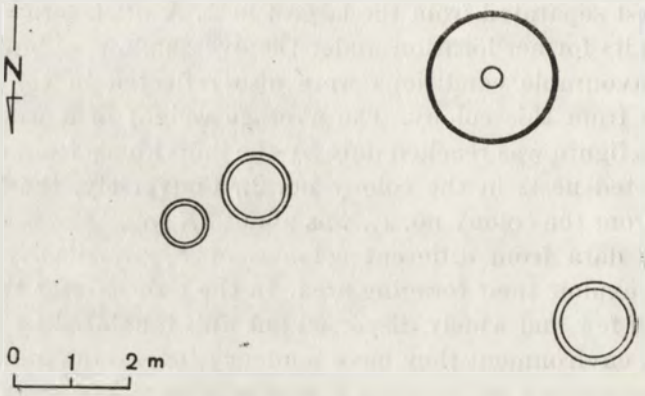

Fig. 10. Exploitation of the feeding area by the society of *F. pressilabris* Nyl. — conditions one year after excavation of the filial nests (explanations as on Fig. 9).

Often the swarm, usually not large, moves completely into the new place. This has been observed on the workers artificially transferred into new habitat. These several times changed their nesting place, even as much as 10 m, each being made after the depletion or disappearance of local food supply. On the other hand, strong swarms which inhabit favourable nest locations in such cases despatch one or more filial nests or foraging stations.

The society of *F. pressilabris* is capable then of adaptation to the changing environment. Traces of a "dispersed" colony in the terrain after large and strong ant hills indicates possibility of change in the societies already mature and stabilized. The ability to regulate the number of ants in the nests according to changes in the trophic condition of the environment allows the polycalic societies of *F. pressilabris* to maintain swarms of optimal size in relation to the feeding capacity of their territory.

Absence of mutual aggressivity between different swarms permits free circulation of ants within the entire territory of the colony. The foraging areas of the neighbouring nests often overlap, while frequently individual ants enter other nests occupied by different swarms. The size and the direction of migrations in the territory of the colonies no. 1 and 2 are shown in numbers in Tables 2 and 3, graphically in Figs. 11 and 12. In the case of colony no. 3, during the observations lasting several days there was noted only one instance of the transfer of a single worker from one nest to another. The degree of the contact intensity of these swarms is expressed as 0.2. The intensity of migration is related directly to population density in the nests in a given territory and therefore

Table 2. Degree of intensity of contacts between different nests as sampled on the fragment of a polycalic colony no. 1 of *F. pressilabris* shown as median number of marked individuals (% size of series), registered in a "forein" nest during a single catch (in the nests i, j, k, l the workers were not marked).

Despatching nests \ Receiving nests	a	b	c	d	e	f	g	h	i	j	k	l
a		–	0.15	–	–	–	–	–	–	–	–	–
b	–		–	–	–	–	–	–	–	–	–	–
c	–	–		–	–	–	–	–	–	–	–	–
d	–	0.25	0.50		0.50	–	–	0.50	0.25	–	–	–
e	–	0.28	0.55	–		–	–	0.82	0.82	0.27	–	–
f	–	–	–	–			0.70	0.70	0.35	–	0.35	–
g	–	–	–	–	–	0.35		0.18	–	–	–	–
h	–	0.25	–	–	0.25	–	0.25		–	0.50	–	–

is a function of the trophic conditions of the habitat occupied by the society of this species of ants. Thus while the population density in the nests in the examined fragments of nos. 1,2 and 3 respectively is 0.70; 0.45; and 0.25, nest in a square meter the intensity of contacts between the swarms of these societies calculated as the mean of emigration and immigration for one nest is: 0.80; 0.50 and 0.05, respectively (Fig. 13).

Analysis of the data concerning the intensity and direction of migration from a particular swarm and the analysis of the conditions in which it lives, permit to reveal certain rules governing mutual contacts between the ant nests. Namely, the individuals from the swarms living under the conditions of impoverished food supply are migrating most frequently into "foreign" and more favourably located nests. Conversely, immigration into their own ant hills is minimal or absent altogether. Moreover, there are almost no individuals from well supplied nests into the neighbouring ant hills, while there is a considerable inflow of "foreign" ants into their own. An example of this in the territory of colony no. 1 was migration into the nest b located in the tall, untrampled

Table 3. Degree of intensity of contacts between different nests as sampled on the fragment of polycalic colony no. 2 of *F. pressilabris* shown as median number of marked individuals (% size of series), registered in a "foreign" nest during a single catch.

Despatching nests \ Receiving nests	A	B	C	D	E	F	G	H	I
A		0.30	0.30	–	–	0.10	–	–	–
B	0.40		–	–	0.20	–	0.20	0.10	–
C	–	–		–	0.20	–	–	–	–
D	0.18	0.18	0.16		–	–	–	–	–
E	–	–	–	–		–	–	–	–
F	–	–	–	–	–		0.32	–	0.16
G	–	–	–	–	–	0.66		–	0.80
H	–	–	–	–	–	–	–		–
I	–	–	–	–	0.10	–	–	0.20	

grass, some distance from the remaining ant nests (Fig. 11). In the territory of the colony no. 2, the equivalent of the just mentioned ant hill b were the nests E and H (Fig. 12). The first was on the edge of a meadow near the line of bushes, the other under the bush of *Frangula alnus* MILL. attacked by the aphids. The ants from these nests were larger and their swarms more numerous and very active.

In some instances the return of the emigrants into maternal nest had been observed. Often however, new arrivals settle in the nest where for a long time they perform their usual, normal functions. For this reason, the above described contacts between different swarms may be regarded as reflection of two processess taking place within the polycalic societies of *F. pressilabris*. Without doubt, we have here gradual migration of swarms from the nests located in less favourable environment to those in more favourable. On the other hand, the return of some individuals after exploration of other nests sug-

gests that swarm contacts may have certain role in the trophallaxis, that is to say an exchange of food between the ants of the same colony. It may have special importance as a form of additional feeding of the nests existing in famine conditions. Thus, we would probably have here the exchange of food of the second degree between different nests of a polycalic colony (CHAUVIN, LECOMTE 1964).

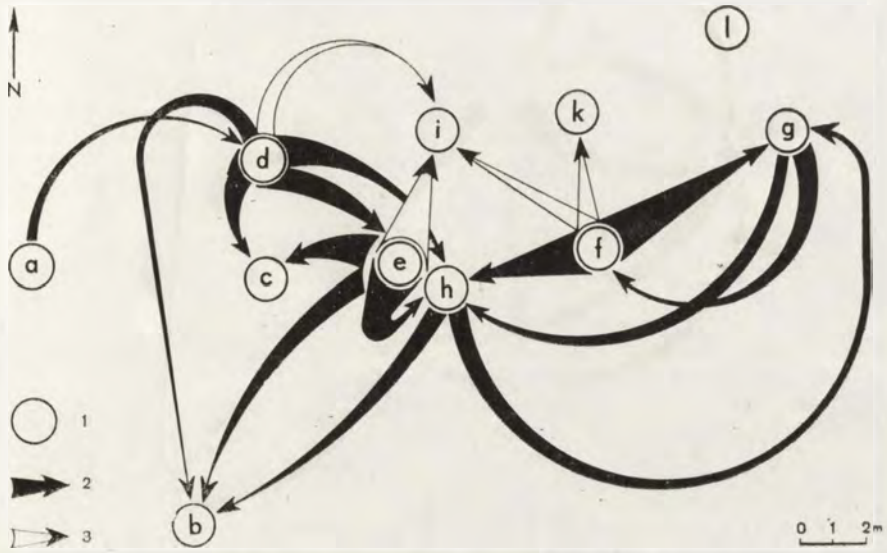

Fig. 11. Contact between different nests of *F. pressilabris* NYL. based upon a fragment of the colony no. 1 : 1 — nest, 2 — migration into the marked nests, 3 — migration in to the unmarked nests (relative population in ant hills: 100–200 individuals per nest); the nest j has been not included in order to retain clarity of drawing

The exchange of workers and food between different nests of a polycalic society are the decisive factors in the strong integration of the *F. pressilabris* colonies functioning as a unit. Thanks to this kind of structure, the endangered swarms are aided by ants from the neighbouring ant hills. For example after artificial transfer of nest sample of *F. exsecta* near the nests of *F. pressilabris*, the workers from other swarms not immediately endangered by the invaders joined in the fight. In the end, the enemy was rapidly liquidated, or in the event it represented too great a force, the most threatened swarm was transferred into another nest. In these latter instances, workers from several swarms undertook the transfer of the threatened brood.

It can then be said that the strong integration of different swarms and great ecological plasticity of the societies enable the polycalic colonies of *F. pressilabris* to exert most important biotic pressure in their environment and to become a decisive factor influencing the character of the biocenosis of their habitat.

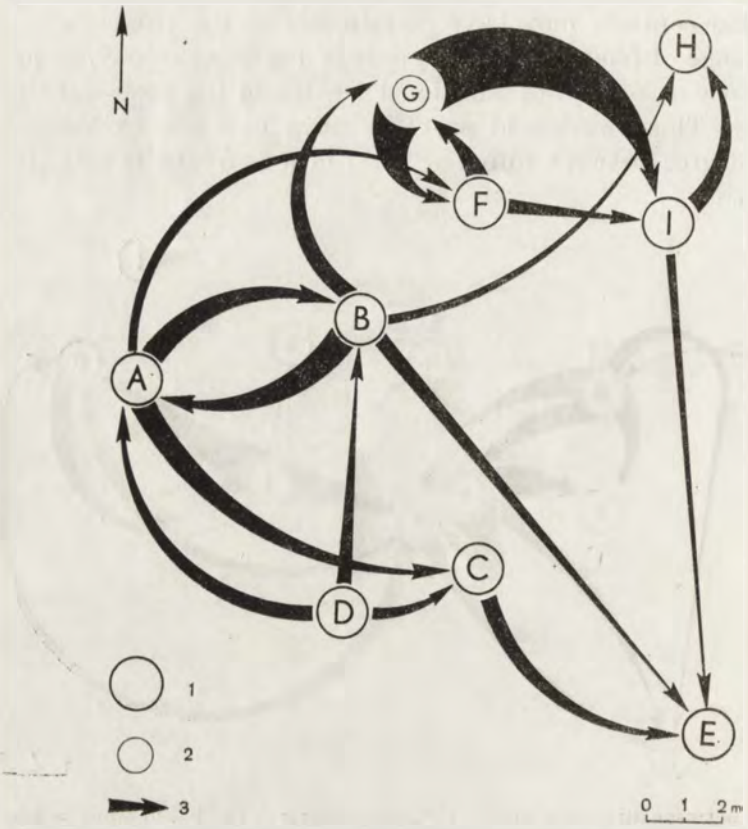

Fig. 12. Contacts between different nests of *F. pressilabris* NYL. based upon the fragment of colony no. 2. 1 – nest, 2 – foraging station, 3 – migration (relative population numbers of the nests: A – 250, B – 230, C – 160, D – 300, E – 200, F – 600, G – 10, H – 400, I – 620 individuals).

Summary

In the Bieszczady Mts. area *Formica* (*Coptoformica*) *pressilabris* NYL. appears as a polygynic form. Consequently, its societies are capable of forming polycalic colonies often of immense size of over 100 ant hills. The colony is made up of various types of nests, each with very specific characteristics: permanent maternal nests and filial nests as well as temporary foraging stations. The structure of the colony changes according to the feeding capacity of its habitat. Depletion of the feeding resources of the environment results in the break-up of the strong swarms into smaller groups of ants and in the multiplication of network of nests in foraging areas. Increasing population density of the nests favours intensification of the contacts between the neighbouring nests of the colony and thus facilitates distribution of food according to the require-

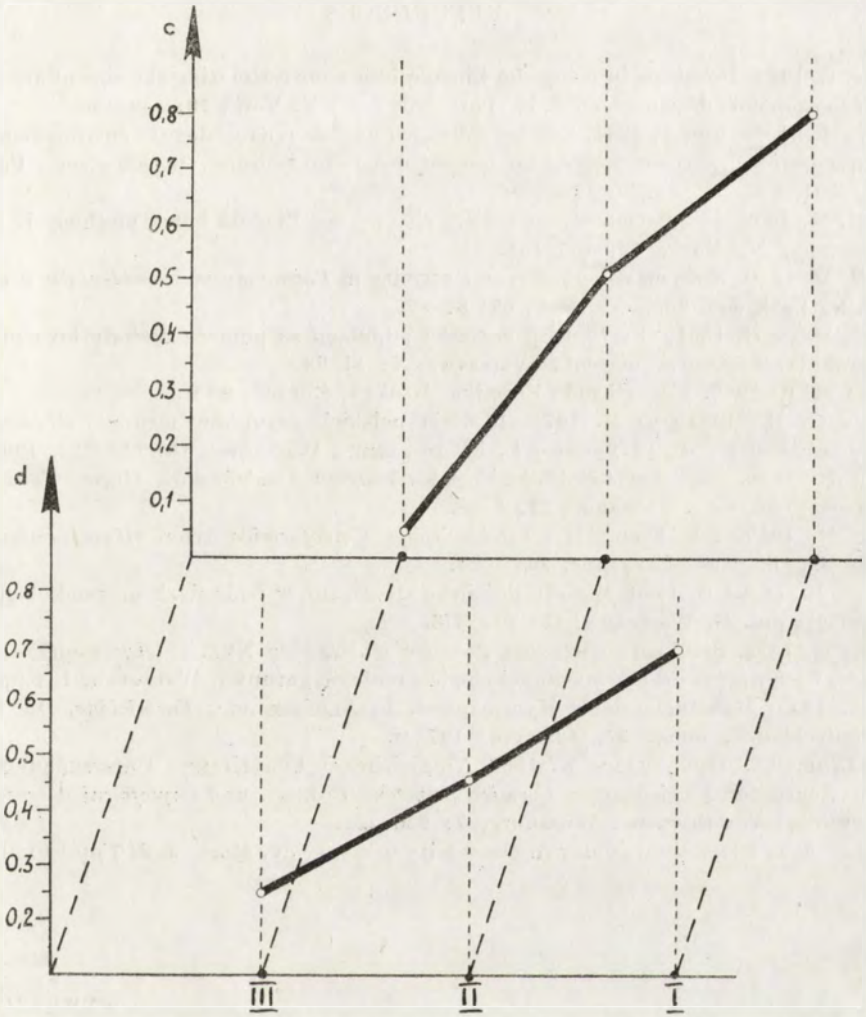

Fig. 13. Influence of the population density of the nests within the polycalic colony upon the intensity of contacts between different nests of *F. pressilabris* Nyl.: d – population density in the nest in a square meter, c – intensity of contacts (I, II, III – based upon the data from three selected colonies.

ment of different swarms. Thanks to their great ecological plasticity the societies of *F. pressilabris* are remarkably adaptable even in the impoverished habitats.

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STRESZCZENIE

[Tytuł: Bionomia *Formica* (*Coptoformica*) *pressilabris* Nyl. (*Hymenoptera*, *Formicidae*)]

W Bieszczadach *Formica* (*Coptoformica*) *pressilabris* Nyl. występuje jako forma poliginiczna. W związku z tym społeczeństwa tego gatunku zdolne są do tworzenia kolonii polikalicznych, osiągających niekiedy ogromne rozmiary (ponad 100 mrowisk). W skład kolonii wchodzą różne rodzaje mrowisk o określonym przeznaczeniu: stałe mrowiska macierzyste i potomne (odkłady) oraz tymczasowe — odkłady pokarmowe. Struktura kolonii polikalicznych jest zmienna i zależy od aktualnej zasobności troficznej zajmowanego przez nią siedliska. Pogarszanie się warunków pokarmowych powoduje rozbijanie się silnych rojów na mniejsze grupy osobników i zagęszczanie się sieci mrowisk na polu troficznym. Znaczenie powyższego zjawiska polega na możności równo-

miernego i ekonomicznego wykorzystania jak najrozleglejszego obszaru. Zwiększone zagęszczenie mrowisk i brak granic między polami troficznymi poszczególnych rojów sprzyja wzmożeniu kontaktów między sąsiadującymi mrowiskami kolonii a tym samym umożliwia rozprowadzenie pożywiania stosownie do potrzeb różnych rojów. Dzięki wielkiej plastyczności ekologicznej społeczeństwa *F. pressilabris* odznaczają się zdolnością adaptacji do siedlisk wyniszczonych i ubogich w pokarm.

РЕЗЮМЕ

[Заглавие: Биономия *Formica* (*Coptoformica*) *pressilabris* Nyl. (*Hymenoptera, Formicidae*)]

В Бещадах *Formica* (*Coptoformica*) *pressilabris* Nyl. встречается как полигиническая форма. В связи с этим сообщества этого вида являются в состоянии создать поликалические колонии, достигающие иногда огромных размеров (свыше 100 муравейников). В состав колонии входят разного рода муравейники, имеющие определенное предназначение: постоянные муравейники центральные и потомственные (почки), а также временные — кормовые почки. Структура поликалической колонии не является постоянной и зависит от актуальной кормности занимаемого ею биотопа. Ухудшение трофических условий ведет к разбитию сильных семей на меньшие группы особей и к уплотнению сети муравейников на кормовом ареале. Значение этого явления заключается в том, что оно дает возможность более равномерного и рационального использования как можно большей территории. Повышение плотности муравейников и отсутствие границ между трофическими ареалами отдельных семей способствует более интенсивным контактам между соседними муравейниками колонии, что дает возможность равномерно распределить корм в зависимости от потребностей разных семей. Благодаря большой экологической лабильности сообщества *F. pressilabris* отличаются способностью адаптироваться к разоренным и трофически бедным биотопам.

Redaktor pracy – prof. dr J. Nast

Państwowe Wydawnictwo Naukowe – Warszawa 1975
Nakład 990+90 egz. Ark. wyd. 1,75. druk. 1 1/2. Papier druk. sat. kl. III 80 g. B1. Cena zł 15. –
Nr zam. 2183-75 Wrocławska Drukarnia Naukowa